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Analysis of Developmental Seaweed Spores (*Kappaphycus alvarezii*) on Culture Media Enriched with a Combination of Nitrogen and Phosphate

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Abstract – This study aims to determine the effect of comparative doses of enrichment of Nitrogen and Phosphate on *Cyrtocarp* development and release of spores. This research was conducted in November 2018 to February 2019, in the Laboratory of Seaweed, the Brackish Aquaculture Center for Takalar (BPBAPT). The research location is in Mappakalombo Village, Galesong District, Takalar District, South Sulawesi Province. For analysis of N and P content in the media analyzed at the Laboratory of water quality at Hasanuddin University. The test organism or algae used is Talus seaweed which has a *Cyrtocarp* of ± 3 cm long with ± 1.5 cm diameter. The experimental container used was a glass bottle with a capacity of 100 ml.

This study used a completely randomized design (CRD) with 6 treatments and 3 replications. A (No enrichment (SW)), B (1N = 0.5 ppm: 1P = 0.5 ppm), C (2N = 1 ppm: 1P = 0.5 ppm), D (3N = 1.5 ppm: 1P = 0.5 ppm), E (1N = 0.5 ppm: 2P = 1 ppm), and F (1N = 0.5 ppm: 3P = 1.5 ppm). Duration of study used for 70 days.

The results showed that the differences in the ratio of enrichment of Nitrogen and Phosphate, showed no significant difference between treatments ($p > 0.05$). The best treatment was found in C with *Cyrtocarp* development time 14 days and average number of spore release $7.67 \pm 1.53b$.

Keywords: *Kappaphycus alvarezii*., Nitrogen, Phosphate, *Cyrtocarp* Development, Spore Release.

I. INTRODUCTION

Seaweed (*K. Alvarezii*) as an algae that lives in the waters, besides being influenced by good environmental factors, also requires several important nutrients in the right amount and balanced so that production reaches the optimal level. In order to utilize spores in seaweed cultivation, data on the production of spores produced by *K. alvarezii* should be obtained in a more controlled condition. This is so that the results obtained are more accurate.

To meet the nutritional needs of *K. alvarezii*, additional nutrients can be used to support *Cyrtocarp* development and the rate of release of seaweed spores. *K. alvarezii* in its growth is in need of Nitrogen and Phosphorus. The benefits of nitrogen and phosphate for the growth of seaweed cannot be replaced with other elements. This is due to the role of nitrogen as a constituent of protein and phosphate as a provider of energy (Lakitan, 2010). Meanwhile, the two

elements are very limited in number and are said to be limiting factors (Yunus, et al, 2010). This is what underlies the need for research to enrich nutrients in the right amount and balanced. The right balance of nutrients (N and P) is expected to have a positive effect on the release and development of *K. alvarezii* spores.

Formulation of the problem:

1. *K. alvarezii* seaweed *Cyrtocarp* experienced developmental delay because there was not enough macro nutrients in the form of N and P in the media in the right amount and balanced.
2. Proper and balanced availability of nitrogen and phosphate in the media can inhibit the release rate of *K. alvarezii* Seaweed spores.

II. THE RESEARCH METHOD

This research was conducted in November 2018 to February 2019, in the Laboratory of Seaweed, the Brackish Aquaculture Center for Takalar (BPBAPT). The research location is in Mappakalombo Village, Galesong District, Takalar District, South Sulawesi Province. For analysis of N

and P content in the media analyzed at the Laboratory of water quality at Hasanuddin University.

The algae organisms test Talus seaweed which has a *Cyrtocarp* of ± 3 cm long with ± 1.5 cm diameter. The pieces are then cleaned with sea water by spraying. To avoid contamination with micro-organisms, shaking was carried out

using ± 100 ml seawater which was given 1% iodine for 3 minutes, then rinsed 3 times.

The experimental container used was a glass bottle with a capacity of 100 ml but only filled with 80 ml of media. Before using other containers and tools washed to avoid possible contamination during the research process. The container is then cleaned by using tissue that has been given alcohol along with all the tools used. The next stage, all research equipment was sterilized by autoclaving at 121°C for 1 hour.

The process of making N and P solutions begins with making a stock solution of 500 ppm each. Determination of stock doses can be determined using the formula:

$$\text{ppm} = \frac{\text{Weight of solute}}{\text{Solution weight}} \times 1.000.000$$

Water is used to make each stock solution using aquabides. Each stock solution is made 500 ml each. Aquabides are used as much as 500 ml and placed in a measuring cup with a capacity of 1000 ml or 1 liter of water. Element N (NaH₂PO₄) was used as much as 1 mg then put into aquabides prepared. The stock media, heated by using a hot plate and magnetic stirrer as a stirrer during the heating process. The heating process is carried out for ± 10 minutes (until the solution boils). The same is done for making P elements (NaNO₃).

The cooled stock solution is then used as a solution for making maintenance media. Dilution of the stock solution is used according to the dosage in each treatment. The desired dose is determined using a dilution formula, namely: M1 X V1 = M2 X V2.

Known:

- M1 = Initial substance concentration
- V1 = Initial volume
- M2 = Concentration after dilution
- V2 = Volume after dilution.

After the calculation of media dilution, 3 doses of concentration were made, namely 0.5 ppm, 1 ppm, and 1.5 ppm. Based on these doses, the amount of stock solution used is 0.5 ml, 1 ml, and 1.5 ml. The dosage determination was also carried out on P elements. Each study container will be filled with 80 ml of media water with a ratio of 50:50. So each

concentration of comparison will be used 40 ml for the concentration of N and 40 ml for P.

In the maintenance process the talus is carried out in a closed and controlled room with a temperature of 30°C. The salinity used in the media is ± 31 ppt, the salinity is considered the best salinity in the process of releasing spores and the growth of seaweed (Hariyati, 2014). Talus which is kept in a glass bottle and then installed a raffia rope as a substrate for spores that have been released.

The lighting source will use 18 watt fluorescent lamps with ± 1000 lux light intensity (Syamsuddin, 2013). According to Prihatman (2000), fluorescent lamps produce larger light with lower power than incandescent lamps. This lamp has a lower temperature than an incandescent lamp so it is suitable for supplying light to plants. Lighting settings (dark and light) are adjusted to conditions in nature, namely: 12 hours of light and 12 hours of darkness using a timer. Media water changes are carried out every 7 days or when a change is needed at any time. Observation of *Cyrtocarp* development is done by observing its development once every day.

The spores produced in each study container were observed using a microscope once a day with 40x magnification on a microscope. If the spores produced are small, manual calculation is done through direct observation of the substrate using a microscope. More spores and manual calculations are difficult, so they are calculated using Haemocytometer and converted into formulas to determine the density of spores / ml. Spore density per ml was calculated using the formula Gabriel & Riyatno (1989) as follows:

$$C = \frac{t}{N \times 0,25} \times 10^6$$

Known:

- C = Spore density / ml per ml solution.
- t = The total number of spores in the sample box observed.
- N = Number of sample boxes observed.
- 0,25 = Is a use correction factors small scale sample box inside Haemocytometer.

III. RESULTS

A. Development of *Cyrtocarp*.

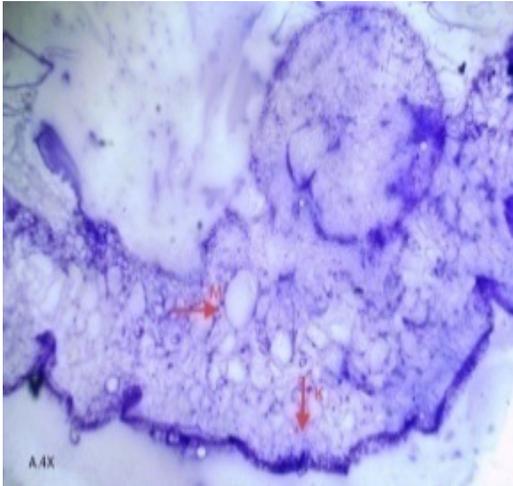
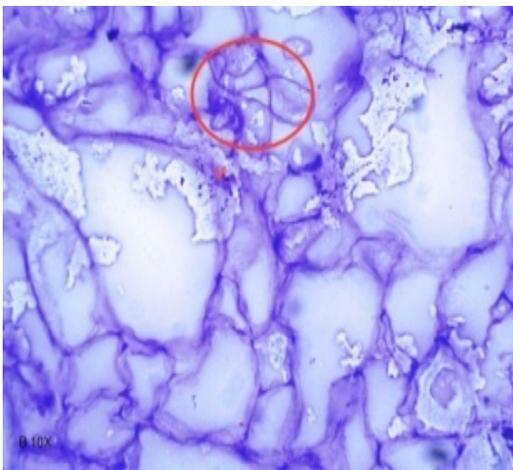
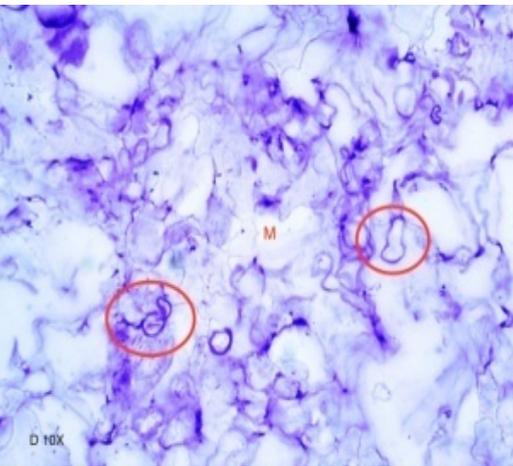
The time needed for *Cyrtocarp* development in each treatment is presented in Table 1.

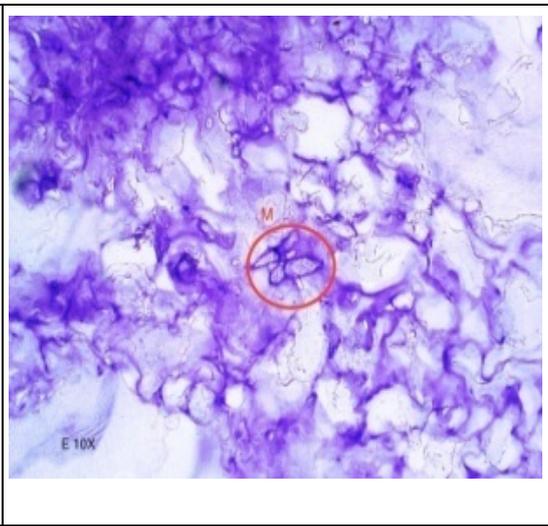
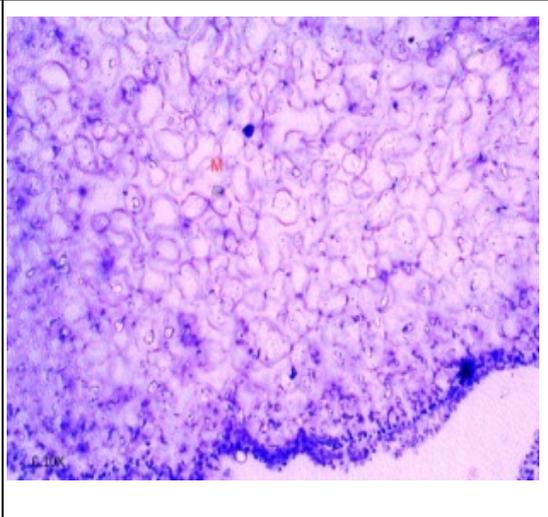
Table 1. The time needed for *Cyrtocarp* development in each treatment.

| <i>Cyrtocarp</i> Development process | Time Needed (Days) | | | | | |
|--------------------------------------|--------------------|----|----|----|----|----|
| | P1 | P2 | P3 | P4 | P5 | P6 |
| A | 1 | 1 | 1 | 1 | 1 | 1 |
| B | 4 | 3 | 3 | 3 | 4 | 3 |
| C | 7 | 7 | 6 | 5 | 7 | 6 |
| D | 10 | 9 | 7 | 6 | 8 | 8 |
| E | 12 | 12 | 9 | 8 | 10 | 10 |
| F | 15 | 14 | 11 | 11 | 12 | 11 |
| G | 17 | 16 | 14 | 13 | 15 | 15 |
| H | 18 | 17 | 15 | 14 | 16 | 16 |

The process of developing *Cystocarp* and spores produced based on the results of observations or histological tests in each of its developments, are presented in Table 2.

Table 2. The process of *Cystocarp* development based on observations and histological tests.

| Thallus | Elargement (10x) | Information |
|---|--|---|
|  |  | <p>The medulla thallus has no spore</p> |
|  |  | <p>The medulla thallus is a spore (circle).</p> |
|  |  | <p>The medulla thallus is a spore (circle).</p> |

| | | |
|--|---|---|
|  |  | <p>The medulla thallus is a spore (circle).</p> |
|  |  | <p>The medulla thallus has no spore</p> |

The fastest development of *Cyrtocarp* in releasing spores is found in treatment D, it only takes 14 days to get to the spore release stage. Comparison of the addition of N and P in media with a ratio of 3: 1 is considered the best treatment of all treatments. This is because the time needed by *Cyrtocarp* to develop faster than other treatments. Faster development is due to the content of N three times more than the element P given. This opinion is in accordance with the statement from Wibowo *et al.*, (2009), that an appropriate comparison in the waters between elements N and P, where element N is three times greater than the element P. Not fulfilling one element will result in a decrease in the quality and quantity of production.

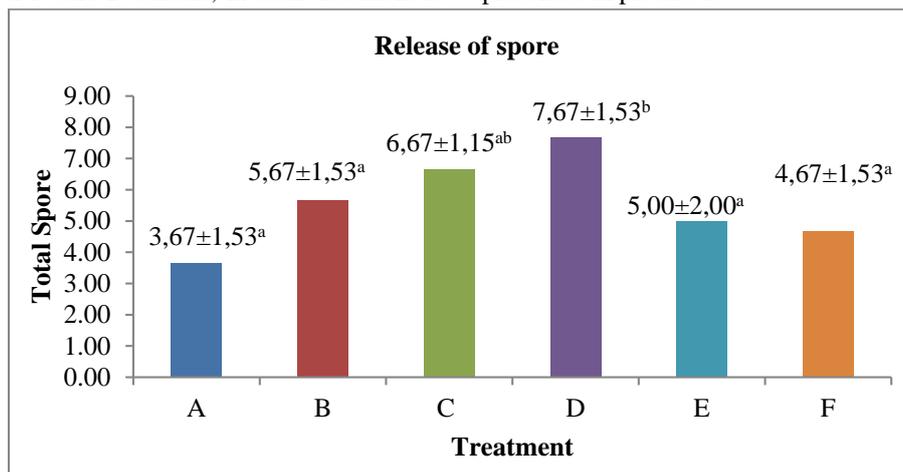
Nitrogen and phosphate are very important for seaweed in regulating metabolism and reproduction. Growth can be achieved well if seaweed is sufficient for nitrogen and phosphate. Seaweed can utilize nitrogen and phosphate through the diffusion process in all parts of the body (Djafar, 2011). The more often seaweed absorbs nitrogen and phosphate in maintenance media, the faster the growth and maturity of *Cyrtocarp*. Nitrogen and phosphate are very important for seaweed in regulating metabolism and reproduction. Growth can be achieved well if seaweed is sufficient for nitrogen and phosphate. According to Yu and Yang, (2008), that the utilization of nitrogen and phosphate by

seaweed is not only from the concentration in the environment, but also with the concentration of internal nitrogen and phosphate in the thallus tissue of seaweed.

Nitrogen seaweed extraction and storage can be affected by concentrations of inorganic nitrogen in water. Low concentrations of nitrogen and phosphate in the environment cannot meet the need for seaweed for nitrogen and phosphate for further use, but seaweed has the ability to assimilate and store nutrients from its environment especially at low concentrations (Sakdiah, 2009). Among the elements in nature, N and P elements are the most important elements and are also the main factors that determine water fertility (Handayani, 1999). According to Sidabat (1973), nitrogen is an element that plants need in the process of photosynthesis, also an important component in protoplasm. Based on various statements, it can be seen that the benefits of the elements N and P play a significant role in the development and growth of *Cyrtocarp K. alvarezii*. These statements also show that treatment D, which is the ratio of N and P to media with 3: 1, can be considered the best treatment of all treatments.

B. Release of spores.

Spore release data Gathering sea *K. alvarezii* with different comparison of N and P content, in each treatment is shown in Annex 3. The average yield of spore release is then presented in picture 1.



Picture 8. Average amount of *K. alvarezii* spore release in each treatment.

Description: The same letter shows the treatment does not have a significant effect ($p > 0.05$) on the Amount release of *K. alvarezii* spores.

The high number of spores produced in treatment D was compared to other treatments, with the average spores which were successfully released from $7.67 \pm 1.53b$, because the nitrogen and phosphate content in the talus increased. Giving N and P to media with a ratio of 3: 1 provides better nutrition for *Cyrtocarp*. Based on the treatment of nutrition it was seen that the nitrate value in treatment D was 0.282 ppm. This is in the opinion of Boyd (1990), the lowest tolerance limit of nitrate for algal growth is 0.1 ppm while the highest limit is 1 ppm. Mean while ammonium levels in the media were 0.0015 higher than other treatments. The content is also still in a good level for seaweed. Hartomo & Widiatmoko (1994) stated that ammonium levels that are feasible for seaweed growth are 0.5 ppm.

The entry of nitrogen into the body tissues of seaweed through a diffusion process that occurs in all parts of the seaweed thalli. The diffusion process is the transfer of ions from one place to another (Salisbury and Ross, 1992). The absorbed nitrogen is processed through stages, namely: nitrogen fixation, nitrification, assimilation, and denitrification and ammonification. The process of fixation, nitrification, denitrification and ammonification is generally carried out by bacteria, while the assimilation process is carried out by plants including algae (Iksan 2005).

In addition to the nitrogen content in the media, seaweed also requires a certain level of phosphate as a provider of energy (Lakitan, 2010). Energy in seaweed is needed in sufficient quantities to be able to release spores. Phosphate in the media containing 4.0859 ppm is still good in the process of limiting factors for not yet optimal spores produced by each treatment.

CONCLUSION

Based on the results of research that has been done, it can be concluded that:

spore release. According to Gusriana (2006), the proper range of phosphate for seaweed growth is 0.9-1.8 ppm. While according to Effendi (2003) the range is 0.02-1 ppm. The high phosphate content in the media does not make seaweed respond negatively. This is because algae is able to absorb phosphate beyond its needs (Luxury consumption) and besides it is also able to absorb phosphate at very low concentrations. This is because algae have alkaline phosphatase enzymes which can convert phosphate to orthophosphate which is ready to use. This is one of the causes of the fast depletion of orthophosphate in the waters. Phosphate deficiency will be more critical for aquatic plants including algae (Djafar, 2011).

Yu and Yang (2008) state that increased nutrient supply can improve the physiological process of seaweed, which in turn can increase assimilation. Nitrogen and phosphate added to the media and into research containers are utilized by seaweed. Increased nutrition in the talus of seaweed makes the *Cyrtocarp* in treatment D release more spores than other treatments. Although each treatment is considered successful in the process of releasing spores. However, the results obtained are considered still not optimal. This is suspected because the need for other nutrients is still not fulfilled for seaweed. To grow and develop, seaweed also needs a variety of essential nutrients to support the growth and reproduction process. There are several important nutrients found in PES fertilizers which are also needed by seaweed such as vitamin B12, Thiamine, Biotin, $MnSO_4$, H_2BO_3 , $ZnSO_4$, $CoSO_4$, and Fe (Inscription, 2016). These various nutrients are thought to be Treatment D with a ratio of N and P elements of 3: 1 was the best treatment of all treatments, in the fastest *Cyrtocarp* development process with 14 days and spore release $7.67 \pm 1.53b$.

SUGGESTION

In order for the amount of nutrients to be given, N and P needs to be given as needed from *K. alvarezii* seaweed. In addition, it is also recommended to review the comparison of N and P elements with more varied doses to obtain the optimal

dose. And in the future in order to pay attention to other nutrients in supporting the growth and development of seaweed.

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Association Between WFNS Grade at Admission & Glasgow Outcome Score after Surgical Clipping in Ruptured Cerebral Aneurysms

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Abstract- INTRODUCTION: Intracranial aneurysms are localized dilatations of the arteries in the brain due to weakness of the arterial wall, can lead to serious morbidity and mortality after rupture. Subarachnoid hemorrhage(SAH) usually occurs with rupture and is associated with a high rate of morbidity and mortality. The current study is an institution based study in an attempt to understand the outcome of surgical clipping and its association with WFNS grade at admission in light of established facts and principles in standard literature in a selected group of patient population.

AIM OF THE STUDY: To study the association between WFNS grade at admission and Glasgow outcome score after surgical clipping in patients with ruptured intracranial aneurysm at our centre.

METHODS: This is a prospective non randomized observational study carried over a period of 2 years and 5 months. All diagnosed cases of ruptured cerebral aneurysm admitted to our institute during the study period and treated by surgical clipping were included in the study. Patients undergoing open surgery were compared in terms of clinical condition before treatment using World Federation of Neurosurgical Societies (WFNS) score and clinical outcome was assessed using the Glasgow outcome scale (GOS).

RESULTS: Out of 76 patients who were admitted with the complaints of SAH, 35 patients i.e. half of the study subjects had WFNS grade II. 23 patients with SAH had WFNS Grade III. 35.5% of study subjects had Glasgow outcome score of IV. 18.4% of patients in surgical group had Glasgow outcome score of V followed by 15.8% of subjects with a score of III. Mortality rate in surgical group was 28.9% (Glasgow outcome score of I)

CONCLUSION: There is a highly significant association between WFNS grades at presentation and post operative Glasgow outcome score. Patients with good WFNS grades at presentation had good Glasgow outcome scores.

I. INTRODUCTION

Intracranial aneurysms are localized dilatations or ballooning of the arteries in the brain due to weakness of the arterial wall, can lead to serious morbidity and mortality after rupture. Subarachnoid hemorrhage (SAH) usually occurs with rupture and

is associated with a high rate of morbidity and mortality.^{1,2,3} Aneurysmal subarachnoid hemorrhage is a disastrous and fatal medical emergency requiring immediate intervention as approximately 12% of patients die before receiving medical supports, 33% within 48 h and 50% within 30 days of a SAH and 50% of survivors suffer from permanent disability and dependency².

Our institute being a prominent tertiary care neurosurgical centre in eastern India receives a substantial proportion of patients with ruptured intracranial aneurysms. With state of the art DSA facility, the understanding of the disease has improved. The current study is an institution based study in an attempt to understand the outcome of surgical clipping and its association with WFNS grade at admission in light of established facts and principles in standard literature in a selected group of patient population.

II. AIM OF THE STUDY:

To study the association between WFNS grade at admission and Glasgow outcome score after surgical clipping in patients with ruptured intracranial aneurysm at our centre.

III. METHODS:

After obtaining clearance from the ethical committee of the institute, this study was carried out in Department of Neurosurgery, Bangur Institute of Neurosciences & SSKM Hospital, IPGME & R, Kolkata from 10th August 2016 to 20th January 2019. It is a hospital based non randomized prospective observational study. All diagnosed cases of ruptured cerebral aneurysm admitted to our institute during the study period and treated by surgical clipping were included in the study. The study protocol was explained to the patient/guardian and a written informed consent was obtained from each subject to be enrolled in the study.

Inclusion Criteria

Patients presenting with subarachnoid hemorrhage due to ruptured intracranial aneurysms diagnosed by CT angiography / MR angiography / DSA :

- a. WFNS grade IV or better
- b. No other contraindications for surgery such as coagulopathy, severe heart disease etc.

Exclusion Criteria

- Individuals not willing to participate in the study.
- Patients presenting with SAH which is found subsequently to be of non aneurysmal origin after proper radiological evaluation.
- Patients with poor neurological status (WFNS grade V) in whom definitive investigation to establish presence of cerebral aneurysm could not be done.

Study Tools:

Patients undergoing open surgery were compared in terms of clinical condition before treatment using World Federation of Neurosurgical Societies (WFNS) score and clinical outcome was assessed using the Glasgow outcome scale (GOS).

- **The World Federation of Neurosurgeons (WFNS) classification:**

| GRADE | GCS | FOCAL NEUROLOGICAL DEFICIT |
|-------|-------|----------------------------|
| 1 | 15 | ABSENT |
| 2 | 13-14 | ABSENT |
| 3 | 13-14 | PRESENT |
| 4 | 7-12 | PRESENT OR ABSENT |
| 5 | <7 | PRESENT OR ABSENT |

- **Glasgow outcome scale (GOS)**

| Grade | Brief description | Full description |
|-------|---------------------|--|
| 5 | Good | Recovery Full, independent life, no or minimal neurological deficit |
| 4 | Moderately disabled | Moderately disabled, neurological deficit or intellectual impairment, but independent life |
| 3 | Severely disabled | Conscious, but totally dependent on others |
| 2 | Vegetative | Vegetative survival |
| 1 | Dead | Dead |

Study Techniques:

This is an observational study among the members of the study population. Results were explained in the form of percentage and by extrapolating and comparing it with standard literature. Patients were examined clinically, radiologically and operated by surgical clipping. Outcomes were assessed using the Glasgow outcome scale (GOS).

Data thus generated was analyzed with the help of Microsoft excel 2007 and SPSS version 22nd software. Appropriate tables and graphs were generated. Chi-square test and other appropriate statistics as applicable was incorporated in the study for statistical inferences.

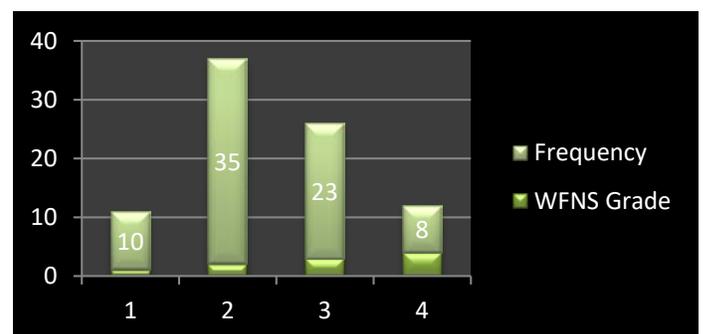
IV. RESULTS:

This is a prospective non randomized observational study from a tertiary care neurosurgical centre carried out on patients with diagnosis of ruptured intracranial aneurysms. Over a study period of two years & 5 months, 76 cases of diagnosed ruptured intracranial aneurysms were admitted for definitive management in the form of surgical clipping, all of them were included in study. Baseline data regarding age, sex and clinical presentation of the subjects was collected. Location and size of the ruptured aneurysm was also noted. 38.2% of study subjects belonged to age group 41-50 years followed by 27.6% of subjects in age group 51-60 years. 72.4% of study subjects were female. Only 21 patients (27.6%) were male

Aneurysmal SAH was the most common presentation. Acom artery was the commonest site for ruptured aneurysm in the present study accounting for 46% of the study subjects.. Majority of single ruptured aneurysms belonged to less than or equal to 10 mm in size.

TABLE 1: WFNS Score of study subjects in Surgical Group

| WFNS Grade | Frequency | Percentage |
|------------|-----------|------------|
| 1 | 10 | 13.2 |
| 2 | 35 | 46.1 |
| 3 | 23 | 30.3 |
| 4 | 8 | 10.5 |



Out of 76 patients who were admitted with the complaints of SAH, 35 patients i.e. half of the study subjects had WFNS grade II. 23 patients with SAH had WFNS Grade III.

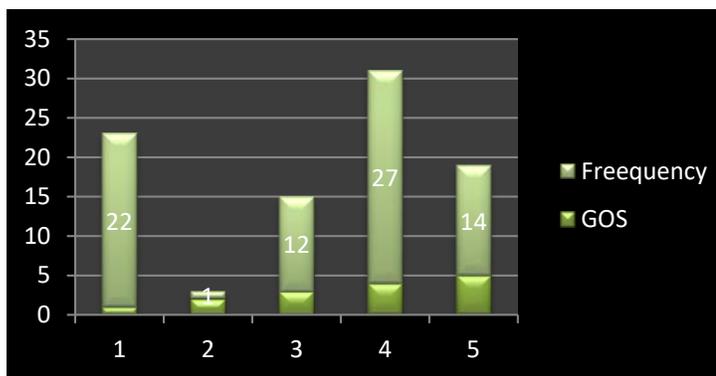
TABLE 2: WFNS Grading of Subjects with Different Location of Intracranial Aneurysm

| Location | WFNS Grading of subjects with SAH | | | | |
|--------------------|-----------------------------------|----|-----|----|----|
| | I | II | III | IV | V |
| ACOM | 9 | 25 | 2 | 5 | 0 |
| A1 Segment of ACA | 0 | 1 | 0 | 1 | 0 |
| DACA | 0 | 3 | 4 | 0 | 0 |
| ICA | 0 | 2 | 4 | 0 | 0 |
| ParaPCOM | 0 | 2 | 1 | 1 | 0 |
| M1 Segment of MCA | 0 | 1 | 1 | 1 | 0 |
| MCA Bifurcation | 1 | 1 | 5 | 0 | 0 |
| M2 Segment of MCA | 0 | 1 | 3 | 0 | 0 |
| PCOM | 0 | 0 | 1 | 0 | 0 |
| Multiple Aneurysms | 0 | 0 | 2 | 0 | 0 |
| Total | 10 | 35 | 23 | 8 | 76 |

Out of 76 patients who were admitted with the complaints of SAH, 35 patients i.e. half of the study subjects had WFNS grade II. Out of these 35 patients 25 had location of the aneurysm in Anterior communicating artery. Out of 10 subjects with WFNS grade I, nine had location of the aneurysm in Anterior communicating artery. 23 patients with SAH had WFNS Grade III.

TABLE 3: Glasgow Outcome Score of study subjects in Surgical Group

| GOS | Frequency | Percentage |
|-----|-----------|------------|
| 1 | 22 | 28.9 |
| 2 | 1 | 1.3 |
| 3 | 12 | 15.8 |
| 4 | 27 | 35.5 |
| 5 | 14 | 18.4 |



35.5% of study subjects had Glasgow outcome score of IV. 18.4% of patients in surgical group had Glasgow outcome score of V followed by 15.8% of subjects with a score of III. Mortality rate in surgical group was 28.9% (Glasgow outcome score of I)

TABLE 4: WFNS Grades and Glasgow outcome score of study subjects.

| WFNS | Glasgow outcome score | | | | | Test of significance |
|-------|-----------------------|----|-----|----|----|---|
| | I | II | III | IV | V | |
| I | 0 | 0 | 0 | 4 | 6 | χ^2 -43.038 df-16 p value-.000 |
| II | 9 | 1 | 5 | 13 | 7 | |
| III | 5 | 0 | 7 | 10 | 1 | |
| IV | 8 | 0 | 0 | 0 | 0 | |
| Total | 22 | 1 | 12 | 27 | 14 | |

There is a highly significant association between WFNS grades at presentation and post operative Glasgow outcome score. Patients with good grades at presentation had good outcome scores.

V. DISCUSSION

There is abundance of literature regarding various aspects of epidemiology, clinical presentation, pathophysiology as well as management of these lesions from various parts of the world. Contrary to earlier assumptions, intracranial aneurysms are quite prevalent in the Indian population as evident from the work of Sambasivan et al⁴ from Trivandrum and Tandon et al in the ICMR collaborative study.⁵ India being such a vast and diverse country comprehensive population based studies are however very few and far in-between.

The present study reflects on a section of population mostly from the eastern part of the country where similar studies focusing on intracranial aneurysms are hard to find. Our institute being a prominent tertiary care neurosurgical centre in eastern India receives a substantial proportion of patients with intracranial aneurysms. The present study has shown light on various aspects of this subset of population with ruptured intracranial aneurysms and also brought to light many limitations and difficulties which are unique to this study.

In the present study, 38.2% of study subjects belonged to age group 41-50 years followed by 27.6% of subjects in age group

51-60 years. Weir et al.⁶ described Mean age in patients with ruptured aneurysms as 46 years. Sodhi et al⁷ in their series found mean age of 51.3 (\pm 13.5) years in their patients from Chandigarh. 72.4% of study subjects were female. Only 21 patients out of 76 (27.6%) treated by surgical method were male. The female suffers 1.78 times more than the male in SAH as evident from a population based study from Kashmir in India⁸. However another Indian study⁷ from Chandigarh in north India has shown the male: Female ratio was nearly equal.

WFNS grades on admission have been recognized as independent factors influencing outcome of management. Patients presenting with SAH (Total 76) were categorized in accordance with WFNS grade on admission. Out of 76 patients who were admitted with the complaints of SAH, 35 patients i.e. half of the study subjects had WFNS grade II. Out of these 35 patients 25 had location of the aneurysm in Anterior communicating artery. 23 patients with SAH had WFNS Grade III. Sodhi et al⁷ in their series of north Indian population found an overall mortality in the surgical clipping group at discharge was 21.2%. Mortality in patients with WFNS grade I and II SAH was 14.2 and 16.2%, respectively. Their series of surgical intervention had WFNS grade at presentation (%) as Grade I in 53.9%; grade II in 22.1; III in 9.4; IV in 14.5 % no patient had grade V presentation.

35.5% of study subjects had Glassgow outcome score of IV. 18.4% of patients in surgical group had Glassgow outcome score of V followed by 15.8% of subjects with a score of III. Mortality rate in surgical group was 28.9% (Glassgow outcome score of I). A significant association has been observed between WFNS grades at presentation and Post operative Glassgow outcome score. In a similar study conducted over a period of 5 years, good outcome (Glasgow Outcome Scale V and IV) was seen in 57.19 of the patients, 14.3% had a poor outcome, and 28.6% died. The cause of death in most patients was found to be a poor clinical grade, postoperative infarct, or presence of multiple aneurysms.¹⁰ Sodhi et al⁷ found 63.6% of the patients at the end of three months follow up had a favorable outcome in the form of GOS 5 and 4. They also found that WFNS grades at admission of I and II had favorable outcome at discharge and 3 months follow up.

VI. CONCLUSION

53.2% of patients undergoing surgery had a favorable outcome in the form of Glasgow Outcome Score of 5 and 4. Majority of patients with SAH presented in WFNS grade I and II. There is a highly significant association between WFNS grades at presentation and post operative Glassgow outcome score. Patients with good WFNS grades at presentation had good Glassgow outcome scores.

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ABBREVIATIONS

| | |
|------|------------------------------------|
| ACOM | ANTERIOR COMMUNICATING ARTERY |
| ACA | ANTERIOR CEREBRAL ARTERY |
| A1 | ANTERIOR CEREBRAL ARTERY SEGMENT 1 |
| CT | COMPUTED TOMOGRAPHY |
| MRI | MAGNETIC RESONANCE IMAGING |
| DACA | DISTAL ANTERIOR CEREBRAL ARTERY |
| DSA | DIGITAL SUBTRACTION ANGIOGRAPHY |
| GOS | GLASGOW OUTCOME SCORE |
| ICA | INTERNAL CAROTID ARTERY |
| MCA | MIDDLE CEREBRAL ARTERY |
| MCA | MIDDLE CEREBRAL ARTERY |
| MRI | MAGNETIC RESONANCE IMAGING |
| PCOM | POSTERIOR COMMUNICATING ARTERY |
| SAH | SUBARACHNOID HEMORRHAGE |
| WFNS | WORLD FEDERATION OF NEUROSURGEONS |

Importance of Water Resource Management

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Abstract- Groundwater is a valuable resource both in the united state and throughout the world. Where surface water, such as lakes and rivers, are scare or inaccessible. The volume of ground water in storage is decreasing in many areas of the united states in response to pumping. ground water depletion is primarily caused by sustained groundwater pumping. The water shortage problem is the lack of sufficient available water resources to meet water needs within a region. It affects every region and around 2.8 billion people around the world at least one month out of every year. More than 1.2 billion people lack access to clean drinking water.

India's groundwater depletion is a national crisis. More than half of wells show declining groundwater levels. The challenge is particularly acute in northwestern India, where baseline water stress is extremely high, Water problems involve caused by water shortage, water stress and water crisis . The relatively new concept of water stress is difficulty in obtaining sources of fresh water for use during a period of time, it may result in further depletion of available water resources .Water shortage may caused by climate change, such as altered weather pattern, increased pollution, and increased human demand and overuse of water . The term water crises noted a situation where the available potable unpolluted water within a region is less than that region's demand.

Index Terms- Save water, Rain guage, Rain Water harvesting

I. INTRODUCTION

The water shortage problem can result from two mechanisms. Physical water shortage result from inadequate natural water resources to supply a region demand and economic water shortage problem result of poor management of sufficient available water resources¹. Water is the foundation of life. Still today, all around the world, many people spend their entire day searching for it. Water shortage problem is either the lack of enough water or lack of access to safe water. The problem of water shortage is growing one .As more people put ever increasing demands on limited supplies,even maintain access to water will increase. In some places, it is simply dry. Water is hard to find. Fresh water makes up a very small fraction of all water on the earth². Nearly 70 percent of the world is covered by water, only 2.5 percent of it is fresh. In essence , only 0.007 percent of the planet water is available to fuel and feed its 6.8 billion people.

Water use has grown at more than twice the rate of population increase in the last century. By 2025, an estimated 1.8 billion people will live in areas plagued by problem of water shortage ,with two third of the world's population living in water stressed region as a result of use, growth, and climate change³.

Global warming changing the nature of climate. It effects we can see on the rainfall, therefore water shortage has been increasing all over the world. Many countries will face this problem near about expected year 2025. This problem become dangerous when the surface water pollution will be increase. Another popular opinion is that the amount of available freshwater is decreasing because of climate change. Climate change has caused receding glaciers, reduced stream and river flow, and shrinking lakes and ponds . Water shortage resulted from population size more than rainfall. The challenge we face now is how to effectively conserve , manage, and distribute the water we have. Water conservation encompasses the policies, strategies and activities to manage fresh water as a sustainable resource to protect the environment and to meet current and future human demands, population, household size and growth and affluence all affect how much water is used. Now it is need of time to change the frame of mind and system or redesigne of the modules are important⁴

We have tried to increase awareness about water shortage problem and discussed with society. We found some solution about this problem⁵. The concept of rainwater harvesting as one of the solution to the water crisis To overcome from the problem it is essential to utilize the resource of sustainable water. Several measures have been developed to waste water, save water and reuse it. so to save water through rainwater harvesting process. Rainwater Harvesting refers to the collecting of rainwater, mostly on a roof, from where it flows through gutters in to a collection tank. In other words, it refers to a storage system could be either above or below the ground that collects, stores and distributes run-off of rain or snow from roofs⁵.

II. OBJECTIVES

- 1) To conserve the water
- 2) To meet the increasing demand of water
- 3) To raise the underground water table
- 4) To reduce the run-off which chokes the drains
- 5) To reduce groundwater pollution
- 6) To reduce soil erosion
- 7) Rain gauge provided with accurate information about the rain in monsoon is given to the farmers for planning of usage of water for next farming process.

III. METHODOLOGY

We installed Rain Gauge. It is used to measure rainfall. It is necessary to know the quantity of rainfall every year in our village as the total rainfall is planned for the next farming season

and the proper use of drinking water. It is also helpful to school life, students gain knowledge of the rain fed equipment and how they measure the rainfall so we installed rain gauge equipment at the school. Students took reading of rainfall every 24 hours in the monsoon season and is provided with accurate information about the rain in monsoon is given to the farmers for planning of usage of water for next farming process. In this way the farmers are told

to show the total rainfall in monsoon and to plan accordingly. It is also help to calculation of amount of water recharge nearby bore well through rain water harvesting. In monsoon of year 2018 every day students took reading of rainfall with the help of rain gauge and record the rainfall of every month. In Askheda village of Nashik district(Maharashtra). It was total rain about 504.3 mm.



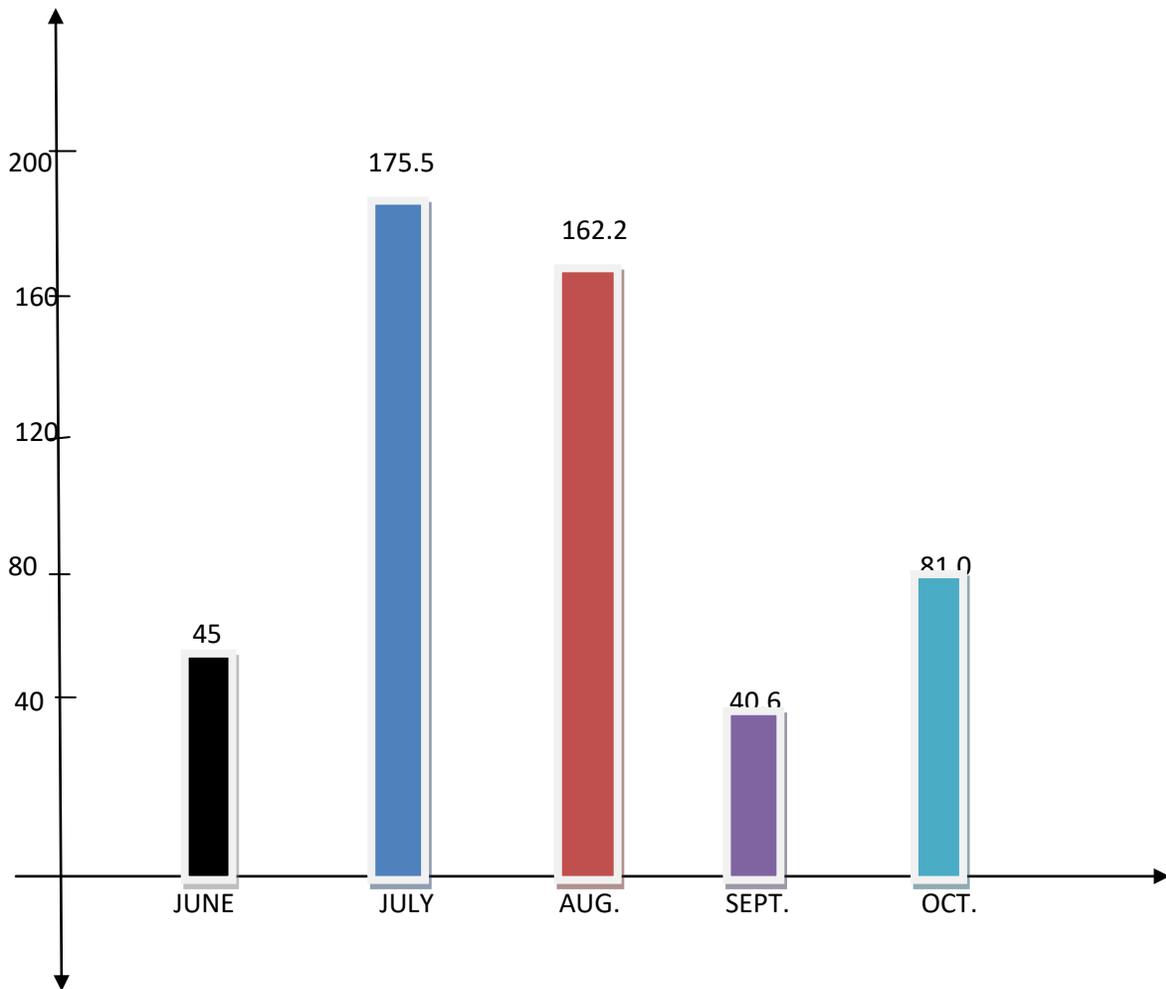
Rain fall in year 2018

| Month | June | July | August | Sept. | Oct. | Toatal Rain Fall |
|-----------------|------|-------|--------|-------|------|------------------|
| Rain fall in mm | 45 | 175.5 | 162.2 | 40.6 | 81.0 | 504.3 |

GRAPH SHOWS RAINFALL IN MONTH

SCALE

ON Y AXIS : 1cm = 40mm



The students dug a pit measure of ten by ten foot near the tube well and filled the pit of coal, pieces of brick and sand and left the entire water of the rain fall through the pipeline from the new building roof. students calculate the area of roof in square meter and total water recharge with the help of total rainfall data was calculated by following formula

IV. RAIN WATER HARVESTING & RECHARGING PROJECT

(Area of Roof in meter)X(Average Rain (meter))x(Coefficient of Rain stream)

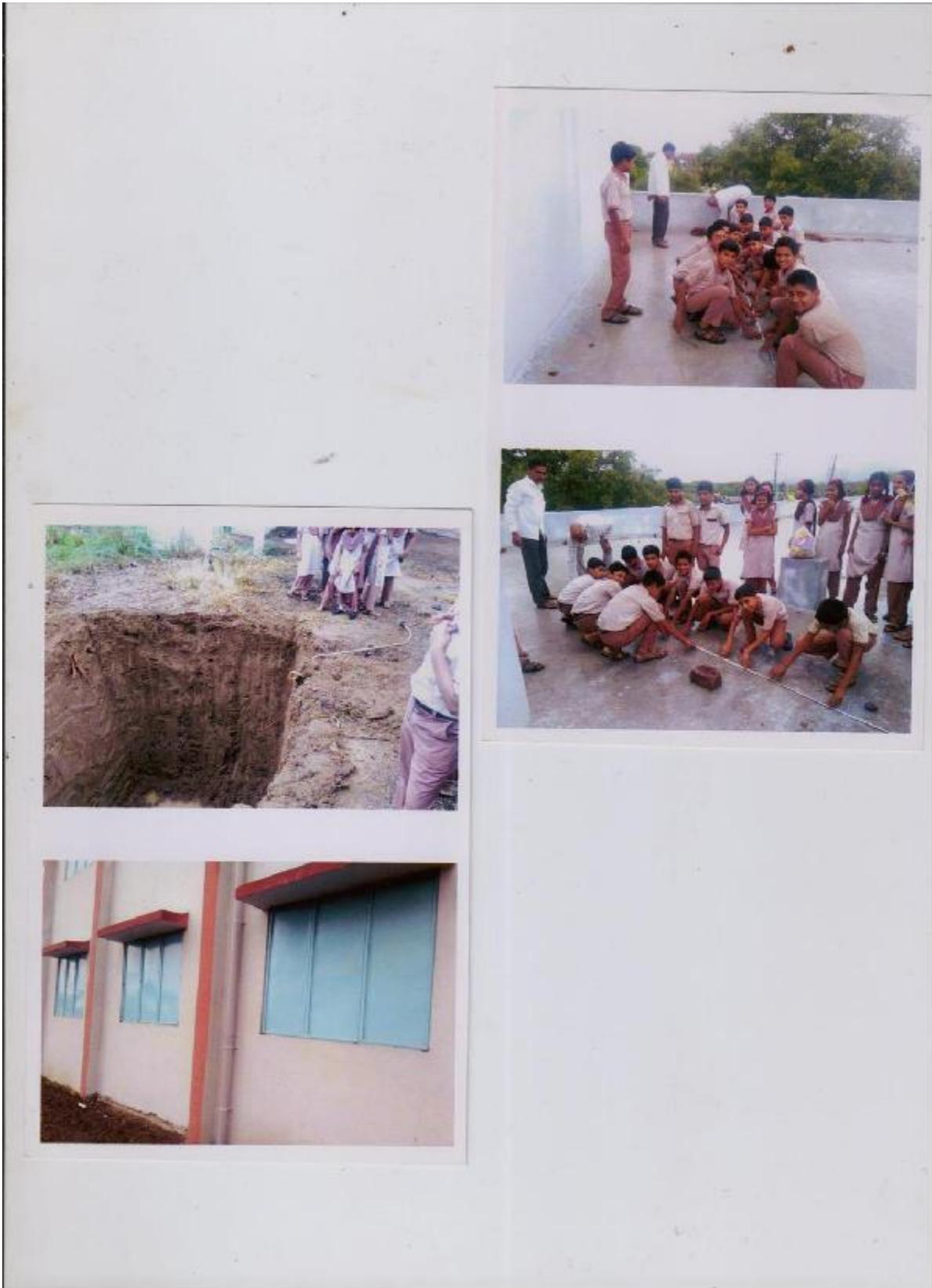
$$269.38 \times 0.5 \times 0.8$$

$$107.8 \text{ cu.m.}$$

$$107800 \text{ lit. (1cum = 1000 lit)}$$

One Lakh seven thousand eight hundred lit. water was accumulated near
Tube well in year 2018

It became helpful to solve Drinking Water problem in Summer season



V. RESULT

- 1) People became alert and aware about ground water depletion
- 2) Students ,youth , People participate themselves in this project
- 3) People became alert and aware about loss of water.
- 4) Rain water harvesting helped to solve Drinking Water problem in Summer season
- 5) People prepared rain water harvesting on roof of their building

VI. CONCLUSION

- 1) It saves the water drinking problem.
- 2) It helps to solved drinking water problem
- 4) Rain water harvesting help to increase water level

VII. SCOPE AND LIMIT

Rain Gauge Instrument is provided with accurate information about the rain in monsoon is given to the farmers for planning for their usage of water for next farming process

Rain water harvesting can be help to solve Drinking water problem in summer season and also help to increase water ground level.

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Perception and Use of Ethnoveterinary Medicine among IDO Poultry Farmers in Ibadan of Oyo State Nigeria

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Abstract- There are many diseases that affect poultry production in Nigeria and treatment of these diseases are too cost to buy because most of these drugs and vaccines are imported to Nigeria, hence, ethnoveterinary medicine is considered as alternative. The study therefore examines the perception and use of ethnoveterinary medicine among poultry farmers in Ido local government area of Oyo State. Purposive sampling and simple random sampling were used to select 113 respondents in the study area. Data was obtained using well structured questionnaire and were analyzed using descriptive statistics such as frequency distribution and percentage while the inferential statistical such as Chi-square and Pearsons Product of Moment of Correlation (PPMC) were used to analysed the hypotheses.

From the study, it was revealed that majority (70.9%) of the respondents were male while 29.1% were female, and 38.2% of the respondents were within the age bracket of 35 and 45 years and 27.3% were within the age range of 46 to 56 years. The results of the study also shows that 6.4% of the respondents had adult education, while 8.2% had no formal education, 7.3% had primary education, 30.9% had secondary education and 47.3% had tertiary education which means that most of the respondents can read and write and they had better knowledge of the questionnaire given to them and all ethnoveterinary practices available in their areas.

Also from the study most of the respondents 55.5% perceived that ethnoveterinary practices is being influenced by tradition and 34.5% of the respondents agreed that ethnoveterinary medicine promotes cultural heritage and 42.7% of them believed that ethnoveterinary medicine helps in controlling diseases and 44.5% of the respondents established the fact that usage of ethnoveterinary medicine required little or no training and 53.6% of the respondents believed that knowledge of ethno veterinary medicine can be easily transferred from one generation to another. Most (59.1%) of the respondents had favourable perception towards the use of ethnoveterinary medicine.

From the study it was revealed that there are some plants that are considered less important to human are sometimes very useful to poultry birds and example of such plants includes uses of *carica papaya* to increase feed intake in poultry (39.1%), uses of *Moringa Oleifera* to resist high temperature in poultry (60.9%), uses of *Citrus Aurantifolia* fruit to resist high temperature in birds (32.7%), uses of oil to treat fowl pox (55.5%) and uses of bitter leaf to treat chronic respiratory diseases (64.5%) in poultry. Most (63.6%) of the respondents had low level of use of

ethnoveterinary medicine. Lack of adequate information (77.3%), unfavorable Government policies (53.6%) and poor research funding (64.5%) were identified as major constraints to use of ethnoveterinary medicine. It is therefore recommended that stakeholders should make information on ethnoveterinary medicine available to poultry farmers.

Index Terms- Perception, Ethnoveterinary Medicine and Poultry Farmers

I. INTRODUCTION

Poultry generally involves raising of domesticated birds, ducks, turkey and guinea fowl. The products that can be derived from poultry are meats, eggs, feather, manure and all of them play a vital role in one way or the other in natural economy. This proves that the main objective of poultry industry is to make profit and that is determined by the ability of birds to convert feed into animal products. Therefore, the risk of poultry product clearly shows that poultry keeping as a business could be profitable if properly managed (Bello, 2007). Poultry products are essentially source of protein, vitamins and minerals to man and source of income to producer and marketers. The increasing demand for animal proteins has arises greater interest in the production of fast growing animals with short generation intervals (Obinne and Okorie, 2008). Apantaku *et al.*, 1998 reported that expansion of poultry industry in Nigeria holds the greatest promise of bridging the animal protein gap prevailing in the country within the shortest possible time.

The protein from poultry meat and egg according to Attah,(2004) is to such quality that is used as the standard against which other proteins are compared. The main problems of poultry production are disease. There are many diseases that affect poultry production in Nigeria and these diseases includes, chronic respiratory disease, infections bronchitis, coccidiosis, etc. the drugs and vaccines which can be used to treat the poultry disease are too cost to buy because most of these drugs and vaccines are imported to Nigeria.

Ethnoveterinary medicine (EVM) is a scientific term for traditional animal health care that encompasses the knowledge, skills, methods, practices and beliefs about animal health care found among the community members. Matekaire and Bwakura, (2004) in Zimbabwe reported that the ethno-veterinary knowledge

(EVK) base differs from regions and also among and within communities based on local or indigenous knowledge and methods of caring for health and managing livestock. EVM knowledge has been developed through trial and error and deliberately experimentation.

Gueye, (1999) argues that EVM is the only option for most of the village poultry farmers in Africa, because there are almost no veterinarians in Africa rural areas. In a recent study in Nigeria by Chan *et al.*, (2009) reported that farmers used traditional remedies because they are readily available and at little cost or no cost at all. Many indigenous veterinary beliefs and practices persist in a wide range of livestock raisers. Ninety percent (90%) of poultry rears said that they never received training in poultry management and indicating that extension services support was inadequate. These results demonstrate that EVM still has a role to play in health management given the lack of cold chain, high price and lack of knowledge of the use of veterinary medicine.

Ethno-veterinary medicine (EVM) benefit is important in treatment and control of diseases and parasites. The plant part used include leaves and roots or both. The remedies were administered before the disease occurred or during disease outbreak. For example, when birds looked unhealthy, went off feed or blood was seen in their droppings, the leaves were crushed before they were mixed with drinking water for the chicken. The medicated water was offered to all birds until they showed sign of good health.

The application of ethno-veterinary in poultry is that the leaves, stems or roots of the plant were used by cutting it, washing and soaked it with water for some days or crushed it together. Most of the poultry farmers in rural area prepare their own knowledge of using local drugs because veterinary services are inadequate and there is no training on how to use the modern drugs with proper management for their birds.

The high cost of these drugs is that most of the drugs used in poultry production are more expensive is that, ninety percent (90%) of these drugs are imported from another country. The chemical residue health remains or acts as a contaminant after a given class of event. Most of these chemicals are also potentially toxic to humans. They may induce adverse health effects including cancer etc.

It has been noticed that diseases is the most common problem of poultry farmers in Ido Local Government Area in Oyo State are facing. Diseases like Chronic Respiratory Diseases (CRD), coccidiosis, fowl pox etc. have killed most of the poultry business in the study area.

Most of the poultry farmers in this study area depend on veterinary drugs to treat the bird than using ethnoveterinary medicine which is readily available. Most often, veterinary drugs are considered to be inaccessible or difficult to purchase due to high cost and importation of some drugs. The poultry industry is more devastated by viral infections such as Newcastle disease and infections bursal disease (Gomboro) in spite of several attempts at vaccinations. Some of the reasons for these may be vaccine failure and the involvement of quacks in fighting these endemic animal diseases in the country (Babalobi 2005, Olugasa *et al.*, 2013).

Sampling procedure and sample size

Purposive sampling was used to select three villages based on the fact that poultry farming activities are predominant in those areas. Thereafter, simple random sampling was used to select fifty percent of the poultry farmers in the selected villages. These include: Akufo 90, Odebode 70, Alakoo 65. The numbers of farmers obtainable were; Akufo farm settlement 45, Odebode 35, and Alako 33 to give a total number of 113 respondents in the study area. Out of 113 questionnaires administered, 110 were retrieved for the analysis of result.

Data Collection

Data was collected with the use of primary source of data collection from the respondents and as well as structured questionnaire

Method of Data Analysis

Data were analyzed using descriptive statistics such as frequency distribution and percentage while the inferential statistical such as chi-square and Pearsons product of moment of correlation (PPMC) were used to analyzed the hypotheses.

II. RESULT AND DISCUSSION

Table 1: Socio-Economic Characteristics of the Respondents
n = 110

| Variables | Frequency | Percentage | Mean |
|------------------------|-----------|------------|------|
| Sex | | | |
| Male | 78 | 70.9 | |
| Female | 32 | 29.1 | |
| Age | | | |
| 24-34years | 31 | 28.2 | |
| 35-45years | 2 | 38.2 | |
| 46-56years | 30 | 27.3 | |
| Above 56 years | 7 | 6.3 | |
| Marital status: | | | |
| Single | 22 | 20.0 | |
| Married | 87 | 79.1 | |
| Divorce | 1 | 0.9 | |
| Religion: | | | |

| | | | |
|------------------------------|----|----|------|
| Christianity | 71 | | 64.5 |
| Islam | 35 | | 31.8 |
| Traditional | | 4 | 3.6 |
| Education: | | | |
| Adult education | | 7 | 6.4 |
| No formal education | | 9 | 8.2 |
| Primary education | | 8 | 7.3 |
| Secondary education | | 34 | 30.9 |
| Tertiary education | | 52 | 47.3 |
| Family size: | | | |
| 1-4 | 35 | | 31.8 |
| 5-8 | 39 | | 35.5 |
| 9& above | 36 | | 32.7 |
| Source of labour: | | | |
| Family | 72 | | 65.5 |
| Hired | 38 | | 34.5 |
| Farmer Association: | | | |
| Yes | 72 | | 38.2 |
| No | 38 | | 61.8 |
| Secondary occupation: | | | |
| Trading | 66 | | 60 |
| Artisan | 11 | | 10 |
| Security | 8 | | 7.3 |
| Crop farming | 17 | | 15.5 |
| Driving | 1 | | 0.9 |
| Civil servant | 7 | | 6.4 |

Source: Field Survey 2017.

Table 1 above shows that majority (70.9%) of the respondents were male and 29.1% were female. This might be linked to the fact that men are predominantly engaged in farming, both crop and animal production. Also the age range of the respondents was between 24years and 56years of age with mean age at 35years to 45 years. About 38.2% of the respondents were within the age bracket of 35 and 45 years, 27.3% was within the age range from 46 to 56 years while few (6.3%) were above 56 years. The result also revealed that majority (66.5%) of the respondents were Christian, while (31.8%) were muslim and only 0.9% practiced traditional religion. In addition, the results also shows that 6.4% of the respondents had adult education, 8.2% had no formal education, 7.3% had primary education, 30.9% had secondary education while almost half 47.3% had tertiary education.

Table 2: Perception of Poultry Farmers on the Use of Ethno-Veterinary Medicine

| STATEMENTS | SA | A | U | D | SD |
|--|----------|----------|----------|----------|----------|
| Use of ethno-veterinary medicine is influenced by my tradition. | 21(19.1) | 61(55.5) | 19(17.3) | 6(5.5) | 3(2.7) |
| Ethno-veterinary medicine provides our cultural heritage. | 6(5.5) | 38(34.5) | 59(53.6) | 5(4.5) | 2(1.8) |
| Use of ethno-veterinary helps to control disease on our poultry farm. | 12(10.9) | 47(42.7) | 28(25.5) | 6(5.5) | 17(15.5) |
| Use of ethno-veterinary is very simple to use for poultry birds | 15(13.6) | 34(30.9) | 26(23.6) | 14(12.7) | 21(19.1) |
| Ethno-veterinary is readily available | 17(15.5) | 15(13.6) | 37(33.6) | 21(19.1) | 20(18.2) |
| Ethno-veterinary is environmental friendly. | 16(14.5) | 67(60.9) | 20(18.2) | 5(4.5) | 2(1.8) |
| Ethno-veterinary is still has a role to play in health management of poultry. | 12(10.9) | 51(46.4) | 32(29.1) | 13(11.8) | 2(1.8) |
| Use of ethno-veterinary is important in treatment and control of some diseases in poultry. | 18(16.4) | 45(40.9) | 26(23.6) | 14(12.7) | 7(6.4) |
| Ethno-veterinary is indigenous method of treating poultry birds | 45(40.9) | 38(34.5) | 13(11.8) | 11(10.0) | 3(2.7) |
| Ethno-veterinary can be use by mixing with water for the birds | 34(30.9) | 55(50.0) | 11(10.0) | 6(5.5) | 4(3.6) |

| | | | | | |
|---|----------|----------|----------|----------|----------|
| The part of ethno-veterinary that can be use are root and leaves | 24(21.8) | 68(61.8) | 9(8.2) | 9(8.2) | 0(0.0) |
| Ethno-veterinary medicine does not contain chemical which can be danger to human health | 71(64.5) | 20(18.2) | 13(11.8) | 2(1.8) | 4(3.6) |
| Ethno-veterinary medicine is used by both educated the non-educated farmers. | 58(52.7) | 21(19.1) | 15(13.6) | 8(7.3) | 8(7.3) |
| It has no harmful effect on the poultry. | 19(17.3) | 48(43.6) | 22(20.0) | 14(12.7) | 7(6.4) |
| Mode of application of ethnoveterinary is user friendly | 6(5.5) | 55(50.0) | 28(25.5) | 10(9.1) | 11(10.0) |
| Usage of ethnoveterinary require little or no special training. | 17(15.5) | 49(44.5) | 12(10.9) | 16(14.5) | 16(14.5) |
| Knowledge of ethnoveterinary medicine can be easily transfer from one to another. | 59(53.6) | 21(19.1) | 5(4.5) | 7(6.4) | 18(16.4) |

Source: Field Survey 2017.

Table 2 above shows that 55.5% of the respondents agreed that use of ethnoveterinary medicine is influenced by their tradition, while 34.5% of the respondents agree that ethnoveterinary medicine promotes their cultural heritage. This might be linked to the fact that civilization and most farmers these days are using modern technique with the work of science and technology. About 42.7% of the respondents in the study area agreed that the use of ethnoveterinary medicine helps to control disease in poultry, while 30.9% agreed that use of ethnoveterinary medicine is very simple to use for poultry birds. Furthermore, 33.6% were undecided against ethnoveterinary medicine usage due to its unavailability when needed, unlike other drugs. Majority, (60.9%) of the respondents agreed that, ethnoveterinary medicine is environmentally friendly, 46.4% agreed that ethnoveterinary medicine still has a vital role to play in health management of poultry. In addition, 40.9% agreed that, the use of ethnoveterinary medicine is important in treatment and control of some disease in poultry, 40.9% also strongly agreed that, ethnoveterinary medicine is an indigenous method of treating poultry birds. It was the introduction of science and technology that makes farmers to abandon it and shift to vaccination and medications. Half (50.0%) of the respondents in the study area,

agreed that ethnoveterinary medicine can be used by mixing with water for birds, and 61.8% also agreed that, the part of ethnoveterinary medicine that can be used are the roots and the leaves. Most of the respondents (64.5%) strongly agreed that, ethnoveterinary medicine does not contain chemicals which its residual effects can be dangerous to human health. Furthermore, 43.6% agreed that, there is no harmful effect of ethno-veterinary medicine on the poultry, 50.0% agreed that, the mode of application of ethnoveterinary medicine is user friendly. Finally, 44.5% agreed that, the usage of ethnoveterinary medicine requires little or no special training, while 53.6% strongly agreed that, the knowledge of ethno-veterinary medicine can be easily transfer from one person to another.

In summary, the Table 2 shows that most (59.1%) of the respondents in the study area had favourable perception towards the use of ethno-veterinary medicine while 40.9% had unfavourable perception. This implies that perceptual usage of ethno-veterinary medicine is good perception and this will encourage the farmers to continue using the practice and also promote the widespread of the usage to others who have not been using it.

Table 3: Constraints to the Use of Ethnoveterinary Medicine

| Constraints | Major Constraint | Minor Constraints | Not a Constraints |
|--|------------------|-------------------|-------------------|
| Lack of adequate information on use of ethnoveterinary. | 85(77.3) | 24(21.8) | 1(0.9) |
| Unfavourable government policies. | 59(53.6) | 15(13.6) | 36(32.7) |
| Competing needs for material used. | 9(8.2) | 28(25.5) | 73(66.4) |
| Ineffectiveness of some practices. | 52(47.3) | 56(50.9) | 2(1.8) |
| Poor research on ethnoveterinary. | 71(64.5) | 29(26.4) | 10(9.1) |
| Lack of training on how to use ethnoveterinary medicine. | 83(75.5) | 14(12.7) | 13(11.8) |

The above table shows that most (77.3%) of the respondent in the study area identified lack of information as one of the major constraints, 53.6% said that unfavorable government policies is the major constraint. Also 50.9% of the respondents identified ineffective of some practices one of the major constraints. Majority of the respondents said lack of training on how to use

ethnoveterinary medicine is the major challenges while poor research on ethnoveterinary potency (64.5%) was considering as a major constrain. On the other hand, majority (66.4%) of the respondents said that competing needs for material used in ethnoveterinary medicine was not a constraints.

Table 4: Benefits Derivable from Ethnoveterinary Medicine

| S/N | BENEFITS | HIGH | MODERATE | LOW | NO |
|------------|--|-------------|-----------------|------------|-----------|
| 1. | Reduced cost of drugs | 85(77.3) | 21(19.1) | 4(3.6) | 0(0.0) |
| 2. | Easily accessible | 18(16.4) | 63(57.3) | 17(15.5) | 12(10.9) |
| 3. | Very easy to administered | 12(10.9) | 49(44.5) | 28(25.5) | 21(19.1) |
| 4. | Can be used at any time. | 25(22.7) | 53(48.2) | 30(27.3) | 2(1.8) |
| 5. | It is affordable | 55(50.0) | 45(40.9) | 10(9.1) | 0(0.0) |
| 6. | It is cheaper compared to veterinary drugs. | 76(69.1) | 27(24.5) | 7(6.4) | 0(0.0) |
| 7. | It helps to remove effect of chemical residue. | 66(60.0) | 27(24.5) | 17(15.5) | 0(6.0) |

Source: Field Survey 2017

The result on table 4 shows that most (77.3%) of the respondents identified usage of ethnoveterinary medicine to reduced cost of drugs and 57.3% considered easy accessibility to mutual usage of ethnoveterinary medicine as one of the benefit derived while majority 69.1% of the respondents said that ethnoveterinary medicine is cheaper compared to veterinary

drugs available in the market and 60.0% said it helps to remove effect of chemical residue from the meat gotten from poultry. In addition, 44.5% of the respondents considered ethnoveterinary medicine to be very easy to administer and 48.2% of the respondents said it can be use at any time.

Table 5: Uses of Ethnoveterinary Medicine

| S/N | Uses of ethnoveterinary medicine | Very frequently | Frequently | Sometimes | Not used |
|-----|--|-----------------|------------|-----------|----------|
| 1. | Use of Banana(<i>musa sapiartum</i>) to treat excretory disorders. | 5(4.5) | 14(12.7) | 18(16.4) | 73(66.4) |
| 2. | Use of <i>Carica papaya</i> to increase feeding for getting maximum weight. | 10(9.1) | 9(8.2) | 43(39.1) | 48(43.6) |
| 3. | <i>Zingiber officinale</i> (Ginger) to treat chronic respiratory disease. | 3(2.7) | 19(17.3) | 23(20.9) | 65(59.1) |
| 4. | Use of Garlic (<i>Allium satirum</i>) to treat chronic respiratory disease. | 1(0.9) | 23(20.9) | 23(20.9) | 63(57.3) |
| 5. | <i>Moringa oleifera</i> leaf is use to resist high temperature. | 9(8.2) | 11(10.0) | 67(60.9) | 23(20.9) |
| 6. | <i>Glycine max</i> seed (soybean) is used to increase energy and weight. | 28(25.5) | 57(51.8) | 15(13.6) | 10(9.1) |
| 7. | Use of <i>Citrus aurantifolia</i> fruit (Limes) to resist high temperature. | 19(8.2) | 11(10.0) | 36(32.7) | 54(49.1) |
| 8. | Use of bitter leaf (<i>Vernonia amygdalina</i>) to treat Newcastle disease. | 4(3.6) | 25(22.7) | 20(18.2) | 61(55.5) |
| 9. | Use of <i>Khaya senegalenses</i> (Dryzone Mahogamy) to treat Newcastle diseases. | 0(0.0) | 17(55.5) | 36(32.7) | 57(51.8) |
| 10. | Use of palm oil to treat fowl pox. | 9(8.2) | 17(55.5) | 61(55.5) | 23(20.9) |
| 11. | Use of bitter leaf to treat chronic respiratory diseases. | 5(4.5) | 20(18.2) | 71(64.5) | 14(12.7) |

The result in the above in Table 5 shows that 66.4% of the respondents did not use Banana leaf (*Musa sapentium*) to treat excretory disorders. Also 39.1% of the respondents sometimes use *Carica papaya* to increase feeding to get maximum weight. In addition, 59.1% of the respondents did not use Ginger (*Zingiber officinale*) to treat chronic respiratory disease and 10.9% sometimes use *Moringa oleifera* leaf to resist high temperature on the other hand, majority 51.8% of the respondents frequently use *Glycine max* seed to increase energy and weight, while 32.7%.

Sometimes use lime (*Aurantifolail* fruit) to resist high temperature.

Furthermore, 55.5% did not use bitter leaf (*Vernonia amygdalina*) to treat Newcastle disease and also 51.8% did not use dryzone mahogamy (*Khaya senegalese*) to treat Newcastle diseases. In the study area, 55.5% of the respondents use palm oil to treat fowl pox and also majorities (64.51) sometimes use bitter leaf to treat respiratory diseases.

Table 6: Sources of Information on Ethno-Veterinary Medicine

| S/N | | VERY FREQUENTLY | FREQUENTLY | NOT FREQUENTLY | NOT AT ALL |
|-----|---------------------|-----------------|------------|----------------|------------|
| 1. | Radio | 9(8.2) | 2(1.8) | 28(25.5) | 71(64.5) |
| 2. | Friends | 17(15.5) | 31(28.2) | 56(50.9) | 6(5.5) |
| 3. | Posters | 0(0.0) | 10(9.1) | 73(66.4) | 27(24.5) |
| 4. | Television | 2(1.8) | 19(17.3) | 40(36.4) | 49(44.5) |
| 5. | Newspaper | 2(1.8) | 20(18.2) | 62(56.4) | 26(23.6) |
| 6. | Meeting | 21(19.1) | 18(16.4) | 59(53.6) | 12(10.9) |
| 7. | Extension agent | 20(18.2) | 12(10.9) | 43(39.1) | 35(31.8) |
| 8. | Research institutes | 20(18.2) | 13(11.8) | 39(35.5) | 38(34.5) |
| 9. | Veterinary doctor | 0(0.0) | 11(10.0) | 38(34.5) | 61(55.5) |
| 10. | Pharmacy | 1(0.9) | 6(5.5) | 26(23.6) | 77(70.0) |
| 11. | Market vet | 2(1.8) | 3(2.7) | 14(12.7) | 91(82.7) |

From table 6 above, majority of the respondents 64.5% did not get their information from radio which means they got their information from other sources, while only small percentage got their information from friends (28.2%), Television (17.3%), Newspaper (18.2%), Meeting (16.4%), research institutes (11.8%) and veterinary doctor (10%) which is an indication that information about ethnoveterinary medicine is not well known about some poultry farmers sampled.

III. CONCLUSION

The respondents' perception on ethnoveterinary medicine showed that most of the respondents had favourable perception towards the use of ethnoveterinary medicine and majority of the respondents identified that constraints facing the respondents ranges from lack of information, unfavorable government policies, poor research on ethnoveterinary medicine and lack of training on how to use ethnoveterinary medicine. Finally, the contribution of ethoveterinary medicine can not be over emphasis and these includes reduction in the cost of purchase of modern medicine , easily accessible, easy to administer, it promotes organic farming and it has no residual effect on the meat.

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Knowledge and Attitude of Newly Qualified Nurses About Theory and Practice Integration

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Abstract- Theory and practice in nursing are closely linked. They interplay to create the reality of a concept. This research was to investigate the knowledge and attitude of newly qualified nurses about integration of theory into their practice. Descriptive survey design was used for the study involving all the Teaching Hospitals in Enugu and Bayelsa States in Nigeria. Purposive sampling was used to select the hospitals, stratified sampling technique was used to select the sample using 40% across board and convenience method was used to reach the respondents amounting to 272. A validated questionnaire developed by the researchers was used to measure desired parameters. The study found that 98.5% of respondents are knowledgeable about the terms theory and practice with 84.2% regarding the terms as related. Majority of respondents also expressed good knowledge about theory practice gap in nursing and 63.6% of respondents have negative attitude about the gap and described it as a problem. Shortage of nurses, nurses viewing theory as a classroom thing, hospital policies, poor clinical supervision, lack of equipment were implicated as some causes of the poor integration. Efforts made by respondents to close the gap were teaching and mentoring of colleagues to adopt evidence based practice, enforcement of use of nursing care plan. It was thus recommended that written interviews be utilised for promotion exercises, hospitals authorities be influenced to employ more nurses, use of nursing process should be mandatory, seminars/workshops be frequently organised in the hospitals units, and incentives be provided for attending update courses.

Keywords- Newly Qualified Nurses, Knowledge, Attitude, Theory and Practice

INTRODUCTION

Theory and practice are momentous concepts to the nursing profession. According to Priede (2014), ideal practice demands theory and practice integration because they are reciprocal, meaning that theory should be used in practice. Practice needs theoretical questioning to align itself properly and attempt to identify what is unique to nursing. The impetus for practice is provided by theory because it guides knowledge and ultimately improves practice. Practice on its part also provides the premise for theories to be developed which corroborates their reciprocity (Saleh, 2018). Nevertheless, scholars hold differing views about the terms, theory and practice.

According to Scully (2011), the debate on theory and practice relationship in nursing has been for decades and has created what is commonly referred to as “theory-practice gap”, a problem which nurses are faced with. While some literature portrays theory and practice as intertwined and important to nursing (Rowan, 2010, Mintz-Binder, 2019), others view theory and practice as distinctive and unrelated in nature, doubting the relevance of one to the other, and to the practice of nursing (Gallagher, 2007).

According to Da Vinci (2012), theory, practice and research are noted as defining the science of nursing. Theory serves as compass for practice and practice gives life to theory because without practice theory dies out fast. It means theory should be used in practice because it is the basis for understanding the reality of nursing. Nevertheless, Saleh (2018) argues that knowing theory is not a guarantee for good practice because several factors including student, instructor, environment, culture, and the organizational process (Safazadeh, Irajpour, Ali mohammadi and Haghani, 2018) can interplay to ensure successful integration of theory and practice. In this vein, nursing theory and practice have been viewed as two distinct entities with varying influences on nursing activities and practice. In Gallagher (2007), it is also noted nursing education, in some cases also construes theory and practice as discrete entities separated by a metaphorical void thereby aggravating the gap between theory and practice. Interestingly, Saleh (2018) noted that the concept of theory-practice gap is common knowledge in nursing but has become the biggest challenge of the profession which is contributing to degrade the quality of service both in teaching and practice (Safazadeh, et al 2018) especially as newly qualified nurses reportedly find it at times extremely difficult to apply the knowledge they acquired during their education (Bouchlaghem and Mansouri, 2018).

To bridge the gap, Saleh (2018) suggested continued interaction and collaboration between nursing researchers/scholars and practicing nurses, increased students’ exposure to theoretical principles, stress theoretical concepts, constructs, and principles, and provide opportunity for teachers’ clinical involvement. Nevertheless, in the presence of contrasting views some nurses might not even recognize the existence of any gap because of their perception of theory and practice. Others who may have recognized or are aware of the gap may not see it as a problem as well, in which case, nothing might be done to close it. There is also the possibility that some nurses have noted the problem and may

be encountering obstacles in their attempt to close the gap. All these would create attitudes about theory and practice integration.

In any case, so long as the problem continues to exist, the implication would be that nursing practice would be ritualistic, mechanical and intuitive with a scientific basis, which may affect nurses' morale, job satisfaction or retention (Maben et al, 2006) as they may not be motivated to study or utilise evidence based practice. Also, the patient may not receive good quality care, and the drive for autonomy in practice and professionalism might be compromised. The situation would even be worse, if it happens that nurses fail to recognize any gap or even trivialize it, in which case, there might not be any meaningful effort made to close the gap. Hence, this study of the knowledge and attitude of newly qualified nurses about theory and practice integration in nursing was carried out to identify the existence of the problem, the possible causes of the gap, and the attitude of nurses towards it. The hope of the study was to bring the issue to lime light and probably inspire some solutions for the problem in the area of study. This is particularly important because nurses need to bridge the gap if they must continue to develop and grow as professionals and ensure evidence-based quality care. The findings are therefore expected to benefit both the nurse as a provider of care and the consumer of health care. Additionally, the results of this study will contribute to the existing body of knowledge about theory-practice integration, and researchers can rely on them as reference for future studies.

METHODS AND MATERIALS

A descriptive study was performed on registered nurses who are employed and have been practicing for a period within five years from time of licensure at the Federal Medical Centre (FMC), Yenagoa and Niger Delta University Teaching Hospital (NDUTH), Okolobiri both in Bayelsa State and Enugu State University Teaching Hospital (ESUTT) Parklane, Enugu and University of Nigeria Teaching Hospital (UNTH), Ituku-Ozalla both in Enugu State of Nigeria.

A stratified sample of 281 out of 702 (representing 40% the total population and across board) was used for the study (Table 1). The convenience sampling technique was used to reach respondents who were on duty in the wards of the various hospitals.

Data collection was with a validated questionnaire the researchers developed based on literature review. Prior to data collection, permission was obtained from the head of units to access the nurses. Oral consent was also obtained from each respondent before administering the questionnaires. Confidentiality and privacy was also maintained.

The questionnaire was administered by the researchers to respondents who were on duty in each ward during morning and afternoon shifts. Research assistants who were briefed on the purpose of the study administered the questionnaire to the night nurses in each ward. Retrieval of completely filled questionnaire was made, starting from the unit the distribution commenced. Some copies of the questionnaire that were not completed immediately were collected later. Out of the 281 copies of the questionnaire distributed, only 272 copies were retrieved giving a return rate of 96.8%.

Data collection lasted two weeks in each hospital. Therefore the entire data collection was for eight weeks. Data

analysis was carried out by simple descriptive statistics using frequencies and percentages.

RESULTS

Of the 272 nurses that participated in the study, 226(83.1%) were Nursing officers II (NO IIs) while 46 (16.9%) were Nursing officers I (NO Is). Of these, majority (74.3%) were RN and RM holders, while 25.8% were nursing degree holders. All respondents have not exceeded five years since their licensure and have also not worked for more than five years since employment (Table 2).

The results show that respondents have high level of knowledge about theory, practice and their integration. Majority described theory as what is learnt in classroom and from books to pass examinations, a mere mental conception of how something should be done, is an idea that explains/predicts the way something should be done, the knowledge gained from the classroom and books on how to do a thing (Table 3). Practice was described by majority of respondents as solving identified problems by doing things based on information or knowledge gained from theory, the art of carrying out procedures as instructed, the conventional or traditional way of doing procedures or things, while 4(1.5%) out of 272 participants consider practice as administering of prescriptions in a hospital ward (Table 4).

Table 4 showed participants' perceptions about theory practice relationship. Of the 272, 219 (80.5%) indicated theory as needful to practice nursing in the ward while 19.5% (53) did not see any need of theory to practice nursing. Many, 91 (33.5%) indicated that theory provides explanations for practice, 40 (14.7%) respondents claim that theory provides the information needed to practice, 10.7% say practice provides the basis to develop theories, 83 (30.5%) regarded all the above as the relationship, while 29 (10.7) did not consider any of the options as indicating the relationship between theory and practice.

On the extent of integration of the terms, 70 (25.7%) think of theory as only needed to carry out certain procedures like giving of injection. Twenty nurses (7.4%) considered theory as not necessary if a procedure is prescribed by a doctor and the nurse is familiar with it. Four subjects (1.5%) regarded theory as not needed any more if one has become very conversant with the routine care of patient, while 178 (65.4%) considered theory as needed in all situations and procedures of patient care and at all times of practice (Table 5).

As responses to the questions, "Do you think the knowledge you gained from training and books is fully utilised in your care of patients, and have you heard of theory-practice gap respectively?", 37.9% (103) participants claimed that they utilize the knowledge they gained from training and books fully in their patients' care, while 169 (62.1%) do not. Many participants (85.3%) have heard of theory-practice gap, while 40 (14.7%) claim they have not heard of it. Describing the concept, 107 (39.3%) out of the 272 respondents described the expression as a discrepancy between what is learnt and what is practiced, 47 (17.3%) described it as the inability to transfer classroom knowledge to practice, 25 (9.2%) stated it as failure of practice to live up to theory, 34 (12.5%) as practicing nursing without making use of the knowledge and understanding derivable from its theory, 44 (16.2%) all the provided options as description for the expression,

while 15 (5.5%) did not choose any option as describing theory-practice gap.

On the existence of theory practice gap in nursing, 231(84.9%) indicated that theory-practice gap exist in nursing, 35 (12.9%) said it does not exist. In this vein, 225 (82.7%) of respondents reported that their inability to put into practice what they have learnt affect their practice of the profession, while 47 (17.3%) claimed that it does not affect their practice. Consequently, 173(63.6%) of the respondents consider the theory practice gap as a problem, 97 (35.7%) do not think it to be a problem.

Regarding elements that possibly create the gap, 117 (43%) of respondents indicated shortage of nurses as a factor responsible for the gap, 143 (52.6%) blamed nurses viewing theory as a thing of classroom and not absolutely relevant in practice as a factor for the gap, 109 (40.1%) identified hospital policies and organizational constraints on how things should be done as responsible, 92 (33.8%) said poor clinical supervision both during training and on the job is a factor, 153 (56.3%) indicted inadequate supplies and equipment as a cause for the gap, 17 (6.3%) mentioned nature of training and socialization received from the training schools as an influence, 100 (36.8%) identified lack of interest of nurses in doing their practice based on existing current information from research findings and literature as the cause of the gap, 115 (42.3%) reported irregular or infrequent reading and updating of knowledge in current standard practices as a factor, 144 (52.9%) claimed that not reading frequently or attending seminars and workshops often enough to update knowledge/poor knowledge of current information is a cause, 39 (14%) implicated lack of time as a cause, while 46 (16.9%) regarded inter-professional squabbles or poor inter-professional relationship as a cause for the theory practice gap.

On recommendations that can close the gap, 26.8% of respondents think that good and effective teaching methods in training schools will help, 79 (29.0%) said adoption of the habit of always making use of existing current information in the practice in the ward will help, 48 (17.6%) identified adequate clinical supervision during training and in the work situation as possible help, 47 (17.3%) suggested frequent exposure to update courses as help, while 25 (9.1%).

Concerning efforts made by nurses to remedy the gap, 66 (24.3%) respondents said they have tried to influence change in many ways. 41 (15.1%) claim that they draw up care plans of patients for other colleague to implement, 81 (29.8%) suggested to their bosses to make the use of nursing process mandatory by all nurses, 10 (3.7%) claim that they have done options b, c and d at different times. But the efforts have not been effective. 74 (27.2%) of the subjects claim that their efforts yielded positive results, 187 (68.8%) reported no positive results.

DISCUSSION OF FINDINGS

Although this study was done with junior nurses, it applies to all nurses and the nursing profession. The major findings in this work are discussed based on the set objectives of the study.

Objective One: To ascertain the knowledge nurses have about theory-practice gap in nursing.

Findings from the study reveal that 94.5% of the subjects have knowledge about theory-practice gap in nursing.

Demonstrating their knowledge of the gap, 84.9% asserted that theory-practice gap exists in nursing. This shows that nurses have a fairly good knowledge about theory and practice integration (or theory-practice gap) in nursing. This could be due to their exposure to the terms theory and practice during training and the emphasis in the classroom of evidence-based practice. The result agrees with the report of Saleh (2018), that, theory-practice gap is well known by nurses.

Further findings of the study revealed that 62.1% of respondents claimed they could not fully utilise the knowledge they had gained from books and training. These experiences are also congruent with the report of Maben et al (2006), that, even if a practitioner knows what to do for patients it is not always possible to do so, thus justifying their knowledge of the theory-practice gap in nursing.

However, 40 respondents claimed ignorance of a theory-practice gap that they have not heard of it. This may be due to their view of the terms theory and practice. Saleh (2018) noted that practitioners view the theory-practice relationship in different ways, which has generated serious debates over the years. Gallagher (2007) corroborated this, noting that, the specific way nurses think of theory or practice has contributed to the belief that they are separate entities.

Objective Two: To determine if nurses perceive the gap as a problem

Findings from the study show significantly that many nurses are not comfortable with the gap. They perceive it as a problem and majority (82.7%) described it as affecting their practice. Other respondents (64.3%) reported that it makes their practice routine and ritualistic, 70.6% said it reduces them to merely carrying out orders from other professionals, while 17.6% claims, it reduces their professional autonomy and ability to take initiatives. This may be the reason why 63.6% regard the gap as a problem. These findings agree with the prediction of Maben et al (2006), that the gap would affect nurses' morale, job satisfaction or retention; make practitioners mechanical and ritualistic rather than being scientific. The respondents' view of the gap as a problem is also consonant with the opinion of steveklabnik (2012) that theory and practice are two inseparable and inclusive entities because they always have a relationship of one giving birth to the other.

However, the findings also showed that, although a large proportion of the respondents claimed the gap affected them adversely, 1.5% stated the effect as a benefit to them, it affords them the opportunity to care for many patients in a short time so that they could rest; 4.4% said they do not need theory to practice nursing, which reflects the report of Saleh (2018), that theory and practice are distinct and unrelated and that knowing theory is not a guarantee to good practice. Nevertheless, since most respondents regard the gap as a problem, it is possible that more nurses will also see it as a problem since transfer of what is taught to what is experienced is imperative to ensure safe practice in nursing (Maginnis & Croxon, 2010). Therefore, a solution is needed.

Objective Three: To identify factors nurses perceive as influencing the integration of theory and practice.

Findings from Table 7 revealed that many factors affect the integration of theory and practice in nursing. In order of ranking according to response percentages, the factors include: inadequate supplies and equipment (56,3%), not reading frequently or

attending seminars/workshops for update (52.9%), nurses viewing theory as a thing of classroom and not absolutely relevant in practice (52.6%), shortage of nurses (43%), irregular or infrequent reading and updating of knowledge in current standard practices (42.5%), hospital policies and organisational constraints on how things should be done (40.1%), lack of interest of nurses in doing their practice based on existing current information from research findings and literature (36.8%), poor clinical supervision both during training and on the job (33.8%), inter-professional squabbles or poor inter-professional relationship (16.9%), lack of time (14.3%) and nature of training and socialization (6.3%). These factors identified in the study are not confined to this study population alone. They are also reported in Akinbo, Odebiyi, Okunola, and Aderoba(2013) and Safazadeh, et al (2018) as negatively affecting the integration of theory and practice. Other factors implicated are: duration of licensure and employment (79.4%) and the thought that if a nurse stays off from reading often for 5 to 9 years, he or she will lose touch with current knowledge(39%). These responses are based on the fact that, naturally if one does not see or do a thing often, the ability to recognise it or do it is gradually lost. The finding again agrees with that of Akinbo et al (2013), which reported that practitioners with less than 5 years since licensure appeared more knowledgeable about the concept of evidence-based practice (i.e. good theory-practice integration) than those with greater than 15 years since licensure. The little difference between the findings of this study and that of Akinbo et al is that, in their work, above 15 years of licensure is the upper limit at which a practitioner might lose touch with theory-integrated practice, while respondents in this study expect a practitioner to should lose touch with theory-based practice in less than 10 years.

Objective Four: To identify what nurses proffer as recommendations to bridge the gap.

From the results in Table 8, respondents identified various factors that would help to close the gap, in which good and effective teaching methods in training schools and adoption of the habit of always making use of existing current information in the practice in the ward dominated. Also, other factors such as adequate clinical supervision during training and in the work situation, frequent exposure to update courses and good reading culture were implicated as capable of closing the gap. In the same way, respondents' opinions were sought on this issue and they suggested that hospital managements should employ written interviews as a tool for promotion; supportive supervision should be adopted to encourage colleagues; salaries should be increased to motivate staff, and in-service training should be granted to nurses. The possible reason for the above result could be, because nurses see the gap as a problem which has negative influence on their practice, they desire it to be closed. This reason agrees with the opinion of Maben et al (2006), that, the presence of the gap would affect nurses' morale, job satisfaction and quality of care given to patients.

Objective Five: To elicit efforts being made by nurses to help bridge the gap.

Majority of the respondents have made much effort to close the gap; ranging from teaching, encouraging and mentoring of colleagues to imbibe evidence-based practice; initiating seminars or workshops and using the nursing process in patient; while other respondents have not made significant effort to close

the gap. A proportion of respondents (40.1%) also reported that other of their colleagues do not use the nursing process in the management of patients. The efforts made to encourage those colleagues were questioned and 44.8% of the respondents claimed to have encouraged them by drawing up care plans for others to implement and suggesting to their bosses to make the use of nursing process mandatory. These efforts were made possibly in recognition of the negative effect of the gap, the need to improve the quality of patient care and the need to increase the use of evidence in their daily practice since evidence helps in deciding the best care to be given to patients. This reason aligns with the view of Raudonis and Acton (2012) that theory offers nurses with a perspective with which to analyze client situations, and would help them collect useful data, plan comprehensive care and deliver better care.

The findings from this study revealed that nurses have knowledge of the theory-practice gap, nurses perceive the gap as a problem, nurses were able to identify factors responsible for the theory-practice gap, nurses were able to suggest possible measures to close the gap, and numerous efforts are being made to close the gap.

Since nurses are aware of the theory-practice divide, and consider it as a problem, not making adequate efforts to close the gap will not only affect the quality of nursing care but the nursing profession in general. Therefore, the knowledge should be utilised by those concerned or in authority to orientate nurses through seminars and workshops towards the existing gap and sensitize them towards looking for solutions.

Consequent upon the findings, it was recommended that nurse-managers should try and influence hospital authorities to employ more nurses in order to curb the problem of staff shortage, which respondents considered a cause of theory-practice gap. Nurse-managers and their hospital managements should make use of written interviews as a tool for promotion exercises as this will help nurses read and become conversant with current knowledge and standards of practice to be used. Hospital unit managers or heads should make the use of the nursing process mandatory being that it is a tool that will integrate theory and practice. Seminars/workshops should be organised frequently in the hospital units to encourage knowledge update. Management should provide incentive in form of allowance for attending update courses, in order to encourage nurses' interest in such activities. Hospital authorities should be encouraged to provide basic equipments to enable the effective discharge of care. This will help to integrate theory to practice as there will be minimal improvisation. Nurse-managers should update themselves on the skills of supervision and should also be knowledgeable in current ideal practices so as to adequately supervise and provide necessary support.

APPENDICES

Table 1: Distribution of sample in the hospitals (40% each)

| Hospital | NO I | NO II | Total |
|----------|------|-------|-------|
| UNTH | 29 | 113 | 142 |
| ESUTTH | 1 | 78 | 79 |
| NDUTH | 6 | 24 | 30 |
| FMC | 10 | 20 | 30 |
| Total | 46 | 235 | 281 |

Table 2: Demographic Characteristics of Respondents

| Characteristics | Frequency | Percentage |
|--------------------------------|-----------|------------|
| Age: | | |
| 22 – 29 years | 160 | 58.8 |
| 30 – 35 years | 112 | 41.2 |
| Sex: | | |
| Male | 15 | 5.5 |
| Female | 257 | 94.5 |
| Rank: | | |
| NO II | 226 | 83.1 |
| NO I | 46 | 16.9 |
| Qualification: | | |
| RN | 41 | 15.1 |
| RN,RM | 161 | 59.2 |
| BSc Nursing | 27 | 9.9 |
| BNSc | 17 | 6.3 |
| Others | 26 | 9.6 |
| Years since licensure: | | |
| Under 1 year | 49 | 18.0 |
| 1 – 3 years | 130 | 47.8 |
| 4 – 5 years | 93 | 34.2 |
| Duration of employment: | | |
| 1 year | 13 | 4.8 |
| 2 years | 81 | 29.9 |
| 3 years | 72 | 26.5 |
| 4 years | 76 | 27.9 |
| 5 years | 30 | 11.0 |

Table 3: What respondents think is theory

| Options | Frequency | Percentage |
|---|-----------|------------|
| What you learn in classroom and from books to pass exams | 29 | 10.7 |
| Mere mental conception of how something should be done | 65 | 23.9 |
| Ideas that explains/predicts the way something should be done | 138 | 50.7 |
| Knowledge gained from class and books on how to do a thing | 35 | 12.9 |
| No response | 5 | 1.8 |

Table 4: What respondents think is practice

| options | Frequency | Percentage |
|--|-----------|------------|
| Art of carrying out procedures as instructed | 70 | 25.7 |
| Solving identified problems by doing things based on information | 123 | 45.2 |
| Conventional or traditional way of doing procedures or things. | 75 | 27.6 |
| Administering of prescriptions in a hospital ward | 4 | 1.5 |

Table 5: Responses about theory and practice relationship

| Options | Frequency | Percentage |
|--|-----------|------------|
| Theory provides the information needed to practice | 40 | 14.7 |
| Practice provides the basis to develop theories | 29 | 10.7 |
| Theory provides explanations for practice | 91 | 33.5 |
| All of the above | 83 | 30.5 |
| None of the above | 29 | 10.7 |

Table 6: Respondents' View of Extent of Theory-Practice Integration

| Options | Frequency | Percentage |
|---|-----------|------------|
| Only needed to carry out certain procedures like giving of injection | 70 | 25.7 |
| Not necessary if procedure is prescribed by a doctor and you are familiar with it | 20 | 7.4 |
| Not needed any more if one has become very conversant with the | 4 | 1.5 |
| Needed in all situations and procedures and procedures of | 178 | 65.4 |

Table 7: Responses on factors subjects think are responsible for the theory practice gap

| Options | Frequency | Percentage |
|---|-----------|------------|
| Shortage of Nurses | 117 | 43 |
| Nurses view theory as a thing of classroom and not absolutely relevant in practice | 143 | 52.6 |
| Hospital policies and organizational constraints on how things should be done | 109 | 40.1 |
| Poor clinical supervision both during training and on the job | 92 | 33.8 |
| Inadequate supplies and equipment | 153 | 56.3 |
| Nature of training and socialization received from the training schools | 17 | 6.3 |
| Lack of interest of nurses in doing their practice based on existing current information from research findings and literature | 100 | 36.8 |
| Irregular or infrequent reading and updating of knowledge in current standard practices | 115 | 42.3 |
| Not reading frequently or attending seminars and workshops often enough to update knowledge/poor knowledge of current information | 144 | 52.9 |
| Lack of time | 39 | 14.3 |
| Inter-professional squabbles or poor inter-professional relationship | 46 | 16.9 |

Table 8: Factors That Respondents' Think Can Integrate Theory and Practice

| Options | Frequency | Percentage |
|--|-----------|------------|
| Good and effective teaching methods in training schools | 73 | 26.8 |
| Adoption of the habit of always making use of existing current information in the practice in the ward | 79 | 29.0 |
| Adequate clinical supervision during training and in the work situation | 48 | 17.6 |
| Frequent exposure to update Courses | 47 | 17.3 |
| Good reading culture | 25 | 9.1 |

Table 9: Respondents' Efforts To Integrate Theory and Practice

| Questions | Options | | | |
|--|-----------|-----|------------|------|
| | Frequency | | Percentage | |
| | Yes | No | Yes | No |
| Have you ever taught, encouraged or mentored a colleague to imbibe the practice of caring for patients based on current research evidences? | 211 | 61 | 77.6 | 22.4 |
| Have you ever initiated an update seminar or workshop regarding a procedure in your unit of practice? | 162 | 110 | 59.6 | 40.4 |
| Do you make use of the nursing process in your day to day care of patients being that it is a tool for evidence-based care and a bridge for theory and practice? | 141 | 131 | 51.8 | 48.2 |
| Do other colleagues also make use of the nursing process? | 163 | 109 | 59.9 | 40.1 |

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The Development of Learning Devices Using Advance Organizer Model to Improve the Concept Understanding of the Students in Ion and Covalent Bond Materials

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Abstract- This research aimed to produce learning media based advance organizer model which is valid, practical and effective to improve understanding students' concept in material of ion bond and covalent bond. This research was conducted at Senior High school of Sport East Java in class X in odd semester. This development research used development model of Dick and Carey with the trial using One-Group Pretest-Postest Design.

This research was done in three stages, (1) preparation phase which was to develop learning media based advance organizer model, (2) validation phase of learning media and (3) implementation phase of learning media in class. Instruments used in this research were learning media validation sheet, observational sheet of learning process implementation, observational sheet of students' activity, observational sheet of readability of textbooks and LKS, test sheet of students' concept understanding, and questioner sheet of students' responses.

The findings of the research as follow: 1) learning device based advance organizer model that had been developed was revealed valid and proper to use in learning activity; 2) learning device was reviewed from RPP implementation showed in good category; 3) students' activity during learning device implementation had been described suitability with advance organizer learning model. Many relevant activities had enhancement; 4) developed legibility of textbook and student worksheet were in good category; 5) students' learning concept after following Chemistry subject based advance organizer model in ion bond and covalent bond material had effective improvement; 6) students' response after following learning activity could be categorized good, most students were interested to learning activity. Based on the findings, it can be concluded that chemistry learning media based Advance Organizer model in material of ion bond and covalent bond is valid, practical and effective so it is proper to use for students' concept understanding.

Index Terms- Advance organizer model, Concept Understanding, Material of Ion and covalent bonds.

I. INTRODUCTION

Chemistry can be found in all aspects of life, culture and the human environment. The scope includes air, food, drinking water, clothing, shelter, transportation and fuel supplies, and living things other than humans. Chemistry is a science that describes the material, its properties, changes that occur, and changes in energy that accompany the process. The material encompasses everything real, starting from the body and various things in daily human life, to the massive object in the universe. Some parties assume that chemistry is the center of natural science. Chemistry rests on mathematics and physics, and then based on the knowledge of living things, namely biology and medicine, to fully understand the system of living things, it must first understand the chemical reactions and their effects that occur in the body living things. Chemical compounds that exist in the body are very influential on humans, even against their thoughts and emotions.

In Indonesia, students' interest in studying chemistry from 2007 to 2011 showed a decline. 2011 TIMSS (Trends in International Mathematics and Science Study) study showed that the average score of Indonesian students in the chemical domain was 378, 30 points lower than the 2007 achievement score, at 408, while on the other hand literary interest in Indonesian students from the year 2006 to 2011 showed an increase. The 2011 results of PIRLS (Progress in International Reading Literacy Study), showed that the average score of Indonesian students in reading the literature was 428, 24 points higher than the 2006 achievement score of 405.

This fact is contrary to Ausubel's (1963) opinion of meaningful learning. Meaningful learning occurs when students connect new material into their cognitive structure, and the material will be very meaningful to them because it has a link that connected with the structure of knowledge that they already have.

Students' minds that have been prepared to receive and process information, learning through listening, watching and reading will be able to develop the ability of students to be more active in processing information (Joyce, 2009). The form of preparation is an effort to

improve the stability and clarity of the cognitive structure of students before getting a new subject matter. Increasing literacy interest in Indonesian students from 2006 to 2011, as shown by PIRLS research results should also be followed by an increase in their chemical learning outcomes.

The advance organizer model is a learning model designed to strengthen the cognitive structure of students, students' knowledge of specific lessons and how to manage, clarify and maintain that knowledge well (Ausubel, 1963). Several studies on advanced organizer models showed satisfactory results, one of which concluded that there were significant differences between conceptual understanding, and critical thinking skills of students using advanced organizer learning models with conceptual understanding, and critical thinking skills of students using direct teaching models (Budiartawan, Mursalin and Yunginger, 2013). The chemical bonding material is one of the chemical materials that learned in class X high school, in the material of chemical bonds one of the students is required to be able to compare the processes of ion bond formation and covalent bonds. The concepts in ion bond material and covalent bonds must be challenging to understand if students only listen to explanations and memorize a verbal definition without understanding the contents. Therefore, advanced organizer learning models are very suitable to be applied in this learning material.

Based on data from daily test results of class X students, East Java Sports State High School, on chemistry subject matter, the overall average of class X, which is equal to 64.82 on a scale of 0 - 100 or equivalent to 2.59 on a scale of 1 - 4. The average has not reached the standard competency knowledge completeness score according to Article 9 paragraph 2 of Permendikbud No. 104 of 2014 amounting to 2.67 which is equivalent to 66.75 on a scale of 0 - 100 (Siamhady, 2018). The data shows that chemical bonding material is one of the chemical materials that are difficult to understand for students of East Java Sports High School.

Based on the results of interviews with chemistry teachers, information was obtained that the teaching and learning activities that carried out at East Java Sports State High School are conducted after the students' regular training in their respective sports branches, so that students' attention when exhausted during the teaching and learning process was very low in all subject including chemistry subject.

Learning materials are external factors of the students who can strengthen internal motivation to learn. The one way of learning that can influence learning activities is to include learning material in the activity. Learning materials are entirely designed, meaning that there are elements of media and adequate learning resources that will influence the learning atmosphere so that the learning process that occurs in students becomes more optimal. Learning materials in the context of learning is one component that must exist since learning materials are a component that must be studied, examined, studied and made into material that will be mastered by students and at the same time can provide guidance to learn it. Learning is carried out without using learning materials, so the learning will not produce anything. The introduction material presented by the teacher in the form of an advance organizer is one form of learning material.

Learning materials in the form of learning devices have been provided by the government in the form of student books and teacher books. However, the learning devices are still too general, in their application, the teacher must independently develop the device according to the conditions of each school, including a learning device plan (RPP), quality teaching materials and student worksheets (LKS) so that they can achieve learning objectives that are in accordance with the basic competencies in the 2013 curriculum.

Based on this background, the authors are motivated to conduct research aimed at producing learning devices using a valid, practical, and effective advance organizer model to improve students' conceptual understanding of ionic bonding and covalent bonds.

II. METHODS

The test was carried out using the design of the One-Group Pretest-Posttest Design since the test conducted in one group without a comparison group. The design of this study was used to obtain input in the form of recording about the first test score (pretest) and the final test score (posttest) to see completeness and learning outcomes.

2.1 Research Subject

The subject of this study was an advanced organizer chemistry learning device which was tested on class X of East Java State Sports Senior High School.

2.2 Research Instruments

The instruments used to collect data in this experiment are as follows:

2.2.1 Learning Device Validation Sheet

This instrument is used by asking the experts to evaluate learning devices from aspects of content, construction and language. Based on the feedback, the learning device is modified so that it is more adequate, valid, effective and can be used properly. The validation sheet used to measure the feasibility of learning devices includes:

- Student Learning Material validation sheet
- Validation sheet of Learning Implementation Plan
- Validation Sheet for Student Worksheets
- Validation Sheet for Student Concept Understanding Tests

2.2.2 Observation Sheet for the Implementation of the Learning Process

This instrument or observation sheet is used to observe the feasibility of each step in the learning process made by the researcher and observed by the observer. This instrument contains the steps that must be taken by the teacher in the implementation of learning.

2.2.3 Student Activity Observation Sheet

Instruments or observation sheets of student activities in teaching and learning activities include the activities of students during the teaching and learning activities. Observations are made from the beginning of learning till the completion.

2.2.4 Readability Sheet for Student Learning Materials and LKS

Readability sheets are used to determine the level of readability of Teaching Materials and LKS. Readability sheet instrument in the form of a questionnaire.

2.2.5 Student Concept Understanding Test Sheet

This assessment sheet was developed by researchers and used to obtain information or data on the extent to which students understand concepts that have been mastered. This assessment sheet consists of 25 items consisting of objective questions to understand students' conceptual understanding.

2.2.6 Student Response Questionnaire Sheet

The student response questionnaire sheet developed by this researcher was used to obtain information or data on student responses to learning using an advance organizer learning model. The questionnaire responses students write instructions and requests to students to give their responses in their own opinion without being influenced by others, student responses consist of very agree, agree, disagree, and strongly disagree.

2.3 Data Collection Techniques

The techniques used to collect the data are:

2.3.1 Device Validation

The development of teaching materials and worksheets is a requirement of this study. Before the trial was conducted, the learning devices developed first were validated by experts or validators using the RPP validation instrument, Student Learning Materials, Student Worksheets and Student Concept Understanding Test Sheets. Data from the learning device validation results are collected after the validator provides an assessment of the learning device on the validation sheet.

2.3.2 Test Giving

The test given is done twice, namely before the learning process begins (pretest) to determine the level of readiness of students in learning the concept of ion bonds and covalent bonds, and after the learning process (posttest) to determine the level of achievement of learning indicators.

2.3.3 Observation

The data collection techniques used in the research development of this learning device are as follows:

a. Observation

Observations were made to collect research data about the feasibility of RPP, student activities during the learning process, and the performance of understanding students' concepts. Observers are two observers who have been given direction first so that they can use the observation sheet correctly and precisely.

b. Distribution of Questionnaires

The distribution of questionnaires aims to collect research data about student responses to the learning process that has been conducted. The questionnaire is filled with honesty and objectively without pressures from any party.

2.4 Data Analysis Technique

The data analysis technique to answer the proposed research questions is by descriptive analysis techniques. This technique describes the activities of teachers and students during the learning process takes place with an advance organizer model to improve students' conceptual understanding, which includes Analysis of Learning Device Validation Results, Analysis of Observation of RPP Implementation, Analysis of Student Response to Learning Activities, Observation Analysis of Student Activities, Analysis of Concept Understanding Students.

III. RESULT AND DISCUSSION

3.1 Learning Device Validation

Assessment given by validator in media developed was proper. It meant that all learning tool developed had been worth and they could be used with some revision. Learning media developed referred to 2013 curriculum. They are RPP, BAS, LKS and understanding test question of students/ concept.

Table 1: Results of Learning Device Validation

| No. | Device | Score | Category |
|-----|----------------------------------|-------|------------|
| 1 | Lesson Plan (RPP) | 4 | Very valid |
| 2 | Student Learning Materials (BAS) | 3 | Valid |

| No. | Device | Score | Category |
|-----|--|-------|------------|
| 3 | Student Activity Sheet (LKS) | 4 | Very valid |
| 4 | Students' Concept Understanding Test Questions | 4 | Very valid |

3.2 Implementation of Lesson Plan (RPP)

Based on data analysis of RPP implementation, it can be seen that the result of learning implementation using learning model of Advance organizers at the second meeting were higher than the first meeting. Nevertheless, learning in both meetings showed that learning activities have been conducted well. Thus all the steps listed in the learning tool which have been developed can be carried out very well by teachers and students and play an active role in the learning process.

Average value of RPP implementation in introducing aspect was the same between first and second meetings. On the other side, the average value of RPP implementation in the core and concluding aspects was achieved higher in the first meeting than the second meeting, whereas in the management aspect of the classroom atmosphere the average value of lesson plans was achieved higher than the second meeting. This showed that the delivery of implemented organizers was as good as the first and second meetings, whereas in terms of material delivery or the task of learning and strengthening cognitive processing, the first meeting was conducted better than the second meeting. This occurred because the energy of the instructor/researcher at the second meeting was more drained in the aspect of managing the classroom atmosphere for conducive learning, which when the second meeting focused on group learning activities, evidenced by the average value of managing the classroom atmosphere in the second meeting higher than the first meeting.

Table 2: Implementation of Lesson Plan (RPP)

| No. | Observed Aspect | Mode |
|---|---|-------|
| Introduction | | |
| Observation | | |
| Clarifying the learning objectives | | |
| 1. | Greetings and greet the students. | 4 |
| 2. | Deliver the learning objectives. | 4 |
| 3. | Distributing the teaching material books and student worksheets to students or instructing them to prepare teaching material books and worksheets at each student's desk. | 4 |
| Display the graphic organizer and present it to students | | |
| 1. | Presenting the organizer to students | 4 |
| 2. | Mention the concepts in the organizer and the specific or essential characteristics of each of these concepts. | 4 |
| 3. | Provide examples of these concepts. | 3 |
| 4. | Explain the connection between these concepts. | 4 |
| 5. | Repeat the explanation of new terms or special terms in the organizer. | 4 |
| Questioning | | |
| 1. | Ask some of the students to recall by verbally mentioning the students' previous knowledge and experience relevant to the organizer. | 3 |
| Main | | |
| Collecting data (experimenting) | | |
| 1. | Presenting material through lectures, discussions, films, or reading. | 4 |
| 2. | Provide logical and clear submission numbering in presenting learning material. | 4 |
| No. | Observed Aspect | Modus |
| 3. | Explain the connection between the detailed material presented with the organizer. | 4 |
| Associating | | |
| Using the principles of integrative reconciliation | | |
| 1. | Remind students about all the main ideas of learning material. | 4 |
| 2. | Ask students to summarize learning material. | 4 |
| 3. | Repeating the definitions of concepts. | 4 |

| No. | Observed Aspect | Mode |
|--|--|-------|
| 4. | Give students the task to write down differences that exist between concepts in the material that has been presented. | 4 |
| Organize the active reception learning sessions | | |
| 1. | Ask students to write additional examples of concepts in the learning material. | 4 |
| Closing | | |
| Communicating | | |
| 1. | Ask students to restate learning material in groups in front of the class by using their language. | 4 |
| Generating a critical approach to learning material | | |
| 1. | Ask students to restate all the main ideas from the learning material that students note, in groups in front of the class, using the students' language. | 4 |
| Clarification | | |
| 1. | Ask each group of students to ask, and the question is answered by the teacher. | 4 |
| Classroom Management | | |
| No. | Observed Aspect | Modus |
| 1. | The suitability of KBM with learning objectives | 4 |
| 2. | Management of teaching and learning time used in accordance with the RPP | 3 |
| 3. | KBM tends to be student-centred | 3 |
| 4. | KBM tends to be teacher-centred | 3 |

3.3 Student Activity

Student's activity in this research was set of activities conducted by students during learning activity. Based on the results of data analysis, the dominant activity of students that occurred in the class at meeting 1 was to read or search for teaching material information according to the content, which was an average of 7.5. Whereas the dominant activity of students that occurs in class 2 was discussing assignments/questions in LKS, which are with an average of 6.

There were 2 activities centered in students that showed significance enhancement from meeting 1 to meeting 2, namely activity 5) Record the observational data according to the LKS and 6) Discuss the tasks/questions in the LKS. These activities indicated an increase in the first to second meetings, while the activities conducted by the teacher indicate a decrease in each meeting. This showed that learning was more student-centered and the teacher only played role as a facilitator.

Table 3: Student Activity

| No. | Activity | First Meeting | | Second Meeting | |
|-----|----------|---------------|--------|----------------|--------|
| | | Mean | Pa | Mean | Pa |
| 1 | a1 | 6 | 83,33 | 4,5 | 88,89 |
| 2 | a2 | 7,5 | 93,33 | 3,5 | 85,71 |
| 3 | a3 | 2 | 100,00 | 2 | 100,00 |
| 4 | a4 | 3,5 | 85,71 | 2,5 | 80,00 |
| 5 | a5 | 2 | 100,00 | 3,5 | 85,71 |
| 6 | a6 | 4,5 | 88,89 | 6 | 83,33 |
| 7 | a7 | 2 | 100,00 | 2 | 100,00 |
| 8 | a8 | 3 | 100,00 | 3 | 100,00 |
| 9 | a9 | 4,5 | 88,89 | 2,5 | 80,00 |
| 10 | a10 | 2,5 | 80,00 | 2,5 | 80,00 |

3.4 Readability of Student Teaching Materials (BAS) and Student Activity Sheets (LKS)

Based on result of data analysis, most students considered that BAS and LKS developed by researcher were interested either in content or presentation. The level of understanding of students in understanding questions at BAS and LKS was also high. The illustrations/images used by researchers also make it easier for students to understand these learning model. The difficulty of students in understanding the description in BAS and the presence or absence of questions in LKS that were not understood obtained the lowest score of 63% and 67%. The reason for the low percentage was because students were not fully familiar with the terms ionic and covalent bonding material used in BAS. Thus, for future improvement, researchers will provide language that is easier for students to understand. Based on these results, it can be concluded that the level of readability of BAS and LKS is good (strong) because it is worth $\geq 60\%$.

Factor affecting this legibility level was the interest of students in the model given in terms of the appearance of the layout and the image. This can be seen from the percentage of students' interest in the appearance of BAS and LKS with a high score of 100%. According to Nieven (in Nufus, 2013), it was concluded that BAS developed both in content and appearance was very interesting for

students even though there were some students who felt a little difficulty. The given image or illustration could clarify the description of BAS readability in general so that it was categorized as good and suitable for use in learning.

Table 4: Readability of Student Textbooks (BAS)

| No. | Question Description | Percentage of Student Answer Options (%) | |
|-----|--|--|-----------------|
| | | Interesting | Not Interesting |
| 1 | Is the content of this Teaching Material interesting? | Interesting | Not Interesting |
| | | 80% | 20% |
| 2 | Is the appearance of this Teaching Material interesting? | Interesting | Not Interesting |
| | | 100% | 0% |
| 3 | Is the description/explanation of activities in this Teaching Material difficult? | Hard | Easy |
| | | 37% | 63% |
| 4 | Are the illustrations/images in this Teaching Material easy to understand and clarify the description? | Easy | Hard |
| | | 67% | 33% |
| 5 | Are there any questions in this Teaching Material that you don't understand? | Yes | No |
| | | 30% | 70% |

Table 5: Readability of Student Worksheets (LKS)

| No. | Question Description | Percentage of Student Answer Options (%) | |
|-----|--|--|-----------------|
| | | Interesting | Not Interesting |
| 1 | Are the contents of this LKS interesting? | Interesting | Not Interesting |
| | | 87% | 13% |
| 2 | Is the appearance of this LKS interesting? | Interesting | Not Interesting |
| | | 100% | 0% |
| 3 | Is the description/explanation of activities in this LKS difficult? | Hard | Easy |
| | | 20% | 80% |
| 4 | Are the illustrations/drawings on this LKS easy to understand and clarify the description? | Easy | Hard |
| | | 93% | 7% |
| 5 | Are there questions on this LKS that you don't understand? | Yes | No |
| | | 33% | 67% |

3.5 Student Concept Understanding Test

Test question of valid concept leaning was used by researcher in measuring understanding level of student concept. The initial activity conducted by the researcher was to conduct a preliminary test (pretest) on students who would be given treatment. The average pretest score of students' understanding of the concept of ion bonding and covalent bond as shown in the Table is 41.33 with a low category, while the average posttest score of students' conceptual comprehension level was 89.07 with a high category. The value of increasing the percentage of students' understanding of concepts during the posttest showed that the learning conducted by the teacher goes well and effectively increases students' conceptual understanding.

Table 6: Students' Concept Understanding Test Results

| No. | Student Initials | Pretest | Posttest |
|-----|------------------|---------|----------|
| | | N | N |
| 1 | S 01 | 40,00 | 92,00 |
| 2 | S 02 | 52,00 | 92,00 |
| 3 | S 03 | 44,00 | 96,00 |
| 4 | S 04 | 52,00 | 92,00 |
| 5 | S 05 | 48,00 | 80,00 |
| 6 | S 06 | 44,00 | 92,00 |
| 7 | S 07 | 40,00 | 88,00 |
| 8 | S 08 | 48,00 | 84,00 |
| 9 | S 09 | 36,00 | 88,00 |
| 10 | S 10 | 32,00 | 84,00 |
| 11 | S 11 | 36,00 | 80,00 |
| 12 | S 12 | 48,00 | 92,00 |
| 13 | S 13 | 36,00 | 84,00 |

| No. | Student Initials | Pretest | Posttest |
|-------------|------------------|--------------|--------------|
| | | N | N |
| 14 | S 14 | 32,00 | 84,00 |
| 15 | S 15 | 44,00 | 96,00 |
| 16 | S 16 | 56,00 | 92,00 |
| 17 | S 17 | 36,00 | 88,00 |
| 18 | S 18 | 40,00 | 88,00 |
| 19 | S 19 | 32,00 | 92,00 |
| 20 | S 20 | 64,00 | 96,00 |
| 21 | S 21 | 16,00 | 88,00 |
| 22 | S 22 | 36,00 | 88,00 |
| 23 | S.23 | 40,00 | 84,00 |
| 24 | S.24 | 40,00 | 96,00 |
| 25 | S.25 | 44,00 | 88,00 |
| 26 | S.26 | 56,00 | 84,00 |
| 27 | S.27 | 52,00 | 88,00 |
| 28 | S.28 | 52,00 | 88,00 |
| 29 | S.29 | 24,00 | 92,00 |
| 30 | S.30 | 20,00 | 96,00 |
| Mean | | 41,33 | 89,07 |

3.6 *Students' Respond*

Based on analysis result of student's respond toward the development of learning model (including: teaching material and student activity sheets) was obtained average of 88.67% students considered interesting and 93.33% of students respond to the novelty in other words students responded positively to the learning process that had been conducted (Riduwan, 2010), while the results of the analysis of student responded to the learning components obtained results of 95.33% of students responded interested in it (students respond positively) with very strong criteria (Riduwan, 2010). Based on the results of the analysis, it can be seen that students' responses to the development of media and the implementation of learning during the trial were positive in the very strong category. This meant that students supported, felt happy, and were interested in learning by applying learning based on an advanced organizer model.

Table 7: Students' Respond

| No | Description of Question | Assessment/Opinion | |
|----|--|-----------------------|-----------------------------|
| | | Interested P (%) | Not Interested P (%) |
| 1 | What is your opinion toward following components: | | |
| | a. Material | 90,00 | 10,00 |
| | b. Teaching Material (learning media) | 93,33 | 6,67 |
| | c. Student Activity Sheets (LKS) | 76,67 | 23,33 |
| | d. Learning atmosphere | 93,33 | 6,67 |
| | e. The way teacher teaches | 90,00 | 10,00 |
| | Average | 88,67 | 11,33 |
| 2 | Have you just known about the following components: | New P (%) | Have known P (%) |
| | a. Material | 90,00 | 10,00 |
| | b. Teaching material (learning media) | 93,33 | 6,67 |
| | c. Student Activity Sheets (LKS) | 90,00 | 10,00 |
| | d. Learning atmosphere | 93,33 | 6,67 |
| | e. The way teacher teaches | 90,00 | 10,00 |
| | rata-rata | 91,33 | 8,67 |
| 3 | Can you understand the following components easily: | Easy P (%) | Difficult P (%) |
| | a. Language in bool | 96,67 | 3,33 |

| No | Description of Question | Assessment/Opinion | |
|--|--|--------------------|------------------|
| | b. Material/book content | 96,67 | 3,33 |
| | c. Exercise | 93,33 | 6,67 |
| | d. Student activity sheets | 96,67 | 3,33 |
| | e. Guide of practice in LKS | 93,33 | 6,67 |
| | Average | 95,33 | 4,67 |
| 4 | What is your opinion about following statements: | Clear | Unclear |
| | | P (%) | P (%) |
| | a. Explanation of teacher during teaching and learning activity | 90,00 | 10,00 |
| | b. Teacher's guidance when you find concept through trial. | 90,00 | 10,00 |
| | c. Teacher's guidance when you finish LKS | 96,67 | 3,33 |
| | Average | 92,22 | 7,78 |
| 5 | What do you think about the way teacher uses learning model of Advance Organizer: | Good | Not Good |
| | | P (%) | P (%) |
| | a. Classifying learning objectives | 93,33 | 6,67 |
| | b. Identifying organizer concepts | 90,00 | 10,00 |
| | c. Presenting organizer context | 93,33 | 6,67 |
| | d. Encouraging the awareness of knowledge and students' experience | 90,00 | 10,00 |
| | e. Presenting material | 96,67 | 3,33 |
| | f. Making logic and clear material order | 93,33 | 6,67 |
| | g. Using integrative reconciliation principles | 100,00 | 0 |
| | h. Suggesting active reception learning | 93,33 | 6,67 |
| | i. Arising critical approach in learning material | 93,33 | 6,67 |
| j. Clarifying | 90,00 | 10,00 | |
| | Interview | 93,33 | 6,67 |
| 6 | What do you think if: | Agree | Disagree |
| | | P (%) | P (%) |
| | a. Further chemical subject used learning like this way? | 90,00 | 10,00 |
| b. Other subjects are taught as this learning? | 96,67 | 3,33 | |
| | rata-rata | 93,33 | 6,67 |
| 7 | Do you feel easy to: | Easy | Difficult |
| | | P (%) | P (%) |
| a. Answer test question concept knowledge ? | 96,67 | 3,33 | |

IV. CONCLUSION AND SUGGESTION

4.1 Conclusion

Based on the result of analysis, discussion and findings in research, it can be concluded that learning model using advanced organizer models on ion bond material and covalent bonds are valid, practical, and effective. Thus, it is feasible to be used to improve students' conceptual understanding.

4.2 Suggestion

Based on suggestions which can be revealed by researcher according to research conducted are as follow:

- Teacher should be able to manage time during learning because high school students of sport are athletes who prior to teaching and learning activities always practice exercise that consumes stamina. This can be dealt with by taking into account the time at the presentation and allocating more time to group discussion activities which require student activity.
- Division of BAS, LKS, and groups should be conducted before the implementation of learning activities. It is to make it easier for students to learn aspects to be conducted such as the scientific approach used during learning activities.
- Students need to be given more time in understanding the organizer because students have just known about the organizer.

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Gender Ideologies as Correlates of Career Maturity Among Senior Secondary School Science Students in Nasarawa State, Nigeria

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Abstract: This study was a correlational research design which investigated gender ideologies as correlates of career maturity among senior school students in Nasarawa State, Nigeria. The population of the study comprised 1900 public senior secondary school science students in the State, while the sample size was 200 senior secondary school III (SSIII) students comprising 100 males and 100 females purposely sampled from 20 schools. The instrument used for data collection was a researcher-modified questionnaire titled, "Career Maturity Inventory Attitude Scale for Students" (CMIASS). The instrument was validated by experts in the Faculty of Education, Nasarawa State University, Keffi, Nigeria. The instrument was thereby, pilot-tested in five independent senior secondary schools selected outside the original sampled 20 schools. The reliability coefficient of 0.81 was determined using Cronbach alpha. Data were analysed using descriptive statistics in the form of frequencies and percentages for research questions, while z-test and Pearson's Product Moment Correlation methods were used to test the hypotheses. The findings of the study showed that there was a significant positive relationship between gender ideologies and students' career maturity. Based on the findings of this study, it was recommended that; Science students should be exposed to attend career conferences and field trips for career exploration so as to enlighten them on different career options to them before they graduate.

Keywords: Career Maturity; Gender Ideologies; Senior Secondary School Science Students.

Introduction

Science is a core subject taught in schools all over the world, and science educators believe that any nation that hopes to develop must not neglect the teaching and learning of science in its schools (Fafunwa, 2004). Science education is a veritable instrument for social change which brings about socio-economic development and empowerment all the world. The application of scientific knowledge to real life problems is the most powerful instrument for enabling society to face global challenges and innovations in education. Eze (2010) maintained that science education is at the centre of empowerment of students toward self-reliant and industrial skills that are needed for survival especially in this era of global economic crisis.

Gender ideologies refer to ways and manners in which people consider themselves as masculine, feminine, or some combination of the two (Malicke, 2013). Gender ideologies also refer to attitudes regarding appropriate roles, rights and responsibilities of men and women in society as well as their distinctive roles as either breadwinners (men) or homemakers (women), (Davis & Greenstein, 2009). The characteristic qualities associated with a particular gender vary over time, and across cultures. For instance, at one time it was not considered very feminine to play sports; however, in contemporary cultures both men and women play sports with equal zeal. Despite an abundance of research on ethnic and racial ideologies, work on gender ideologies is minimal (Banchevsky & Park, 2018). Male-dominated environments attract and reinforce gender ideologies that support a masculine status-quo and discourage women from joining, influencing, or remaining within that environment. Although often used interchangeably, a distinction should be drawn between the term "gender" and "sex", where "gender" refers to a broad set of characteristic qualities that distinguish between masculinity and femininity and includes personal attributes, social roles, social customs, activities, and behaviors, while "sex" refers to being male or female (Newman, 2018).

Men in male-dominated fields benefit from a masculine culture in which they are presumed to be superior. In a classroom environment, for instance, male children may tend to draw men when asked to draw a scientist because they believe that men are naturally more gifted than women in male-dominated fields (Eddy & Brownell, 2016). This may explain why men in male-dominated environments determine the beliefs and attitudes which bestows upon them a greater sense of belonging (Danbold, Felix & Huo, 2017) and self-efficacy (Eddy & Brownell, 2016) when compared to women. These positive gender ideologies should therefore, be less commonplace among men in male-dominated fields compared to men in other fields. Some women face the gender reversal trend by assimilating to masculine norms in male-dominated fields as a coping mechanism—to be taken seriously, avoid harassment, and advance their career (Danbold, Felix & Huo, 2017). It is thus, reasonable to expect that regardless of gender ideologies, women will be more likely than men to disagree with the negative gender ideologies, and agree with the positive gender ideologies.

From early to mid-adolescence, youths' understanding of gender is quite rigid and stereotyped. As a result, younger adolescents will typically participate in more gender-stereotyped behaviors than do older adolescents (Kpanja & Umar, 2018). There are a number of reasons for these gender-stereotyped behaviors. For instance, physically, they have changed so much during puberty that their bodies now begin to resemble adult bodies. This explains why girls may enjoy shopping for bras that satisfy their new feminine figure, while at the same time, they may begin to use costly cosmetics to conceal unwanted black facial patches. On the other hand, boys may employ their new shaving ritual and insist on spraying themselves with heavy designer perfumes and deodorants to mask their new powerful body odour.

As young men and women become more secure and confident in their gender ideologies, they no longer feel they must always present a perfectly masculine or feminine appearance (Winter, 2016). This explains why young ladies may feel totally comfortable wearing jeans, tee-shirts, sneakers, and ball caps, even though this outfit isn't particularly feminine. By late adolescence youth have usually figured out their role in society, including their gender ideologies that meets their aspirations in life (Winter, 2016). When a child's interests and abilities are different from what society expects, they may be subjected to discrimination and bullying (Abdulkadir, Gulma & Mohammed, 2018). It is thus, natural for parents to have gender-based expectations for their children and to want to protect them from criticism and exclusion. Instead of pushing children to conform to these pressures and to limit themselves, parents can play an important role in advocating for safe spaces where their children can feel comfortable and good about themselves (Abdulkadir, Gulma & Mohammed, 2018).

Career maturity is the extent to which an individual has mastered the tasks needed for career development (Liu, Peng & Won, 2014). This is as an individual's readiness to make well-informed career decisions in the face of global labour competition. It thus, describes an individual's ability to successfully cope with career development tasks that are encountered across the development stages. At a socio-economic spectrum, the person's career maturity is influenced by age, race, status and gender. The complexities of these factors invariably, affects the individual's readiness to succeed in achieving the tasks needed at every stage of career development.

Most senior secondary school students in Nigeria do not possess career maturity by the time they are leaving school due to lack of qualified personnel and equipment required to galvanise the curriculum for effective success in their favours (Adekeye, Adeusi, Ahmadu & Okojide, 2017). Furthermore, the female students in almost all cultures are stereotyped to be helpers to their future husbands and as such their careers may not be all that important to them as they are to the males. Researches on the relationship between gender ideologies and career maturity have produced inconsistent results. For instance, some researchers have found significant gender differences in career maturity (Sivakumar & Sridhar, 2016; Alam, 2013) others found no such differences (Momin & Chetry, 2016; Sivakumar & Sridhar, 2016; Tekke & Ghani, 2013).

From the foregoing, it is evident that most senior secondary school students lack the prerequisites of career maturity that can bolster them into successful career aspirations and actualisation. In order to fit into their expectations, they depend on external factors for guidance such as their parents, peers and society instead of their internal capabilities (Kumazhege, 2017). Consequently, most the students make immature and unrealistic career decisions. They shut their eyes and focus only on the salaries, positions, glamour and prestige attached to the careers (Mayange & Umar, 2018). For instance, most of them may prefer careers in medicine, engineering, law, banking, architecture, and pharmacy without adequate knowledge of what it takes to succeed and achieve in those careers (Mayange & Umar, 2018). Consequently, this study examined the relationships between gender ideologies and career maturity of senior secondary school science students in Nasarawa State, Nigeria.

Research Questions

The following research questions guided the study:

1. What is the relationship between gender ideologies and senior secondary school science students' career maturity?
2. What is the relationship between male and female senior secondary school science students' gender ideologies and career maturity?

Research Hypotheses

The following hypotheses were tested at 0.05 level of significance.

Ho1: There is no significant relationship between gender ideologies and senior secondary school science students' career maturity.

Ho2: There is no significant relationship between male and female senior secondary school science students' gender ideologies and career maturity.

Methodology

This study is a correlational research design in which questionnaires were used for data collection. The population of the study comprised 1900 public senior secondary school students in Nasarawa State, Nigeria, while the sample size was 200 comprising 100 male and 100 female senior secondary school III (SSIII) science students purposely sampled from 20 schools of the State. The instrument for the study was a researcher-adapted Career Maturity Inventory Attitude Scale for Students (CMIS). CMIS was rated using a four-point rating scale. The options were; Strongly agreed (SA) = 4 points, Agree (A) = 3 points, Disagree (D) = 2 points and Strongly Disagreed (SD) = 1 point. The instrument was validated by experts in the Faculty of Education, Nasarawa State University, Keffi, Nigeria. The instrument was pilot-tested in five independent senior secondary schools selected outside the original sampled 20 schools, but had similar characteristics (public coeducation schools) as the original sample. The reliability coefficient was found to be 0.81 using Cronbach-alpha.

Results

Data were analysed using descriptive statistics in the form of frequencies and percentages for research questions, while z-test and Pearson's Product Moment Correlation methods were used to test the hypotheses at 0.05 level of significance.

Research Question One: What is the relationship between gender ideologies and senior secondary school science students' career maturity?

To answer this research questions, students' responses were placed in Table 1

Table 1
Students' Responses on Gender Ideologies and Career Maturity

| Variables | Male | | | Female | | |
|--------------------------------------|------------|------------|------------------|------------|------------|------------------|
| | Frequency | % | Position | Frequency | % | Position |
| Gender Aware | 14 | 11.5 | 4 th | 10 | 11.5 | 5 th |
| Gender Blind | 3 | 2.00 | 9 th | 17 | 16.5 | 2 nd |
| Gender Assimilation | 20 | 29.5 | 1 st | 20 | 21.00 | 1 st |
| Gender Segregation | 7 | 6.00 | 6 th | 7 | 4.50 | 7 th |
| Career Maturity | 2 | 1.00 | 10 th | 15 | 15.00 | 3 rd |
| Involvement in carrier choice | 16 | 14.5 | 3 rd | 12 | 12.00 | 4 th |
| Independence in career choice | 5 | 5.00 | 7 th | 4 | 2.00 | 10 th |
| Orientation towards work | 18 | 17.00 | 2 nd | 7 | 4.50 | 7 th |
| Preference for career choice factors | 10 | 9.00 | 5 th | 5 | 3.50 | 9 th |
| Conception of career choice process | 5 | 4.50 | 8 th | 3 | 9.50 | 6 th |
| Total | 100 | 100 | | 100 | 100 | |

Table 1 shows that among male students, gender assimilation has the highest frequency, while career maturity was the lowest. The female students also have gender assimilation with the highest frequency, while independence in career choice was the lowest.

Research Question Two: What is the relationship between male and female senior secondary school science students' gender ideologies and career maturity?

The students' responses regarding research question two are demonstrated in Table 2.

Table 2
Descriptive Statistics and Bivariate Correlations between Gender Ideologies and Career Maturity

| Variables | Gender Awareness | Gender Blind | Gender Assimilation | Gender Segregation | Career Maturity |
|--------------|------------------|--------------|---------------------|--------------------|-----------------|
| Gender | 1 | 0.014 | -0.014 | 0.03 | 0.05 |
| Awareness | | | | | |
| Gender Blind | 0.002 | 1 | 0.07 | 0.01 | 0.04 |
| Gender | -0.33 | -0.014 | 1 | 0.06 | 0.39 |
| Assimilation | | | | | |
| Gender | -0.01 | 0.001 | 0.05 | 1 | 0.17 |
| Segregation | | | | | |
| Career | 0.001 | 0.09 | 0.08 | 0.07 | 1 |
| Maturity | | | | | |

P<0.05

Table 2 shows that gender awareness correlates positively with gender segregation and career maturity, but negatively with gender assimilation. Similarly, Career maturity correlates positively with all the other variables.

Hypotheses Testing

Hypothesis One: There is no significant relationship between gender ideologies and senior secondary school science students' career maturity.

Table 3
Z-test for Influence of Gender Ideologies on Career Maturity

| Variables | Male (200) | | | Female (200) | | | Z-Cal. | Z-Crit. | Decision |
|-----------|------------|------|-----|--------------|------|-----|--------|---------|----------|
| | Mean | S.D. | DF. | Mean | S.D. | DF. | | | |
| Gender | 2.40 | 1.01 | | 2.41 | 2.03 | | | | |
| Ideology | | | 198 | | | 198 | 5.89 | 2.37 | Reject |
| Career | 3.31 | 2.16 | | 3.18 | 3.08 | | | | |
| Maturity | | | | | | | | | |

P<0.05

Table 3 shows that the calculated Z-test value (5.89) is higher than the critical value of Z-test (2.37) at alpha = 0.05, indicating a rejecting of the null hypothesis and accepting the alternate hypothesis. This means that there is significant influence of gender ideologies on the students' career maturity.

Hypothesis Two: There is no significant relationship between male and female senior secondary school students' gender ideologies and career maturity.

Table 4

Relationship between Gender Ideologies and Career Maturity (N= 200)

| Variables | N | Mean | S.D. | R-Cal. | R-Crit. | Decision |
|-------------------|-----|-------|-------|--------|---------|----------|
| Gender Ideologies | 200 | 25.55 | 10.13 | .193 | .036 | Sig. |
| Career Maturity | 200 | 10.72 | 08.38 | | | |

P<0.05

Table 4 shows that the calculated R-value (0.193) is greater than the R-critical value of (0.36), indicating significant relationship between gender ideologies and career maturity.

Discussion

This study investigated the relationship between gender ideologies and career maturity of senior secondary school science students in Nasarawa State, Nigeria. The study shows that among male students, gender assimilation has the highest on the students' career maturity. The female students also indicated that gender assimilation has the highest influence on their career maturity. This finding supports that gender maturity has influence on both male and female senior secondary school students' career maturities in Nasarawa State, Nigeria. This indicates that they have similar level of career maturity. A probable explanation might be that they all have similar exposures on career decision, independence in career decision making and what careers to choose. This result supports the findings of (Sivakumar & Sridhar, 2016; Alam, 2013) who found that gender ideologies have significant influence on career maturity of secondary school students.

Another finding of this study shows that gender awareness correlates positively with gender segregation and career maturity, but negatively with gender assimilation. Similarly, career maturity correlates positively with the other variables. This means that gender has significant influence on the career maturity of the students, hence they have similar level of career maturity. This finding supports the research finding of (Sivakumar & Sridhar, 2016) who found that gender has significant influence on career maturity, but disagrees with the findings of Momin and Chetry (2016) as well as Sivakumar and Sridhar (2016) who in their different researches found out that gender has no significant influence on the career maturity of students.

The finding of the study also shows that the calculated Z-test value (5.89) is greater than the critical value of Z-test value (2.37) at $\alpha = 0.05$, indicating a rejection of the null hypothesis and accepting the alternate hypothesis. This implies that gender ideologies and career maturity differed significantly. This finding agrees with the finding of Alam (2013), who discovered that the two variables were noticeable among their respondents.

Lastly, the finding of this study indicates that the calculated R-value (0.193) is greater than the R-critical value (0.36), which infers a significant relationship between the students' gender ideologies and career maturity. This agrees with the finding of Salami (2010) who found that gender ideologies moderate the relationship between the two tested variables and added the fact that gender has to be considered when dealing with students' career maturity.

Conclusion

The findings from this study showed that the influence of gender ideologies on career maturity among students revealed divergent outcomes. This is an evidence of inconsistency which needs to be clarified and gaps that need to be filled. The results may however, provide clear pictures about the influence of gender ideologies and career maturity among senior secondary school students in Nasarawa State, Nigeria. The findings also suggest that gender ideologies are significant predictors of students' career maturity. Given the relationships between gender ideologies and career maturity, career planning interventions could be encouraged to facilitate both occupational and gender ideology development among senior secondary school students.

Recommendations

In view of the findings of this study, it is recommended that:

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- i. Counsellors should design interventions to improve career maturity level of science students in order to increase their awareness of career aspirations and minimize their level of career ignorance;
- ii. Teachers should explore the understanding of the problems of career maturity of science students in relation to their gender ideologies for better career stability in future;
- iii. Parents, school authorities and the significant others should encourage senior secondary school science students to relate career maturity with their gender ideologies so as to operate on a platform that produces mature career development;
- iv. Science students should be exposed to attend career conferences and field trips for career exploration so as to enlighten them on different career options to them before they graduate.

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Association of Fibroblast Growth Factor-2 (FGF-2) Immunoexpression with Histopathology Grade of Meningioma

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Abstract- Meningioma is one of the primary brain tumors, originating from arachnoid cap cells. FGF-2 as a growth factor is a potent stimulator of endothelial proliferation which is very important in the process of angiogenesis. FGF-2 levels in meningiomas have been assessed using the ELISA and qPCR methods in many previous studies using blood serum. This study used tissue samples of meningioma tumors to assess the association between immunohistochemical expressions of FGF-2 and histopathology grade among meningioma patients. Formalin-fixed paraffin-embedded tissue blocks of 32 meningioma patients were immunohistochemically studied for FGF-2 expression. The basic characteristics of the samples were obtained through medical records or pathology archives. The association between FGF-2 expression and grade were analyzed using SPSS 22 version. FGF-2 was expressed in 15.6% of the meningioma specimens. FGF-2 positive expression was significantly associated with higher histopathological grade ($p < 0.05$). A higher grade has a tendency of 14.3 times to express positive FGF-2. The positive expression of FGF-2 in the higher grade indicates that angiogenesis plays an important role in terms of tumor growth especially in malignant cases. This can be a prognostic indicator and possible target therapy for these neoplasms.

Index Terms- FGF-2, meningioma, grade, immunohistochemistry

I. INTRODUCTION

Meningioma is one of the primary brain tumors that most often occurs at the age of 60-70 years.¹ The classification and grade of histopathology of meningioma currently used is based on the fourth revised edition of the World Health Organization (WHO). WHO grade 1 as benign (75% of cases), WHO grade 2 as atypical (10-15%) and WHO grade 3 as malignant (1-3%).² Depending on location and grade, treatment for meningiomas includes surgery and postoperative radiation therapy. Although meningiomas are generally benign tumors but in higher grades, they tend to be progressive and recurrent.³ Reported recurrence rates for grade 1, 2 and 3 meningiomas are 7-25%, 29-52%, and 50-94%.^{4,5} Many researchers have confirmed the existence of receptors of growth factors in

meningiomas such as epidermal growth factor (EGF), platelet-derived growth factors (PDGF), fibroblast growth factor (FGF), and insulin-like factors I and II (IGF-I and IGF-II). Growth factors are a large group of very diverse peptides or proteins that act as cell signals. These factors have a role in tumorigenesis meningioma.^{6,7}

FGF-2 is a very potent stimulator for proliferation, migration of endothelial cells, and tube formation in vitro and also high angiogenic in a number of tissues in vivo.⁸ It has been reported that FGF-2 is produced in more than 90% of glioma tissue and meningioma which shows that both are involved in autonomic cell growth and tumorigenesis as an autocrine growth factor in vivo.⁹ In a Japanese study of tumor tissue in the brain including glioma, meningioma, and metastasis tumor, Northern Blot and In Situ Hybridization analyzes were conducted. The expression of mRNA for FGF-2 was found in cases of glioma and meningioma indicating that FGF-2 was produced by these tumor cells.¹⁰ A study was also conducted in analyzing quantitative FGF-2 using the Enzyme Linked Immunosorbent Assay (ELISA) method for tissue of several variants of grade 1 meningioma. Of all the meningioma samples that were observed, it was proven that FGF-2 protein could be detected in all meningioma tissue.¹¹

The study of FGF-2 levels associated with grade meningioma have been done before in Medan Indonesia but this study used blood samples of patients and not with tissue samples.¹² Therefore, this study aimed to evaluate the immunohistochemical expression of FGF-2 in meningioma from the tumor tissue and analyze its association with histopathology grade of meningioma.

II. MATERIAL AND METHODS

Sample selection

This cross sectional study was conducted in Department of Anatomical Pathology, Universitas Sumatera Utara/ H. Adam Malik General Hospital, Medan and includes 32 cases of meningioma. All samples were obtained through surgical procedure. Inclusion criteria were meningioma cases with adequate clinical data, available and undamaged formalin-fixed paraffin embedded tissue block with sufficient tumor tissue. Detailed clinical data were obtained from medical records or pathology archives consisting of age, sex, and location of the tumor. Histological type and grade were determined

independently by researchers through hematoxylin and eosin stained slides examination.

Immunohistochemistry protocol and interpretation

The tissue sections were deparaffinized and rehydrated before pretreatment. Endogenous peroxidase was blocked with hydrogen peroxide followed by antigen retrieval. FGF-2 (GTX84502, GeneTex, California, America) mouse monoclonal antibodies was used as primary antibody. Diagnostic BioSystems (Diagnostic BioSystems, Pleasanton, CA, USA) polymer kit was used for detection. The reaction was visualized with diaminobenzidine and counterstained with Mayer's hematoxylin followed by dehydration, clearing, and mounting. Positive control was colon. FGF-2 expressions were determined independently by researchers. The expression in cytoplasm was analyzed. Immunostaining of FGF-2 was evaluated in terms of the proportion and staining intensity of tumor cells. The proportion was assessed on the basis of the percentage of immunopositive cells as follows: 0, less than 10%; +1, 10-25%; +2, 26-50%; +3, 51-75%; +4, greater than 75%. Staining intensity was evaluated as negative (0), weak (+1), moderate (+2), and strong (+3). The proportion score (0-4) was multiplied by the intensity score (0-3) and a final score was assigned, 0-4 as negative staining and 5-12 as positive staining.

Statistical analysis

Statistical analysis was performed using SPSS software package version 22.0 (SPSS Inc., Chicago) with 95% confidence interval and Microsoft Excel 2010. Categorical variables were presented in frequency and percentage. Fisher's Exact test was applied to find out the association between FGF-2 expressions with histopathology grade of meningioma. The p-values < 0.05 were considered significant.

III. RESULT

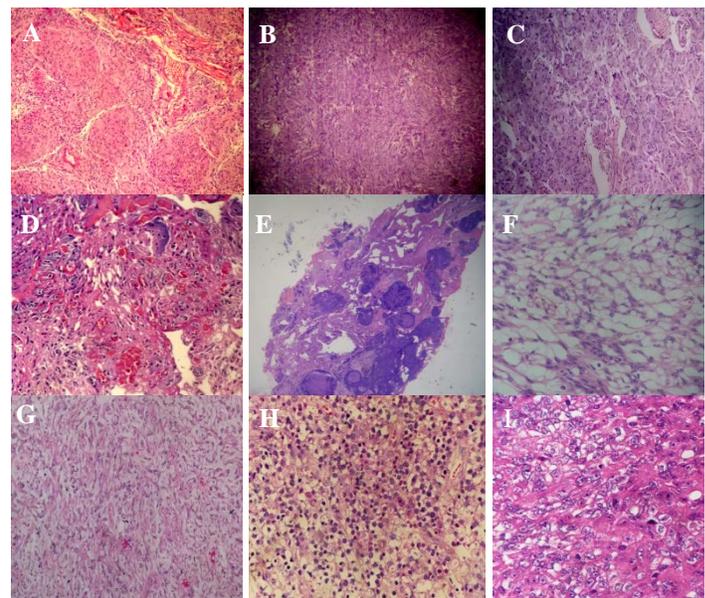
Patients' characteristics

The mean age for meningioma patients was 43.97 (±11.47) years. The most common in 41-50 years age group. Twenty-three patients (71.9%) were females, only 9 patients (28.1%) were males. All the tumors were located in intracranial where convexity was the predominance. The number of the patients with WHO Grade 1 meningioma was 25 (78.1%), with Grade 2 meningioma was 5 (15.6%), and with Grade 3 meningioma was 2 (6.3%). The histological subtypes of meningioma varied and meningothelial meningioma was the majority of this case. Clinical basic characteristic of meningioma patients were summarized in table 1. Representative H&E sections are shown in figure 1.

Table 1. Characteristic of meningioma patients

| Characteristics | Number of cases | Percentage (%) |
|-----------------------|-----------------|----------------|
| Age, mean ± SD, years | 43.97 ± 11.47 | |
| < 20 years | 1 | 3.1 |
| 21-30 years | 1 | 3.1 |
| 31-40 years | 10 | 31.3 |
| 41-50 years | 12 | 37.5 |

| | | |
|-----------------------|----|------|
| 51-60 years | 6 | 18.8 |
| 61-70 years | 2 | 6.3 |
| Sex | | |
| Female | 23 | 71.9 |
| Male | 9 | 28.1 |
| Location | | |
| Supratentorial | 28 | 87.5 |
| Convexity | 23 | 82.1 |
| Parietal | 8 | 34.8 |
| Frontal | 4 | 17.4 |
| Temporal | 1 | 4.3 |
| Temporoparietal | 6 | 26.1 |
| Frontoparietal | 3 | 13 |
| Parietoccipital | 1 | 4.4 |
| Sphenoid | 2 | 7.1 |
| Parasagittal | 1 | 3.6 |
| Suprasella, parasella | 2 | 7.1 |
| Infratentorial | 4 | 12.5 |
| Cerebellum | 1 | 25 |
| Foramen Magnum | 1 | 25 |
| CPA | 2 | 50 |
| Subtype | | |
| Meningothelial | 11 | 34.4 |
| Fibroblastic | 4 | 12.5 |
| Transtitional | 5 | 15.6 |
| Psammomatous | 2 | 6.3 |
| Angiomatous | 1 | 3.1 |
| Microcyst | 2 | 6.3 |
| Chordoid | 1 | 3.1 |
| Clear cell | 1 | 3.1 |
| Atypical | 3 | 9.4 |
| Anaplastic | 2 | 6.3 |
| Histological grade | | |
| Grade 1 | 25 | 78.1 |
| Grade 2 | 5 | 15.6 |
| Grade 3 | 2 | 6.3 |



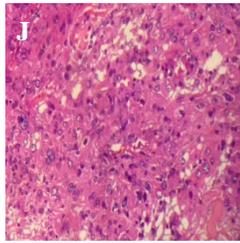


Figure 1. Histological type. A, Meningothelial meningioma. B, Fibroblastic meningioma. C, Transitional meningioma. D, Angiomatous meningioma. E, Psammomatous meningioma. F, Microcyst meningioma. G, Chordoid meningioma. H, Clear cell meningioma. I, Atypical meningioma. J, Anaplastic meningioma.

FGF-2 expression

Twenty-seven out of 32 (84.4%) meningioma cases were negative while positive expression was seen in five cases (15.6%) (table 2). The intensity of FGF-2 expression in cytoplasm are shown in figure 2.

Table 2. Meningioma cases based on FGF-2 expression

| FGF-2 expression | Number of cases | Percentage (%) |
|------------------|-----------------|----------------|
| Negative | 27 | 84.4 |
| Positive | 5 | 15.6 |

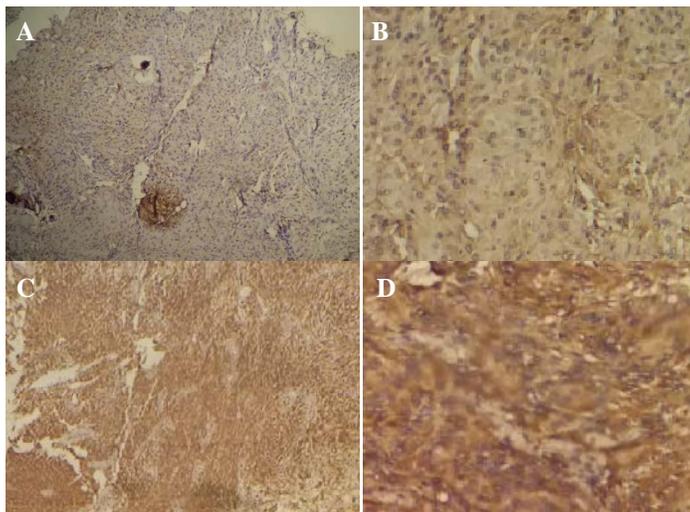


Figure 2. Immunohistochemical FGF-2 expression. A, Negative intensity. B, Mild intensity. C, Moderate intensity. D, Strong intensity.

Association between FGF-2 expression and grade

The number of cases for positive FGF-2 expression was found more in higher grade meningioma (57.1%) while negative expression was found more in grade 1 (96%) compared to higher grade (42.9%). This difference was significant (p=0.004) with prevalence ratio was 14.3 (table 3).

Table 3. Association of FGF-2 expressions with histopathology grade

| Grade | Negative | | Positive | | p | Prevalence ratio (CI=95%) |
|---------------|----------|------|----------|------|--------|---------------------------|
| | n | % | n | % | | |
| Grade 1 | 24 | 96 | 1 | 4 | 0.004* | 14.3 (1.88-108.19) |
| Grade 2 and 3 | 3 | 42.9 | 4 | 57.1 | | |

IV. DISCUSSION

Data in the United States (2002-2006) reported that meningioma occupies 33.8% of all cases of primary brain and central nervous system tumors. The prevalence rate in the United States confirmed by pathology examination of 97.5 per 100,000 populations.¹³

Significant levels of FGF-2 and its receptors, FGFR1 and FGFR2 have been detected in meningioma. FGF becomes mitogen as well as differentiation and angiogenic agents that can affect tumor development as an autocrine growth factor.¹⁴ FGF exerts extensive mitogenic activity by stimulating the growth of fibroblasts, endothelium, and cancer cells. FGF-2 is an important regulator of cell growth and differentiation under physiological and pathological conditions.¹⁵ FGF-2 is present in any part of the body and has a strong affinity for glycosaminoglycans such as heparan sulfate. FGF-2 is stored by binding to glycosaminoglycans on the cell surface or extracellular matrix. When FGF-2 is actually needed, cells secrete various enzymes such as heparinase which release FGF-2 from glycosaminoglycans so that they can reach the target cell.¹⁶ Previous studies have suggested the role of FGF-2 as a prognostic marker for various types of malignancy.¹⁵

The expression of FGF-2 in the cancer surgery section was evaluated using immunohistochemical techniques, Western blot, and qRT-PCR. The latest diagnostics and antibodies allow proper detection and quantification of FGF-2. Immunohistochemical and immunofluorescence studies have shown that FGF-2 staining is heterogeneous and increases significantly in malignant tissue compared to benign or normal tissue.¹⁵

This study used an immunohistochemical technique FGF-2 in meningioma cases. Denizot et al. also analyzed FGF-2 levels through tumor tissue samples, but used the quantitative ELISA method. Based on the results obtained, there was no significant difference in FGF-2 levels between meningioma subtypes grade 1.¹¹ The current study, the authors only tried to classify FGF-2 expressions based on grade and did not evaluate further for each subtype due to no all subtypes can be found as well as the number of cases that are not the same between each of the existing meningioma subtypes.

Baritaki et al. also evaluated FGF-2 from tissue samples through qRT-PCR examination of brain tumors including glioma, meningioma, and metastasis. All cases of meningioma show higher expression than normal brain tissue. However, unfortunately in that study all cases of meningioma were included in the benign meningioma group, so there was no comparison with cases of higher grade meningioma.⁹

Beside immunohistochemical techniques, FGF-2 examination can be done through blood serum. Significant correlation

between serum FGF-2 level and tumor stage, size, and metastasis has been reported in several cases of malignancy.¹⁵

Granato et al. reported that patients with breast cancer had serum FGF-2 levels that were significantly higher than serum VEGF levels, in comparison with healthy individuals, and they suggested serum FGF-2 levels might serve as a tool for diagnosing breast cancer. While Ueno et al. also measured serum FGF-2 levels in patients with lung cancer types of adenocarcinoma, squamous cell carcinoma, and small cell carcinoma.¹⁶

Vesely et al. reported that patients with thyroid cancer had significantly higher serum FGF-2 levels ($p < 0.01$) than serum FGF-2 levels in healthy individuals. Landriscina et al. reported that patients with colon cancer had significantly higher serum FGF-2 levels ($p < 0.04$) than serum FGF-2 healthy individuals. However, they also reported that serum FGF-2 levels were not associated with cancer stage.¹⁶ Different things were revealed by Akl et al. through additional studies in the tissue section that high intratumoral FGF-2 levels were associated with advanced bladder tumor, glioma, head and neck, liver, and prostate.¹⁵ Takei et al. compared serum FGF-2 serum levels before and after surgery for breast cancer and found significantly lower postoperative compared with before surgery. Takei et al. also noted the potential presence of FGF-2 secreted by tumor cells.¹⁶

Hanzhiev et al. also conducted a serum FGF-2 study combined with VEGF by taking samples from brain tumor patients such as meningioma, low grade astrocytoma, and high grade astrocytoma (glioblastoma). The results indicate that FGF-2 levels have much higher levels in the case of glioblastoma, while meningiomas in this study were not grouped into grade 1, 2, or 3 even though it was proven that all cases of meningioma detected FGF-2 protein.¹⁷

While for cases of brain tumors in Indonesia, Risfandy et al. also examined the relationship between serum FGF-2 levels and histopathological grade of meningioma. From the test analysis obtained it was found that there was no significant relationship between the two things.¹² In contrast to the immunohistochemical study in this study found a significant difference between the expression of FGF-2 and grade meningioma. This may be due to the number and distribution of different samples. Risfandy et al. only classified meningioma grades into 1 and 2, while the authors divided grade 1 and combined grades 2 and 3 based on tumor biological behavior. Although it was considered not significantly significant, Risfandy et al. revealed that serum FGF-2 levels were found to have higher levels in higher grade meningiomas. This can show that FGF-2 as a growth factor, plays a role greater in cell proliferation and angiogenesis in higher grade meningiomas. Angiogenesis itself is controlled by the balance of promoters and inhibitors. The Vascular Endothelial Growth Factor (VEGF) and angiopoietin (Ang) are key roles in the balance of angiogenic growth factors. FGF-2 has also received attention as another very potent angiogenic growth factor. Although the detailed mechanism of the relationship between FGF signals and the onset of malignant tumors is still unclear, however, at this time, mutations in the FGF receptor are assumed to activate the FGF signal constantly and ultimately promote tumor cell growth and metastasis.¹⁶

Although in this study it did not take samples of normal brain tissue for comparison, there was a significant comparison of FGF-2 expression between grade 1 or benign meningioma with grades 2 and 3 as atypical and malignant meningioma. Many literatures have explained that grade 2 and 3 do have a higher level of recurrence and a more aggressive nature. Angiogenesis which will play an important role in this recurrence rate. However, it does not mean that grade 1 meningioma cannot occur in recurrence, only the possibility is smaller than the higher grade.

It is also important to think that in most studies, serum and intratumoral levels of FGF-2 were associated with decreased survival. High intratumoral and serum FGF-2 levels are also associated with recurrence of various types of cancers such as lung, bladder, breast, esophagus and Hodgkin Lymphoma.^{15,18} Donnem et al. explained in their study that high expression of FGF-2 in NSCLC cases has 37% for 5 years of survival, while for low FGF-2 expression, the number increased to 59%.¹⁸

Apart from several contradictory findings, FGF-2 is considered a significant tumor biomarker and potential target therapy. Current and future clinical trials can guarantee to determine whether FGF-2 can be included in the prognosis of cancer and whether FGF target therapy has a beneficial effect in cases of recurrent tumors and cases of malignancy with high mortality.

V. CONCLUSION

There is significant association between FGF-2 expression and histopathology grade of meningioma.

COMPETING INTERESTS

The authors have no relevant financial interest in the products or companies described in this article.

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ETHICAL APPROVAL

Health Research Ethical Committee, Universitas Sumatera Utara, Medan, Indonesia approved this study.

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The Effect Of Functional Transformation On The Joglo Traditional House Concept

(A Case Study of Muncul Jaya Restaurant)

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Abstract-There are many philosophies that build upon a Joglo traditional house in its era, from the decided location, building orientation, manufacturing period, differentiating the sections and ornaments that decorate the house. Unfortunately, this phenomenon is hardly to be found in this digital era nowadays.

Muncul Jaya Restaurant was built by ethnical concept in the shape of Joglo traditional building. It is very attractive in the middle of this modern architectural works. Joglo is used to be a resident-able house but it is adapted to be a commercial purpose which is a restaurant. This functional transformation leads to the needs of the reseach about Joglo as an original traditional house.

Along with quantitative paradigm and self-interpreted analysis, the researcher is trying to find the conclusion of, are the functional transformation of this modern Joglo concept affects the original Joglo concept.

Index Terms- Joglo; Joglo Traditional House; Traditional House; Joglo Transformation

I. INTRODUCTION

A. Background of the Study

Javanese traditional house has various shapes and each of them reflects to the owner's social status. Joglo is one of the Javanese traditional houses that we can still find nowadays. In its history, the owner of this type of house must be the rich people. Not only because of the expensive building materials than the other type of house but also the historical meaning behind it. Javanese people in the previous era, believe that Joglo should only be owned by respected and famous people meaning not all of the people can own it.

Like any other traditional architecture, in its manufacture, there are many philosophies that follow it shape, from the decided location, building orientation, building period, differentiating the sections, ornament that decorate the house, etc.

Along with the development of the era, efficiency and effectivity had been the important thing. Thus, the construction of the modern house in Java began to abandon the Javanese philosophical concept that mentioned before, including modern

Javanese houses built in the shape of Joglo. This is why it leads to the need for a study of a modern Joglo house.

The object of the research was done at the Muncul Jaya Restaurant in central Java, Indonesia, where it is clearly can be seen that the restaurant's shape is ethnical and it took the concept of Joglo traditional house, but its design had transformed from a house that functioned as a residential to a commercial functioned house, a restaurant.

Along with quantitative paradigm and self-interpreted analysis from the empirical data as the source in the form of direct observations on the object of research, the researcher is trying to find the conclusion of, are the functional transformation of this modern Joglo concept affects the original Joglo concept.

B. Problem Statement

Muncul Jaya Restaurant was built in 2017 in the shape of a traditional Joglo. This house is purely a new house, not a renovated heritage house. Although it is a new building, the façade of the building is made almost similar to the traditional Javanese Joglo building, starting from the material, the shape of the roof, the type of ornaments and the soko* or pillars.

The main problem identified in the research object was the functional transformation of the Joglo house, from a Joglo house which used to be a residential house to the commercial purpose house namely as restaurant. Does this functional transformation affect the basic concept of the Joglo house?

C. Purpose of the Study

This research final purpose is to get the answer of the problem mentioned before which about the influence about the transformation of Joglo traditional house concept as the effect of the architectural functional transformation.

D. Research Method

The paradigm used in conducting this research is quantitative, by using a comparison system of items contained in the original Joglo traditional house concept towards Muncul Jaya joglo restaurant, which then analyzed according to the researcher's interpretation that leads to one final conclusion. Empirical data

collection was carried out by direct observation at Muncul Jaya Joglo restaurant, located at Central Java.

II. LITERATURE REVIEW

A. Traditional House

According to Machmud (2006), traditional house or folk house can be interpreted as a house built in the same way by several generations. There are some criteria in assessing the authenticity of traditional house including people's habits that become an unwritten rule when a house is established or used.

There are certain rituals such as the first pole erection ceremony, selamatan/kenduri* and the right timing. Other than that, there are still many procedures or rules used, for example the direction of the house, shape, color, motifs decoration, building material, sesajen*, prayers or mantera that must be read and so on that closely related to traditional houses.

Characterization of traditional architecture are:

1) Religious Background

The existence of traditional architecture building can not be separated from religious factor, both conceptually, building, or the form of the building. This is caused by the perspective and concept of traditional society in placing an integral part of nature (part of the cosmological system), namely the universe (macroscopic) and the small nature (microscopic), which traditional communities strive for is how stability and natural balance remain awake. The form of embodiment with natural is carried out in various ways, which are:

- Assuming that certain directions has magical power:

They know which direction that assumed to be good and bad. Moreover, there are also people who belief this relation with the world symbolism (good and pure), middle (moderate), and low (ugly, bad, dirty). These good directions affect building layout patterns in one site. The buildings must be facing to the good direction and backing the bad direction.

- Assuming that certain spaces has magical power:

Sometimes certain buildings in a building are considered to have sacred values. This sacredness is realized by giving more value in a room. The middle senthong in a Javanese house is considered as a holy and sacred space compared to other spaces.

2) Influence of Family Relationships or Citizen Relationships

Family relationships in traditional community structures can be divided into several criteria. Based on blood relations (genealogy) traditional community groups are divided into:

- Bilateral or parental system:

The family of this system contains of a father, a mother and children. In its development, the number of family members in this system is bigger from time to time. Thus, the family members that live together will be bigger until there is no space in their own house.

- Unilateral system

The family structure of this system is drawn from the bloodline only from the father's side (patrilineal/patrilokal) or from the mother's side (matrilokal).

3) Influence of Humid Tropical Climate

Because of Indonesia's location is in a humid tropical climate, so the existence of the traditional architecture must be referred to humid tropical climate. The concept of adaptation to the local climate that is applied to the building of their residential house is believed to be one good example. The composition of the mass, direction of the house (orientation), the shape of the roof selection, building materials selection, composition techniques, all of them are really calculated against aspects of the tropical climate so that it can provides comfort for residents of the house.

B. Javanese House Architecture Typology

As Ronald (1998) said, in relation to cosmological belief, architecture has an important role as a sign of a power, status and privacy. There is also dichotomy in Javanese cosmology as sacred and profane, man and woman, front and back, and also public and private.

Most of the residential houses in Yogyakarta and Surakarta have the orientation direction to the south. This orientation is based to the tradition that people believe from Nyai Roro Kidul that live in southern sea.

Classification of Javanese house architecture typology can be seen from the shape and the characterization of its roof. The highest level of the roof is Tajug (mosque), joglo for noble class, limasan* for the middle class and kampong* and panggang pe* for ordinary people.

C. Types of Joglo

Form the construction, parts of the main structure of Joglo, as can be seen on figure 1. The upper structure consist of soko guru, sunduk, sunduk kili, sledge, blandar and tumpang sari. While the sub structure only consist of umpak.

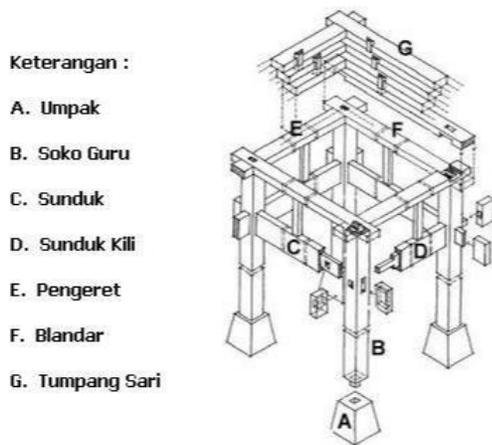


Figure 1. Joglo House Construction
Source: Traditional House, 2014

According to Hamzuri, broadly speaking, based on its construction, shape of Joglo is divided into 12 types, namely:

- Joglo Jompongan
A type of Joglo with two square edges in a square. This is another basic form of Joglo.
- Joglo Kepuhan Lawakan
A type of Joglo without hitching and the roof is rather upright so it looks high.
- Joglo Ceblokan
A type of Joglo that use *soko pendhem* where the lower part of the saka is hidden in the ground. It is usually without *sunduk*.
- Joglo Kepuhan Limolasan
It is almost likely with Joglo Lawakan, the difference is this type of Joglo uses a longer *sunduk bandang* and shorter *ander**, so that the roof (*empyak*) is longer.
- Joglo Sinom Apitan
A type of Joglo that uses three sledges, three or five *tumpang**, and four *emper**. It is also called as Joglo Trajumas.
- Joglo Pengawit
It is a type of Joglo that uses hanging symbol, the stretchy roof from the *penanggap** roof, *emper* roof that stretch from *penanggap* roof, *saka bentung* in every room edges embedded in *dudur**, 5 *tumpang**, using *singup** and *geganja**.
- Joglo Kepuhan Apitan
It is almost the same with Joglo Limolasan, but its *empyak brunjung* is higher because the sledge is shorter.
- Joglo Semar Tinandu
It is a type of Joglo that uses 2 sledges and 2 *saka guru* between 2 sledges. It is usually the two poles are replaced with the connection wall from *beteng** and most for *regol**.

- Joglo Lambangsari
It is a Joglo that uses *lambang Sari*, without *empyak emper*, uses 5 level of *tumpang Sari*, uses double screw and *godegan*. This form is found in *Keraton Yogyakarta* ward.
- Joglo Wantah Apitan
It is a type of Joglo that use 5 *tumpang*, uses *singup**, *geganja* and *takir lumajang*.
- Joglo Hageng
It is almost the same with Joglo Pengawit but it is shorter in size and there is a roof addition called *peningrat**, and also there is a *tratak** around as an addition. The example of Joglo Hageng is *Pendopo Agung Istana Mangkunegaran Surakarta*.
- Joglo Mangkurat
It is basically the same as Joglo Pangawit, but it is higher than Joglo Pangawit. There is also a difference on the method of connecting the *penanggap* roof and *penitih**, in Joglo Pangawit it uses *saka bentung* while in Joglo Mangkurat uses *lambang Sari*. The example of Joglo Mangkurat is *Bangsar Kencono Kraton Yogyakarta*.

D. Joglo's Space Pattern

The traditional Joglo house pattern in general is as shown in the figure below. Space configuration or parts of Javanese house in the village forms a three-part linear back-order. The *pendopo** is located at the front, *peringgitan** in the middle and *dalem** in the back and deepest house. This linear configuration allows to builds a house by stages starting from *dalem*. In fact, the width of the pavilion in Javanese residences is quite large. This happen because it is predicted to be able to accommodate relatives or kindred that will come at Eid Fitr holiday. Other than that, *pendopo* is functioned as for drying rice. In the Javanese room configuration, there is a dualism (binair opposition), between outside and inside, left and right, resting area and activity area, male spirit (where the placenta usually placed on the right) and female spirit (where the placenta is usually placed on the left), right *sentong* and left *sentong*. These two differentiation also occurs during the puppet show, where the screen is placed along *peringgitan*, the *dalang* and his crew in *pendopo* section placed with the male audience while the woman watches from the back (the shadow) in *emperan*.



Figure 2. Room Pattern of Joglo House
Source: Traditional House, 2014

E. Joglo's Space Value

According to Rapoport (1969), an architectural works is made not only for a symbol or as a place for living but also it has more value than just a shelter for people. In traditional community, architecture is always associated with religious thing. Religious things, something that assumed as holy and sacred considered as main consideration in the preparation of architectural patterns.

Generally, the value of space in Joglo traditional house is divided into two elements, which are vertical element consist of floor/jogan, pillar/saka and roof/empyak while horizontal element consist of emper/terrace, pendopo/semi private, dalem and pawon (kitchen) that considered as private. Jogan/floor is interpreted as a place to stand on, a human nature as a person. Saka/pillar is interpreted as a symbol of social life, the relationships with one another. Meanwhile empyak/roof is interpreted as a symbol of gunungan, the relationship with the One Almighty God.

Emper/terrace is interpreted as something that related to the outside, an open space without roof, as a transition from outside

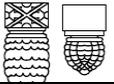
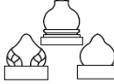
and inside of the house. Pendapa is interpreted as a place to welcoming the guest. It does not have a barrier which means an acceptance to a representation of the society in harmony living concept. Dalem interpreted as a private space where there are sentong as a place that relates to upper world, bedroom as a private place and pawon that assumed as a dirty place that separated from pendapa and other private spaces because it considered as unholy place.

Cosmologically, there are a concept between human relation (micro-cosmos) and universe (macrocosmos). As Rapoport, 1982 said there are ways to fathom the space values. It can be done by using space element analysis that consist of Fix Element, space element that already stabilized so it is hardly shifted or changed in shape.

F. Architectural Elements of Joglo

Decoration of Javanese traditional buildings consists of decorative flora, fauna, nature and religious. Decorative flora can not be separated from the pre-Islamic times (Hindu Era) influence

The Table Of Ornaments In Joglo Traditional House

| Ornaments | Name | Shape | Location | Meaning |
|-----------|---------------------|---|--|----------------------------------|
| Flora | <i>Lung-lungan</i> |  | Roof truss beam, <i>pamindangan*</i> , <i>tebeng*</i> door, window, <i>patang aring*</i> . | Aesthetic and <i>wingit*</i> |
| | <i>Saton</i> |  | Roof truss beam, up and bottom pillar of building, <i>tebeng</i> door | beauty |
| | <i>Wajikan</i> |  | Ornaments placed in the middle of the pillar or crossed block building fence. | Aesthetic and also <i>wingit</i> |
| | <i>Nanasan</i> |  | | Beauty and attempt of happiness |
| | <i>Tlancapan</i> |  | Base and the point of the frame beam | Brightness and majesty |
| | <i>Kebenan</i> |  | <i>Blandar, tumpang, saka</i> | Beauty |
| | <i>Patran</i> |  | Frame beam | Beauty and perfection |
| | <i>Padma</i> |  | <i>Umpak</i> | Aesthetic and purity |
| Fauna | <i>Kemamang</i> |  | Fence's door, fort | Eliminate the bad |
| | <i>Garuda peksi</i> |  | <i>Bubungan, tebeng, middle senthong, patang aring and fence</i> | Erased crime |
| | <i>Dragon snake</i> |  | Door's fence and <i>bubungan</i> | Dismiss the disaster |

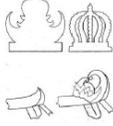
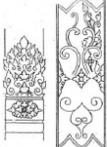
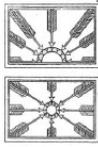
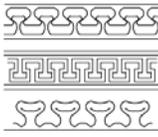
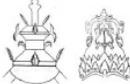
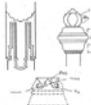
| | | | | |
|----------|--------------------------------|---|--|--|
| | Kock |  | The point of <i>bubungan</i> | Virility, bravery, physical and spiritual strength |
| | Mirong |  | <i>Saka guru, saka penanggap, penitih</i> | The embodiment of <i>Kanjeng Ratu Kidul</i> |
| Alam | Mountain |  | <i>Bubungan</i> | <i>Kayon</i> or a shelter tree |
| | Makutha |  | Roof's <i>bubungan</i> or at the left-right side | Blessed the people of the house |
| | Praba |  | <i>Saka</i> | The light on the pillar adding a beauty |
| | Arrow |  | <i>Tebeng's door</i> | As a ventilation, 8 wind directions as a repellent for bad spirits |
| | Kepetan |  | <i>Patang aring senthong, door, wall of gebyok</i> | Source of light |
| | Mega mendung |  | Point of <i>blandar, door, window's tebeng, tebeng's block</i> | The two characters, man and woman, black and white, day and night, good and bad. |
| | <i>Banyu tetes (teardrops)</i> |  | Along with the <i>patran</i> and beam | There is no life without water, beauty |
| Religion | Mustaka |  | <i>Tajug</i> roof, for mosque or grave | Crown or king |
| | Type of calligraphy |  | Frame, <i>dadapeksi, patang aring, tebeng's door, pillar</i> | Prophet Muhammad SAW, The Almighty of God |

Figure 3. The ornaments of Joglo
Source: processed from Cahyandari, 2012

III. FINDINGS AND DISCUSSION

Muncul Jaya restaurant located in Semarang District, Central Java Indonesia. Muncul Jaya restaurant has been opened since 9th April 2017. Muncul Jaya restaurant building with an ethnic concept is purely a new building which adapts the form of a traditional Joglo house, both on the façade building, ornaments that used, material used, pillar used, and furnishing used.

Muncul Jaya restaurant consists of 2 buildings namely the main building and meeting room building. The main building which functioned as a restaurant consists of 2 and 3 floors while the meeting room building consists of only one floor.



Figure 4. Main Building Perspective
Source: Jateng Pos 2018



Figure 5. Meeting Room Building Perspective
Source: Jateng Pos 2018

A. Roof

The shape of the roof on this building is the Joglo roof. As can be seen from its location, this building can be categorized as Joglo Kepuhan Limolasan, where the house uses double screw. The roof that it used is a tile roof with terracotta colors.



Figure 6. Front View of the Main Building
Source: Jateng Pos 2018

On the inside of the roof top, there is a *brunjungan* with wooden material and a carving motif, which consists of *Ulang* and *dada peksi*, but there is no *ander**. There are *molo* and *iga-iga* on the roof frame. The front building in the meeting room buildings seems to be higher, because it is *Joglo Kepuhan Lawakan* type of joglo where it does not use *geganja*.

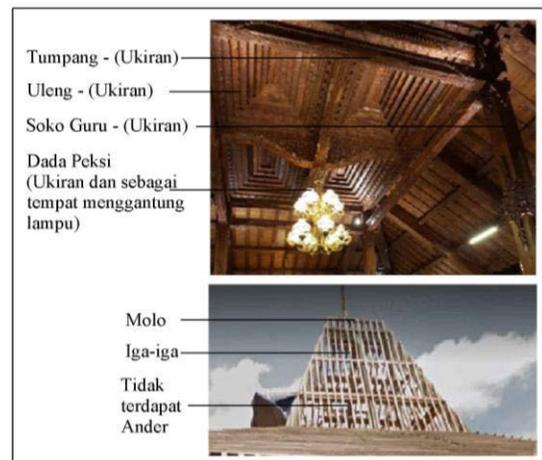


Figure 7. Detailed Roof
Source: Self Document and Processed from Jateng Pos 2018

B. Pillar

400 x 400 mm support pillars or *soko* made of wood carved on all four sides. Judging from its pillar, this building can be categorized as *Joglo Ceblokan* where it uses *soko pendhem*, which is a pole at the bottom that is buried under the floor and not in the form of *umpak*.

It can be seen that the *soko* material is made from a wood which then carved and finalized by natural colors, but in reality, wood material is not so massive. The inside of the wood as the main structure is reinforced concrete which then covered by wooden around the reinforced concrete structure. So that the load of the building is supported by reinforced concrete columns, while the wood covered column only functioned as a sweetener ornament.



Figure 8. Detailed Soko

Source: Self Document and Processed from Jateng Pos 2018

C. Floor

The floor of the restaurant building on the 1st and 2nd floors uses patterned ceramics. The buffer structure on 2nd floor is a plate and reinforced concrete.



Figure 9. Detailed Floor

Source: Processed from Jateng Pos 2018

D. Walls

There are 2 types of walls that Muncul Jaya building used which are gebyok wall system made from wood carved by relying on column structure as its strength that used in a public dining room and wall made by a pair of bricks covered with wall panels made of wood carved like the gebyok wall system used in the kitchen, office section, on the 1st and 2nd floors.



Figure 10. Detailed Wall and Gebyok

Source: Processed from Jateng Pos 2018

E. Ceiling



Figure 11. 1st Floor Ceiling Detail

Source: Self Document 2018

It used a wood ceiling with carved motif and matching finishing between soko and its gebyok to cover the beam structure and plate on the 1st floor. The lighting uses a type of halogen downlight and classic pendant lamps that are classically styled with a combination of crystal and wrought iron materials in addition to leave an old-fashioned impression.



Figure 12. 2nd Floor Ceiling Detail

Source: Processed from Jateng Pos 2018

Whereas on the 2nd floor, the ceiling beside the brunjung located in the middle of the Joglo's bud, was made according to the slope of the Joglo's roof with the exposed frame system. Iga-iga and overlays are still visible, ceiling panels made of wood are placed between the tiles and iga-iga, with matching finishing by its soko.

Besides using a classic pendant lamp from a combination between crystalline and wrought iron materials with bronze finish, it also uses a long fluorescent lamp that placed on rangka usuk in certain areas.

The addition of a flat ceiling on the 1st floor is made because Muncul Jaya restaurant building has of two floors. Thus it is a slight different from the original Joglo traditional house which does not use this system. This is only one of the adaptations on the Muncul Jaya restaurant due to the form that increased vertically.

F. Space Pattern

Muncul Jaya Restaurant building orientation between the main building and the meeting room building is different. This is due

to the building position that opposite from the main road, this each building is directed towards the main road to attract visitors since this is a commercial building.

The main building is facing southeast but it can be accessed from the southeast side and from the northwest side. Meanwhile the meeting room building is facing the northwest and can be accessed from the northwest side and southeast side.

Figure 13. Building Orientation of Muncul Jaya Restaurant
 Source: Processed from Jateng Pos 2018

The distribution of zoning space in Muncul Jaya restaurant can be seen in figure 14.

Figure 14. Room Configuration
 Source: Self-Analyzed 2018

In accordance with its function as a commercial building with restaurant designation, the zoning division is only divided into public spaces, private and semi private place. Public space is divided into two categories namely the general category and VVIP on the top floor. In the space configuration, there is no binair opposition, division of space based on cosmology and transition space between public space and private space.

The walls, both gebyok and permanent gebyok layered walls is made rather high to differentiate the inner space and outer space. Thus there are stairs made at each entry doors.

G. Space Value

In accordance to its function, the joglo house in the Muncul Jaya restaurant can be seen from two elements which are vertical elements and horizontal elements as in figure 15 shows below.

| No | Element | Position | Term | Cosmology | Characteristic | Meaning | function |
|----|------------|----------|--------------------------------|-----------------|----------------|---|---|
| 1 | Vertical | Bottom | <i>Jogan/</i> floor | Soil/ ground | Public | Floor is assumed as a place for a human to stand with their feets above the earth, a human nature behaviour | Dining room's floor, parking lot's floor, stage for gamelan performance |
| | | Middle | <i>Saka/</i> pillar | Earth/ world | Social | Assumed as a symbol for social life, relationship with one another | Functioned structurally and constructurally, as a beauty |
| | | Upper | <i>Empyak/</i> roof | Sky | Private | Symbol of mountain, relationship between human and The Almighty of God | A shelter from sunlight and rain |
| 2 | Horizontal | Front | <i>Emper/</i> terrace | outside | Public | In relation to the outside in the form of a public place without a roof as alternation between outside and inside | Parking lot |
| | | Middle | <i>Pendapa/</i> dining room | Middle world | Semi private | Like a <i>pendapa</i> , this room is made for welcoming the guests which is the visitors of the restaurant. Without a barrier means an acceptance to a representation of the society in harmony living concept. | A place to serve the servings/ dining table/ VVIP room |

| | | | | | | | |
|--|--|------|--------------------------|-------------|---------|---|---------|
| | | Back | <i>Pawon/</i> kitchen | Dirty place | Private | As a dirty room, separated from <i>pendapa</i> and other private rooms, assumed to be not pure. | Kitchen |
|--|--|------|--------------------------|-------------|---------|---|---------|

Figure 15. Room Value on Muncul Jaya Restaurant
Source: Self-Analyzed, 2018

In Muncul Jaya restaurant, space is interpreted in several types of spaces, which are:

1) Transition Space:

Transitional space is formed as a facility, a transition between the outer space and inner space. In Muncul Jaya restaurant, this space is a parking space for two-wheeled and four-wheeled vehicles which located on the right and front side of the main restaurant and in front of the meeting room.

The fix element is a paving block arrangement with a lower contour layout for the main building which symbolizes the average impression or moderate or not luxurious compared to the higher main building. This transitional space boundary is formed according to the area of paving blocks. Other fix element is the existence of plants that deliberately arranged around the main building. The plants arrangement is not only for the decoration but also as a barrier between the transitional space and the inner space.

2) Main Space:

The main space is the center of the activity. In this case is the activity of visitors to enjoy the offerings. This main room is in the form of a dining room on the 1st floor where all the visitors without gender, age and economic level restrictions can do activities to enjoy serving dishes in this room. This space is formed from several fix elements such as matching ceramic floor, a wood ceiling, semi element shaped in gebyok carved in an old Javanese nuance and non fix element such as typical Javanese serving foods along with the friendly serving activities service.

3) Flexible Space:

The flexible space is almost similar to the main space which is the center of activity for visitors to enjoy the servings. Not just any visitor can be in this flexible space. The visitors that can visit the space are only those who booked the room and already placed an order. This space consists of VVIP dining room on the 2nd floor and music room on the 2nd floor. The forming element is the same as the main room or main space. The territorial boundary is only a widened space on the 2nd floor.

4) Social Space:

Social space is a space used for interacting between the visitors and the owners. This space is a cashier with activities between sellers and buyers, and stairs as the non fix element, and the waiter activities in taking visitors to the VVIP room on the top floor as the fix element.

5) Private Space:

Private space or private room or closed room is a space or room where the access is limited by certain rules. In this case, only employees can access. This room is separated from the main space and flexible space that can be accessed by outsiders for privacy reasons and something that is indeed kept secret from outside the parties.

These rooms are kitchen and office room. The semi fix element is in the work tools such as cooking utensils and other office equipment, while the non fix element is each employee activities where their existence is marked by the uniform that they wear from the management to provide the identity for people who can enter the private rooms.

6) Sacred Space:

The sacred space or room is intended to be a room where both visitors and managers of the restaurant Muncul Jaya do the activities to communicate with God. In this case, the sacred place is a prayer room as a facility for Muslim visitors who want to perform prayers.

7) Gender Space:

A space or room that is formed because of the separated activity due to gender difference that needs to be done. This room is a toilet for men and women. The place is rather hidden from the main room and flexible room to provide a comfortable atmosphere for visitors. The fix element is a barrier wall.

8) Economic Space:

Economic space is a showroom in Muncul Jaya restaurant. Souvenir items are displayed here for sale.

9) Entertainment Space:

Entertainment room is intended for VVIP visitors who want to enjoy the atmosphere of ancient Java with the entertainment of langgam sound produced by gamelan. The Javanese atmosphere is presented by the presence of gamelan, Javanese songs with artists who use traditional Javanese clothes leave a classic impression to the visitors.

H. Element and Decorations

Elements which became a Joglo traditional house characterization that are still maintained in Muncul Jaya restaurant building along with its decorations are shown in the figure below

| No | Name | Shape | Position |
|----|--------------|---|--|
| 1 | Mountain |  | Bubungan, gebyok, gamelan |
| 2 | Makutha |  | Bubungan roof in the middle of on the left and right point |
| 3 | Praba |  | In lower saka pillar on the four point |
| 4 | Arrow |  | Tebeng's door (upper the foot) |
| 5 | Mega mendung |  | Point of blandar, door, tebeng's window, barrier's tebeng |
| 6 | Banyu tetes |  | Beam frame |
| 7 | Lung-lungan |  | Tebeng door, window, and barrier |
| 8 | Saton |  | Beam framed roof, brunjung |

| | | | |
|----|---------|---|----------------------------------|
| 9 | Wajikan |  | In the middle of four point saka |
| 10 | Nanasan |  | In the upper part of barrier |
| 11 | Patran |  | Barrier, the end of the beam |

Figure 16. Ornaments of Muncul Jaya Restaurant
Source: Self-Analyzed, 2018

IV. ANALYSIS

Based on the observation results on the object of research at Joglo house functioned as a restaurant in Muncul Jaya Restaurant, it was obtained space patterns, building typologies, building details, architectural supporting elements and architectural decorations as shown in the tabulation below. The analysis was done by comparing the items mentioned before with the originality of the Joglo traditional house concept by three categories, which are the component category that persist and in accordance with the original, existing component category but experienced an adaptation from the original, and component category which completely do not exist.

Findings Observation And Analysis Table

| No | Item | Description | The Main House | | | The Meeting House | | |
|----------------------|-------------------|--------------------------------|----------------------|------------|-----------|----------------------|------------|-----------|
| | | | Exist Match Original | Adaptation | Not Exist | Exist Match Original | Adaptation | Not Exist |
| 1 | Traditional House | -same built | | | √ | | | √ |
| | | -direction as magical | | | √ | | | √ |
| | | -room as magical | | | √ | | | √ |
| | | -patrilinier | | | √ | | | √ |
| | | -matrilinier | | | √ | | | √ |
| | | -tropical climate adaptation | | √ | | | √ | |
| Sub total | | | 0 | 1 | 5 | 0 | 1 | 5 |
| Sub Total Percentage | | | 0% | 17% | 83% | 0% | 17% | 83% |
| | | -pendopo | | √ | | | √ | |
| | | --pringitan | | √ | | | | √ |
| | | -emperan | | √ | | | √ | |
| | | -omah njero (inside the house) | | | √ | | | √ |
| | | -sentong kiwo (left sentong) | | | √ | | | √ |

| | | | | | | | | | |
|----------------------|---------------------|----------------------------------|-----|------|-----|----|------|-----|---|
| 2 | Room patterns | -sentong tengah (middle sentong) | | | √ | | | √ | |
| | | -sentong tengen (right sentong) | | | √ | | | √ | |
| | | -gandok kiwo (left gandok) | | | √ | | | √ | |
| | | -gandok tengen (right gandok) | | | √ | | | √ | |
| | | -pawon (kitchen) | | √ | | | √ | | |
| | | -pekiwan | | | √ | | | √ | |
| | | -seketheng | | | √ | | | √ | |
| Sub Total | | | 0 | 4 | 8 | 0 | 3 | 9 | |
| Sub Total Percentage | | | 0% | 33% | 67% | 0% | 25% | 75% | |
| 3 | Typology | -cosmology of room | | √ | | | √ | | |
| | | -symmetricity | | √ | | | √ | | |
| | | -building orientation | | √ | | | √ | | |
| Sub Total | | | 0 | 3 | 0 | 0 | 3 | 0 | |
| Sub Total Percentage | | | 0% | 100% | 0% | 0% | 100% | 0% | |
| 4 | Building Components | -type of the roof | | √ | | | √ | | |
| | | -roof construction | | √ | | | √ | | |
| | | -roof material | | √ | | | √ | | |
| | | -umpak | | | | √ | | √ | |
| | | -soko | | √ | | | √ | | |
| | | -soko material | | √ | | | √ | | |
| | | -floor's material | | √ | | | √ | | |
| | | -gebyok | | √ | | | √ | | |
| | | -door | | √ | | | √ | | |
| -ceiling | | √ | | | √ | | | | |
| Sub Total | | | 0 | 9 | 1 | 0 | 10 | 0 | |
| Sub Total Percentage | | | 0% | 90% | 10% | 0% | 100% | 0% | |
| 5 | Supporting element | -gamelan | | √ | | | | √ | |
| | | -paintings/ ornaments | | √ | | | √ | | |
| Sub Total | | | 1 | 1 | 0 | 0 | 1 | 1 | |
| Sub Total Percentage | | | 50% | 50% | 0% | 0% | 50% | 50% | |
| 6 | Room's Value | -jogan's element | | √ | | | √ | | |
| | | -saka's element | | √ | | | √ | | |
| | | -empyak's element | | √ | | | √ | | |
| | | -emper's element | | √ | | | √ | | |
| | | -pendapa's element | | √ | | | √ | | |
| | | -dalem's element | | | | √ | | | √ |
| | | -pawon's element | | √ | | | | √ | |
| Sub Total | | | 0 | 6 | 1 | 0 | 6 | 1 | |
| Sub Total Percentage | | | 0% | 86% | 14% | 0% | 86% | 14% | |
| 7 | Ornaments | -flora's ornaments | | √ | | | √ | | |
| | | -fauna's elements | | | | √ | | √ | |
| | | -nature's ornaments | | √ | | | | √ | |
| | | -religion's ornaments | | | | √ | | √ | |
| Sub Total | | | 0 | 2 | 2 | 0 | 2 | 2 | |
| Sub Total Percentage | | | 0% | 50% | 50% | 0% | 50% | 50% | |
| Total | | | 1 | 26 | 17 | 0 | 26 | 18 | |
| Total Percentage | | | 2% | 59% | 39% | 0% | 59% | 41% | |

Figure 17. Findings Observation and Analysis on Muncul Jaya Restaurant
Source: Self-Analyzed, 2018

As can be seen from the tabulation above, it was found that in Muncul Jaya restaurant, the authenticity of the Joglo traditional house concept was only 2% in the main restaurant and did not even match the original with the meeting room.

While the percentage of elements and components of Muncul Jaya restaurant that experienced adaptation was quite high, it is 59% in the main restaurant and the meeting room.

Besides, it was found that there were many elements and components of Joglo house that were not found in the Muncul Jaya restaurant, it is 39% in the main house and 41% in the meeting room.

From the definition of traditional house point of view, there is no traditional house category that matches the authenticity of the Joglo house, both in the main restaurant of Muncul Jaya and the meeting room. From the definition of traditional house, only 17% of the house that has been modified. Other than that, the original components of traditional house were not found in the Muncul Jaya restaurant both in the main restaurant and in the meeting room.

The elimination of the Joglo house standard room due to the functional transformation of Joglo restaurant shows the highest percentage both in the main dining room and meeting room. Because of its functional transformation, the main dining room eliminated 67% of its space, while the meeting room eliminated 75% its standard Joglo house space.

Both in the main dining room and meeting room, in space cosmologically, symmetry and building orientation, there are no original components as a Joglo traditional house concept. All of them are adapted based on its needs and functions.

There are no original components of the Muncul Jaya restaurant building that are equal to Joglo traditional house concept, both in the main dining room and the meeting room. 90% of the main dining room transformed based to its function and the rest of 10% is eliminated from the original concept. While in the meeting room, all the components of the building are adapted from the original concept of joglo traditional house.

Gamelan that located in the main dining room was made according to the original concept but it does not exist in the meeting room, while the paintings already adjusted both in the main dining room and meeting room.

There is no original room value in the main dining room and meeting room at Muncul Jaya restaurant in, only 86% that have been adjusted, while the rest have not been found anymore.

Religious and fauna patterned ornaments are not found in the main dining room and meeting room. Whereas fauna and nature patterned ornaments can be found in the main dining room and meeting room but the 50% of the motives are adjusted while the rest 50% are removed.

V. CONCLUSION AND PROBLEM SOLVING SUGGESTION

A. Conclusion

According to the description above, it can be concluded that:

- 1) Changes in the house function affect the concept of a traditional Joglo house. Other things that influence the change in concept of a traditional Joglo house are:
 - Constructional system change
 - Material change
 - Architectural point of view in interpreting its work change
 - User behavior change
- 2) Although Muncul Jaya restaurant is a Joglo formed restaurant, its only applies 3% of original Joglo traditional house concept in its reality. Furthermore, the concept is already transformed and adapted even eliminated.
- 3) This transformation can be damaged the original Joglo traditional house architectural concept. Nevertheless, the attempt to conserve Joglo traditional house although it does not fully the same with the original concept that did by Muncul Jaya management team, should be appreciated while the modern architectural design building that popular nowadays.

B. Problem Solving Suggestion

Government regulation that regulate about the procedure of building a traditional house specially Joglo is needed to prevent the distinction or transformation of the original architectural Joglo house.

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GLOSSARY

- *) soko/saka: terms for pillar in Javanese language
- *) limasan, kampong, panggang pe: types of roofs that Joglo used based on its level of social class.
- *) selamatan/Kenduri: a gathering of a community and is led by the oldest person or someone who has a religion knowledge
- *) sesajen: offering or tribute
- *) andar, tumpang: kind of buffer
- *) emper/emperan: terrace
- *) tratak: kind of tent for massive used
- *) pendopo: kind of gazebo

- *)gamelan: javanese music devices
- *)matrilokal: a couple of husband and wife who live with a big family from the wife bloodline.
- *)patrilokal: a couple of husband and wife who live with a big family from the husband bloodline.
- *)blandar: kinds of wood construction in a Joglo's building system
- *)tumpang sari: kind of wood construction in a Joglo's building system
- *)empyak: roof
- *)empyak brunjung, empyak emper: variations of roof
- *)dalem: a closed and subdivided building along the North and South shafts into different areas.

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The Importance of Social Learning Strategies in Enhancing Students' Speaking Skills in MUET.

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Abstract- In Malaysia, it is compulsory for all students in primary and secondary schools to learn English as a second language. To acquire and master all the language skills i.e reading, writing, speaking and listening, definitely is not an easy task. Hence, language learning strategies can be used to guide the students to improve their learning in order to be more competent and proficient in English language. This paper investigates the importance of social strategies in enhancing speaking skill among the students. The respondents of the research are 24 students in Form 6 (pre-university) from SMK Tun Syed Zahiruddin, Melaka and those students are the MUET (Malaysian University English Test) candidates. The issue that contributes to this research is that, many of the MUET candidates are in a low proficiency in English speaking. They have limited ability to speak in English as to respond to the task given in the test. Thus, they are unable to score good language band in MUET speaking. The social strategies in learning were based on a few series of group discussions practice among the students in MUET speaking class. Task fulfillment, language and communicative ability in the group discussion were the aspects to assess the students' enhancement in speaking. A set of questionnaires using a Likert-Scale on speaking strategies by Oxford & Cohill, were distributed to all students involved. Based on the findings, it was found that, social strategies were the types of language learning strategies that can be applied to enhance their speaking skill in MUET speaking. This study also emphasizes that, these two strategies are important and there are few aspects that students could benefit from the strategies that they can apply in group discussion to enhance their performance in speaking skill.

Index Terms - Language learning strategies, social strategies, MUET, speaking skill, group discussion

I. INTRODUCTION

Language learning strategies are used to facilitate students in learning foreign languages in more meaningful and interesting way. It will also determine the progress and improvement of students' competency and proficiency in using the language. In English as a second language (ESL) classroom, students may use any types of learning strategies that best suit to their preferences to acquire all the language skills i.e reading, writing, speaking and listening. However, this study only focuses on how the language learning strategies could help students to improve their speaking skill.

Speaking is an action of someone in conveying information or expressing feelings in speech with someone else. It is an interactive process of constructing meaning that involves producing and receiving and processing information (Burns & Joyce, 1997). Speaking any language could be difficult if it is not well-mastered by the speakers. It would lead to misunderstanding and the messages could not be conveyed.

It is a fact that there are many of students who still could not speak well in English. As stated by Trent (2009), one of the many reasons to take into considerations might be the lack of confidence and anxiety about making errors. This could be minimized by practising and using the language in their daily conversation. This is to prepare the students to be more proficient in using the language as proficiency and competency in the language are regarded as a passport to better academic achievement (Bellingham, 1995; Cheng, 2008).

When a person is delivering a formal speech, the act of speaking is considered to be more complicated than general everyday conversation. Besides, it also involves some other aspects that have to be considered during the delivery process such as choosing topics, organizing thoughts, tailoring the message, and adapting to listener feedback (Lucas, 2001). And all these are very much related to MUET speaking where the students need to speak up and deliver their points, ideas and maturity of thoughts within the time limit. Apart from that, the correct use of English language and their good communicative ability will be an advantage for them to get better marks.

Due to the that, social strategies can be used by the students to enhance their speaking skill by working together in groups. A group discussion is one of the methods in social strategies of learning language. All the group members will have the opportunity to discuss about the topic and share their opinions through speaking.

This is per the standard requirement of speaking task in MUET (Malaysian University English Test). In MUET speaking, one of the tasks is group discussion. The students are given a topic and they have to discuss about the topic in groups. Giving ideas, agreeing or disagreeing on others' points of view could bring the students chances to speak and interact with others. At the end of the discussion, the group will have a group consensus on the topic and then the task is already completed. Without a proper way in managing the group discussion and without help and support from the group members, the discussion will be boring and not lively. Due to that, social strategies could help them to perform better in generating ideas and give maturity responses through speaking during the group discussion.

II. LITERATURE REVIEW

Language learning strategies

According to Rigney (1978) who gave an early definition of language learning strategies stated that, these strategies are the often-conscious steps or behaviours used by the language learners to enhance the acquisition, storage, retention, recall and use of new information. It is agreed by Oxford (1992) who later classified language learning strategies into 6 categories which are cognitive strategies, metacognitive strategies, memory related strategies, compensatory strategies, affective strategies and social strategies.

According to Oxford (1992), cognitive strategies enable the learners to manipulate the language material in direct ways through reasoning, analysis, note taking, summarizing, synthesizing, outlining, reorganizing information to develop stronger knowledge structures, practicing in naturalistic settings and practicing structures and sounds formally. Metacognitive strategies refer to the process of identifying one's own learning style preferences such as planning task, gathering and organizing materials, arranging a study space and as schedule and also evaluating the success of learning. These behaviours are to manage the learning process overall.

Other than that, memory-related strategies help learners to link one language item or concept with another but do not necessarily involve deep understanding. It enables learners learn to retrieve information via orderly string, sounds, images, body movement, location and mechanical means. Compensatory strategies refer to the activities that involve guessing, talking around and using gestures and pause words and it depends on the skills that the learners are focusing to. Affective strategies are the learning strategies that concerned with managing emotions, both negative and positive. The relationship between affective strategies and learning is not clear, but a positive affective environment helps learning in general. Last but not least, social strategies is used when cooperating with others in the learning process.

Social strategies

Social strategies in language learning facilitates the students to establish communication with other people by speaking the target language. According to Lan and Oxford (2003) by having social strategies, the students have the interaction with others by asking questions in a foreign language, receiving answers, correcting mistakes, establishing cooperation, trying to study feelings and thoughts of people of the targeted culture.

In order to make communication in the target language effectively, the students need to develop their speaking skills. Teacher plays a very big role to establish communication among the students. One of the way is to conduct group discussion among students. It is because social strategies need students to interact with other friends to create language social environment. Cooperation with others in generating ideas, sharing knowledge and giving opinions are the process of developing speaking skill. Group discussion would give advantages to students to get ideas and then explain the information that is not clear in the process of language learning. Besides, it is a way to confirm the knowledge and establish cooperation. Cultural sensitivity also can be learned in the process of learning the feelings and thoughts of their friends who belong to different cultures.

MUET (Malaysian University English Test)

English is a second language in Malaysia. However, it is largely used for academic purposes and widely used as a medium of instruction at the tertiary level (Gill, 2005). According to Bellingham, (1995), competency and proficiency in English is a passport to better academic achievement.

In line with that, Education Ministry of Malaysia has introduced Malaysian University English Test (MUET) and it is a mandatory requirement for admission into public universities in Malaysia (Lee, 2004). It can be served as either an entrance requirement or an exit requirement depending on the courses and university that students wish to enroll in. MUET was introduced by the Ministry of Education in late 1999 and fully implemented in 2000. MUET is administered by the Malaysian Examination Council and it specifically aims to bridge the gap in language needs between secondary and tertiary education (Chan & Wong, 2004) Besides, the test is to enhance the students' command of English in a holistic approach, whereby it focuses on all the four skills of language learning (Malaysian Examination Council, 2005). The skills are reading, writing, speaking and listening and all these skills are tested in MUET. Each skill has different weightage for the language band results. Speaking test carries a total of 60 marks for each task and a 15% out of the total score in MUET.

MUET has its own objective, which is to measure the English language proficiency of students. It is a predicator of academic achievement in ESL teacher education (Othman, J & Nordin, A.B (2013). The aggregated scores ranging from 0 to 300 obtained by the students will determine the level of English proficiency of the students. The scores correlate with the band system ranging from Band 1 to Band 6, in which Band 1 is the lowest while band 6 is the highest.

III. METHODOLOGY

A series of group discussions were carried out to determine the progress and improvement of the students' performance in speaking skill. There were 24 students taking part in the activity and they were divided into 6 groups in which each group consists of 4 students. All groups are given a task that they need to conduct a group discussion among the members in the group. They are given 2 minutes for preparation and 10 minutes for group discussion.

The topic to be discussed was given in the written task situation in which there were 4 options given that related to each situation. Along the discussion, all students had to talk about the topic based on the situation given, using the listed options. They can choose any option given in the task and later discuss it in their group. By giving their own points of view, they had to convince the others about their stand on the topic. Besides, they have to either agree or disagree about the other students' opinion with a good explanation and elaboration. At the end of the discussion, they have to reach to a group consensus.

Prior to the activity, all students have been taught about the way how the MUET speaking is conducted. All students also had gone through their first experience sitting for MUET speaking when they were in previous semester. Teachers also have given input about the speaking task and activity during teaching and learning session in class on the previous lesson.

Social strategies in language learning is found when the students are participating in the group discussion. They interact with each other when discussing about the topic. Paying attentively while the others giving responses is in a way to show respect to them. They may ask few questions among themselves about the task in order to make the communication going on. Besides, in this task, they have to help each other by prompting the weak ones to speak. This is to avoid them to be left behind along the discussion. By sharing opinion and ideas, it would enable the other group members who have limited knowledge to get a clear picture and understand more about the topic. So that, they will try to continue the discussion by repeating and adding some other points on their own.

The main objective of the study is to investigate the importance of social strategies in enhancing students' speaking skill in MUET by focusing the aspects of speaking skill that they could improve in group discussion. The aspects are task fulfillment, language and communicative ability. Besides, there will be a comparison of marks that they obtained in Test 1 and Test 2. The difference of marks that they obtained between the two tests will be the guidelines of determining the importance and effectiveness of social strategies in enhancing their speaking performance in speaking skill in MUET. The Test 1 was carried out a few weeks before the programme of group discussion started in the beginning of the semester while the Test 2 was carried out in the MUET final exam in semester 2.

IV. DATA COLLECTION

This study used a survey questionnaires to collect data. The questionnaires used in this study adapted from a Likert scale, a self rating scale questionnaires in which choices were given for each item. It allows respondents to make choices whether they agree, strongly agree, disagree or strongly agree with the items stated in the questionnaires. There were 11 items altogether that related to the aspects of improvement in speaking skill i.e task fulfillment, language and communicative ability.

The survey questionnaires were distributed to all respondents. They were given 15 minutes to answer all the 11 items in the questionnaires. This was an individual task where the respondents should rank the preferred scale on their own. Discussion in answering the questionnaires among them was not allowed.

V. DATA ANALYSIS

Based on the students' responses from the questionnaires, the aspects of improvement in speaking skill the respondents may gain in participating in the group discussion will be discussed further in findings section. This is to highlight how importance the social strategies are in terms of improving students' skill in speaking. It will be shown in tables.

Besides that, there will be a table that shows the comparison of marks obtained by the students in speaking test between Test 1 and Test 2 of MUET speaking. Descriptive statistics is used to describe the mean, standard deviation and the mark range between the two tests.

VI. FINDINGS

Based on the responses from the questionnaires, each student had chosen their most favoured choice in the self rating scale, whether they agree, strongly agree, disagree or strongly disagree with all the items that correspond with the 3 aspects that were being studied in this research i.e task fulfillment, language and communicative ability. The details of the items for each aspect are listed in the questionnaires

The findings are as follows;

| Item | | Total number of respondents | Strongly | Disagree | Agree | Strongly agree |
|------|---|-----------------------------|----------|----------|-------|----------------|
| | By using social strategies in group discussion, it helps me to enhance my speaking skill in MUET in terms of; | | | | | |
| | Task fulfillment | | | | | |
| 1. | understanding the topic better | 24 | 0 | 3 | 16 | 5 |
| 2. | developing and organising ideas effectively | 24 | 0 | 3 | 14 | 7 |
| 3. | providing adequate and relevant response to the task | 24 | 0 | 3 | 15 | 6 |
| | Language | | | | | |
| 4. | using correct language grammar in my speaking | 24 | 0 | 5 | 14 | 5 |
| 5. | | 24 | 0 | 5 | 13 | 6 |

| | | | | | | |
|-----|---|----|---|---|----|---|
| | using variety of sentence structures | | | | | |
| 6. | using varied vocabulary | 24 | 0 | 4 | 14 | 6 |
| 7. | using correct and clear pronunciation of words | 24 | 0 | 4 | 14 | 6 |
| 8. | showing mastery of basic stress and intonation patterns | 24 | 0 | 4 | 15 | 5 |
| | Communicative ability | | | | | |
| 9. | keeping communication going through fluently | 24 | 0 | 3 | 15 | 6 |
| 10. | building up my confidence level | 24 | 0 | 3 | 15 | 6 |
| 11. | managing the discussion competently | 24 | 0 | 5 | 13 | 6 |

Figure 1 : The number of students who gave responses for each item correspond with the aspects of speaking that can be enhanced through social strategies in group discussion

Task fulfillment

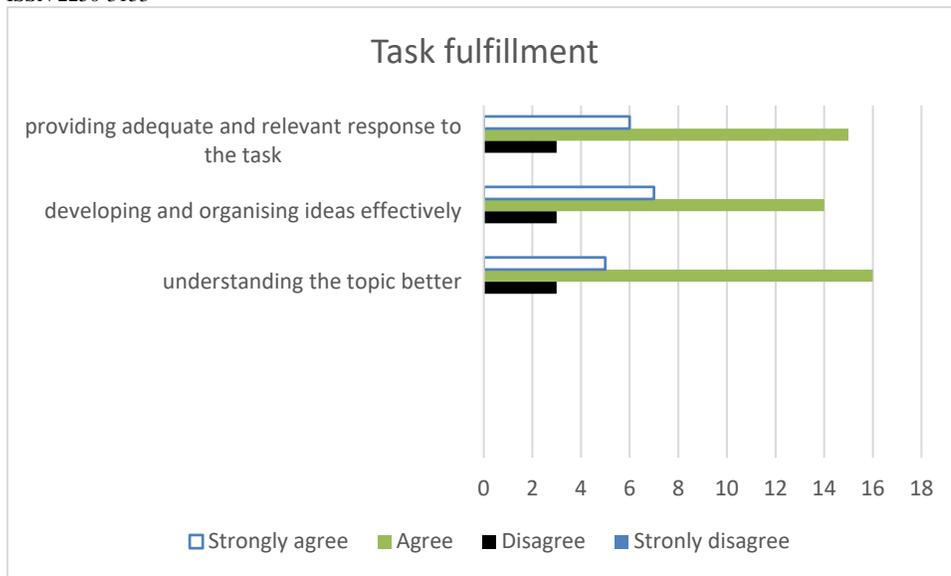


Figure 2 : The responses of students on task fulfillment

Based on the speaking task given, the students are given a situation or an issue that they have to discuss in group. The level of understanding of the topic could be different among the students, whether they have a very good understanding, satisfactory understanding or limited understanding of the topic. However, by practicing social strategies through group discussion, the students will get to understand the topic better as the other group members would somehow help indirectly by explaining and interpreting the whole issue through the discussion. With a good understanding of the topic, the students would develop and organise their ideas effectively and reasonably well. Consistency and looking the issues at various angle could make the speakers outstanding in their presentation. Prompting is used for those who hardly or have a very limited development of ideas. Besides, they have to make sure that their responses on the topic are relevant and convincing enough. Besides, it must be also adequate by having a good elaboration on it. This needs help the other group members to support accordingly. However, if the responses are irrelevant, the group members could argue and help that particular students to be back on track of the discussion.

Language

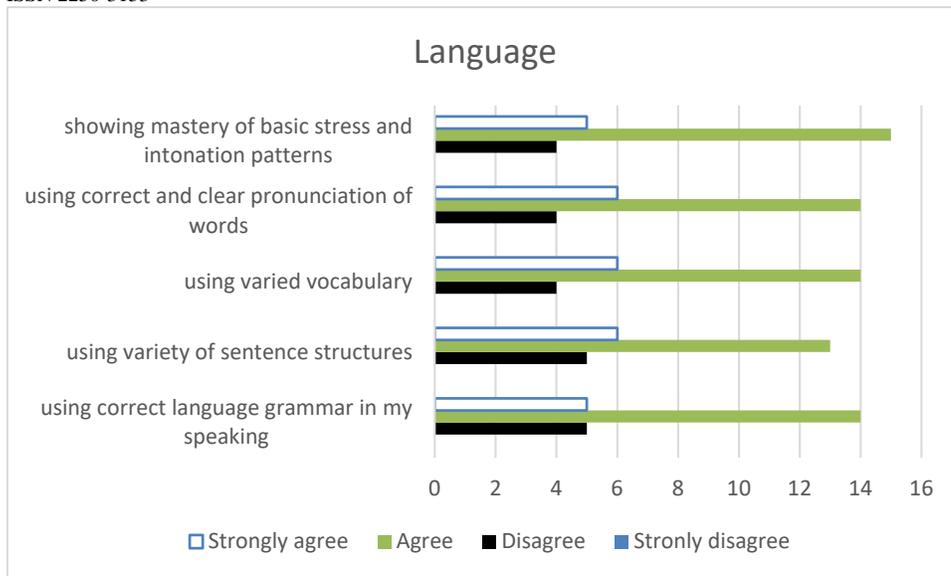


Figure 3 : The responses of students on language

There are a few parts of language that students could improve by practicing group discussion through social strategies. First, the students could improve their command of language. They may use different structures in their presentation without any major errors. There could be some errors in structures but these do not hamper communication. Second, varied vocabulary. Students might use appropriate and varied vocabulary satisfactorily. This also refers to any quotations, popular phrases that are added in during the presentation. They also use appropriate linkers to show the connection between ideas. Third, word stress, intonation and pronunciation of words. By collaborative learning, the students can learn and practice to have a proper kind of pronunciation. There are some students who could not pronounce words correctly, but they have to make sure that their pronunciation does not interfere with comprehension and understanding. The students also could improve the word stress and intonation by social strategies. All these can be improved when the other group members help and support each other.

Communicative ability

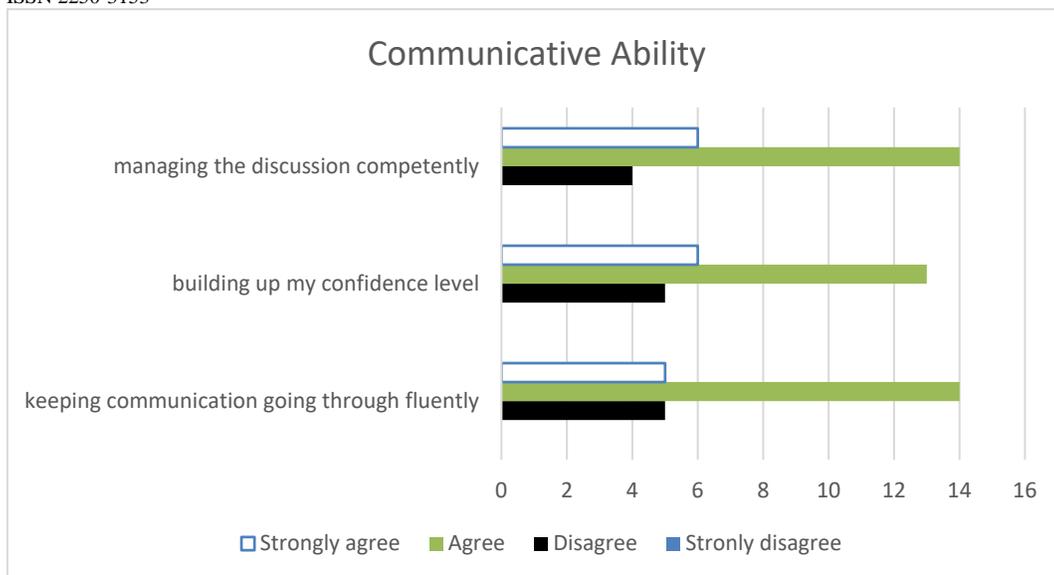


Figure 4 : The responses of students on communicative ability

By doing social strategies through group discussion, the students could build up their confidence level not only in speaking the language but also in giving their point of view on the issues raised. Delivering the speech confidently could convince the others to agree with and at the same time showing maturity in personality and thoughts. The students also could improve their fluency in delivering their presentation. They are able to keep communication going and reduce occasional unevenness, light stumbling and groping for words. Overall, communicative ability makes the presentation to be very easily understood. Besides that, by collaborative learning, the students could display initiative and interest in discussing the topic. They can also improve their interactions with the other group members and manage the discussion very competently.

Based on the responses made to all the aspects of speaking skills above, it was found that there was no students strongly disagree with the items listed. Only a few students chose disagree on certain items but the percentage was too low. Majority of students chose that they agreed that social strategies could enhance their speaking skills in all the three aspects.

Comparison of Students' Marks in Speaking

To prove that social strategies through group discussion could enhance students' skill in speaking, this research also came out with the comparison of students' marks in MUET speaking according to the Test 1 (beginning of semester 2 examination) and Test 2 (final semester 2 examination).

The findings are as follows;

| NAME | MARK (60m) | MARK | % |
|------|------------|------|---|
|------|------------|------|---|

| | | TEST 1 | TEST 2 | DIFF | |
|----|---|--------|--------|------|--------|
| 1 | ABDUL MATIN BIN MOHD SAID SOH | 27 | 30 | 3 | 10.00 |
| 2 | MUHAMMAD FATAHUL HAZIQ BIN MOHD HARIS | 25 | 27 | 2 | 7.41 |
| 3 | SYARIF HIDAYATULLAH BIN KELANA | 12 | 12 | 0 | 0.00 |
| 4 | MUHAMMAD FAIRUS AKMAR BIN ABDULLAH | 18 | 20 | 2 | 10.00 |
| 5 | FILZAH ILI MUSFIRAH BINTI MOHAMAED NOOR | 25 | 29 | 4 | 13.79 |
| 6 | MARIATUL AISYAH BINTI ABB RAHMAN | 22 | 25 | 3 | 12.00 |
| 7 | SYAFIQAH LIYANA BINTI KHAIRUL FUZZI | 12 | 15 | 3 | 20.00 |
| 8 | NURFATIN AFIQAH BINTI RAZALEE | 14 | 20 | 6 | 30.00 |
| 9 | NUR AQIDAH BINTI MOHD SANI | 20 | 25 | 5 | 20.00 |
| 10 | NURUL ATIQAH BINTI MUHAMAD JAIS | 13 | 16 | 3 | 18.75 |
| 11 | NUR FARZANA BINTI ADAM | 24 | 28 | 4 | 14.29 |
| 12 | NURUL NAJIHAH BINTI SALLEH | 14 | 15 | 1 | 6.67 |
| 13 | AFFIAH IZZATI BINTI ABDUL RAZAK | 23 | 27 | 4 | 14.81 |
| 14 | AHMAD FAUZI BIN DAUT | 20 | 24 | 4 | 16.67 |
| 15 | AHMAD MUJAHID BIN MOHD HANAFI | 21 | 21 | 0 | 0.00 |
| 16 | HASYATUL HUSNA BINTI ABD RAHMAN | 22 | 24 | 2 | 8.33 |
| 17 | MUHAMMAD AIMAN BIN AZLAN | 32 | 34 | 2 | 5.88 |
| 18 | MUHAMMAD NOR SHASZREEN BIN SHARAIL | 20 | 21 | 1 | 4.76 |
| 19 | NOR ZAIRELL IKHMAL BIN NOR WAZIZ | 28 | 30 | 2 | 6.67 |
| 20 | NUR HAZIRAH BINTI HASAN | 23 | 20 | -3 | -15.00 |
| 21 | NUR WAHIDAH BINTI SALEH | 23 | 24 | 1 | 4.17 |
| 22 | NUR HAZIMAH BINTI LAILATUL AKBAR | 21 | 24 | 3 | 12.50 |
| 23 | NURUL RAIHANAH BINTI HISHAMUDDIN | 23 | 27 | 4 | 14.81 |
| 24 | SITI AISYAH BINTI AWALUDIN | 25 | 26 | 1 | 3.85 |

Figure 5 : Comparison of students' marks in Test 1 and Test 2

Based on the mark difference, it shows that most of the students had obtained an increase of marks in second test compared to first test. Eventhough it was just a slight increase, it showed that there was still an improvement made by students after participating in the group discussion.

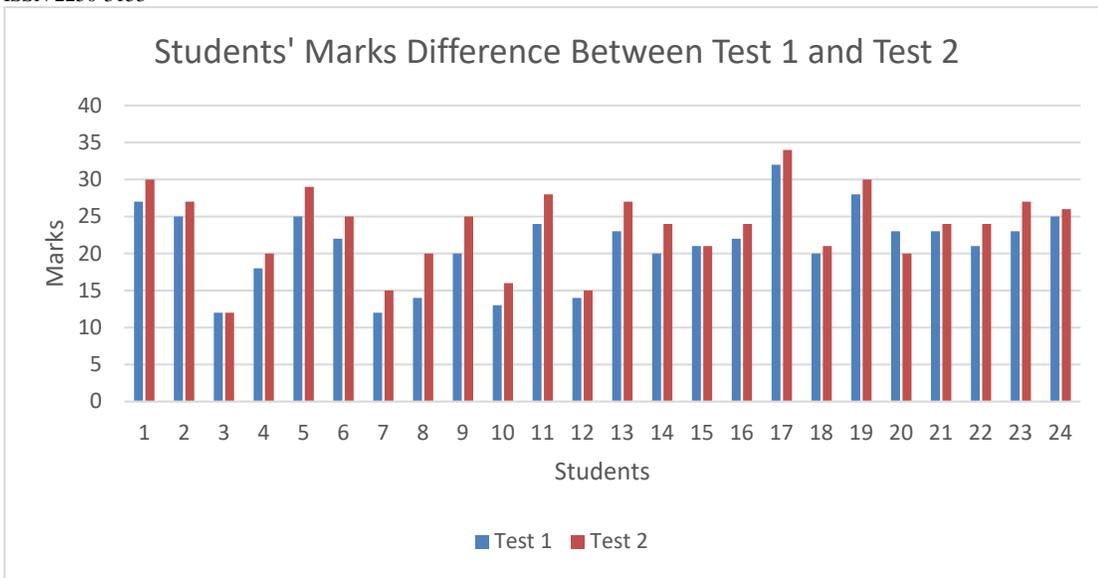


Figure 6: Mark difference obtained by students in Test 1 and Test 2

| Test | N | Min score | Max score | Mean | Median | SD |
|--------|----|-----------|-----------|------|--------|------|
| Test 1 | 24 | 12 | 28 | 21 | 23 | 5.18 |
| Test 2 | 24 | 12 | 34 | 24 | 24 | 5.42 |

Figure 7 : Descriptive statistics analysis of the scores

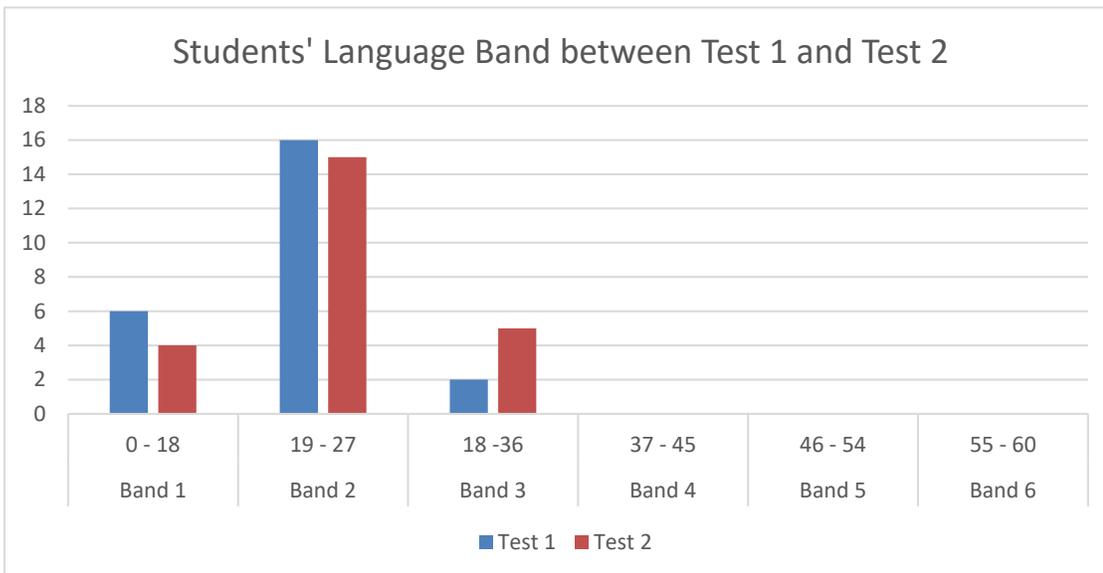


Figure 8 : Comparison of students' language band between Test 1 and Test 2.

Most of the students were happy for having group discussion conducted in MUET speaking class. By participating in the discussion, they could use social strategies in language learning to improve their performance in speaking skill as per the standard requirement of the MUET. Besides, there are many benefits that students could gain through social strategies. It is in line with the requirement of MUET that speaking component is one of the skills tested in examination. If the students do not practise speaking, they will have difficulty to get good score and language band in MUET speaking. Practice makes perfect. Therefore, by having a lot of practice, the students will be able to speak in English as well as they can give good ideas as responses to the task given in MUET speaking.

Besides that, this is an exposure for them to do well in MUET speaking. Having a group discussion will give an opportunity for them to share new knowledge and ideas with regards to the topic given in the task. This is important as the task fulfillment is one of the criteria assessed in MUET speaking. The scope of the topic is too wide. Many of the students have limited knowledge on certain issues. Therefore, through social strategies, the students might discuss a lot of topics in details and they will share the knowledge during the discussion. It will be useful for them as their preparation before the examination.

The concept of social strategies by practicing a group discussion among the learners has become a 21st century learning trend. It is indeed a way to enhance the ability of the students not only in speaking and but also in giving ideas and opinions. This approach also gives the opportunity for the students to broaden their minds by discussing the issues given in the task thoroughly. It prepares the students to be a proficient user of the language and gives a tremendous effect in students' performance and could lead them to achieve a good score and language band in MUET speaking. There is an improvement that the students show after several practice of group discussion conducted in line with the collaborative learning method.

VII. CONCLUSION

As a conclusion, social strategies in language learning through group discussion is one of the ways to enhance the students' speaking skill in MUET. It is believed that in order to improve language skill especially speaking, it takes time and hard work from the students. They should always practice speaking and never be shy to communicate with others using the language. By having several practice on group discussions, we can see the improvement of speaking skill among the students. Even though there was just a little improvement, the students should never feel disappointed. It shows that they should never stop having this programme in MUET classroom. Definitely, before they sit for the real MUET speaking test at the end of their studies in form 6, they would improve a lot and a higher score and language band will be in their hands if they continue and focus on collaborative learning.

Besides that, they should read a lot as they need knowledge and information with regards to any topic as their preparation for the task in MUET speaking. Having a wide general knowledge is an advantage to score well in the task fulfillment. In contrast, if they have limited knowledge, they will be facing difficulties to present ideas and thoughts. By social strategies, it helps the students to expose themselves with many areas of topics to discuss in groups. Group discussion is one of the ways to generate and share ideas with the others. The reflection upon the discussion would enable the students to identify their strength and weaknesses in their presentation. Finally, social strategies is proven that it could enhance students' speaking skill in MUET.

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The Management Model of Conducting Education and Training in The Technical Field of Education and Religion

(A Case Study at Manado Religious Education and Training Center)

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Abstract: The objectives of this research are: 1) Describing and analyzing the education and training plan in the technical and educational section of Manado Religious Education and Training Center; 2) Describing and analyzing the implementation of education and training in the technical and educational section of the Manado Religious Education and Training Center; 3) Describing and analyzing the evaluation of education and training in the technical and educational section of the Manado Religious Education and Training Center. A qualitative research method was employed, and the participants involved in the study were superiors, structural officials, staff, and trainers (widyaiswara) at Manado Religious Education and Training Center. Data collection techniques involved interviews, observation, and documentation. The research procedure consisted of data collection, data reduction, data display, and concluding. Research results reveal that: (1) the planning of the training programs in Manado Religious Education and Training Center consists of planning the organizational needs by identifying the training needs, the specification of tasks including task-sharing between the committee and trainers (widyaiswara), the learning needs related to academic and non-academic facilities; formulating the general objectives of the training and the specific objectives in learning; and determining the training curriculum including the supporting and operational curriculum; 2) the training conducted in the Manado Religious Education and Training Center consists of widyaiswara learning strategies employing the andragogical approach, the learning resources include the references and the use of instructional media, and the training implementation is based on a predetermined schedule; 3) the evaluation and monitoring in Manado Religious Education and Training Center involve evaluating the organizing committee concerning the services provided to the trainees in relation to the learning outcomes before and after the training, as well as to the trainers (widyaiswara) in relation to the teaching methodology during the learning process. Monitoring is conducted based on the evaluation results related to the success and obstacles during the training implementation in Manado Religious and Education Training Center.

In conclusion, it is vital to conduct proper planning by setting the objectives and curriculum, implementing the training based on the plan, and continuously evaluating and following up the training in Manado Religious Education and Training Center.

Keywords: model, education and training

Introduction

A. Background of the study

Education and training are required to improve the performance of the Ministry of Religious Affairs employees, as attached to the duties of the Civil Service Bureau following the decision of the minister of religious affairs (KMA) Number 47 of 1963 and Number 114 of 1969. However, in its subsequent developments, the education and training center (Pusdiklat) was formed in 1975 through KMA Number 18 of 1975 concerning the organizational structure of the Ministry of Religious Affairs. KMA Number 18 of 1975 also stated that if it is necessary, the Minister of Religious Affairs can create Technical Implementation Unit (UPT) within the Ministry of Religious Affairs, including establishing regional Education and Training Centers. In 2001, as the research and development division was merged with the education and training division, the Research

and Development Agency (Religious R & D) became the the Religious Research, Education and Training Agency (Badan Penelitian Agama dan Diklat Keagamaan) based on the regulation of minister of religious affairs (PMA) Number 1 of 2001. The Education and Training Center (pusdiklat and balai diklat) that was used to be under the Secretariat General of Religious Research Development Agency became part of the Religious Education and Training. Based on the PMA Number 3 of 2006 concerning the organization and working procedures of the Ministry of Religious Affairs, structural and nomenclature changes occurred. The Religious Research and Development Agency (Badan Litbang Agama) and Religious Education and Training (Diklat Keagamaan) became the Research, Development, Education and Training Agency (Badan Litbang dan Diklat) overseeing two Education and Training Centers namely the Administrative Staff Training and Education Center as well as Religious Technical Training and Education Center; 14 Regional Education and Training Centers throughout Indonesia.

One of regional Religious Training and Centers is Manado Religious Education and Training Center. Based on PMA Number 59 of 2015 concerning the Organization and Management of the Religious Education and Training Centers, article 2, the Religious Education and Training Center is in charge of organizing the education and training for the religious education administrative and technical personnel. Therefore, Manado Religious Education and Training Center conducts the Education and Training for the administrative and technical education personnel as well as the technical education and religious personnel who are responsible for developing the human resources within the Ministry of Religious Affairs of North Sulawesi Province, Gorontalo Province, Central Sulawesi Province, STAKN, Manado IAIN, Palu IAIN, and Sultan Amai Gorontalo IAIN. Manado Education and Religious Center offers various types of education and training to improve the performance of the employees.

Tenaga fungsional tersebut menjadi hal penting dalam meningkatkan kualitas pelayanan Kementerian Agama terhadap masyarakat. Program kediklatan pada Balai Diklat Keagamaan Manado, sebagaimana uraian di bawah ini:

Optimal management of education and training implementation is required in Manado Religious Training and Education Center. One of the section of the Education and Training is the education and religion that focuses on functional staff such as teachers, instructors, and marriage celebrants. The functional staff is essential in improving the quality of the service offered by the Ministry of Religious Affairs for the community. The program of Manado Religious Education and Training Center is described in Figure 1.1.

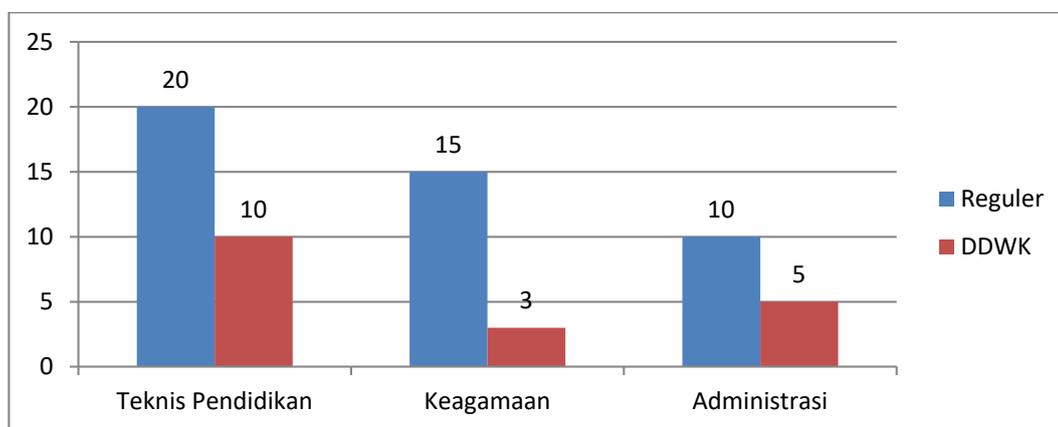


Figure 1.1 The Educational and Religious Technical Training Program Including the Regular Training and DDWK (Education and Training within Working Areas) in 2018

Based on Figure 1.1, the implementation of training in Manado Religious Education and Training Center related to the technical education conducted 20 batches of regular training and ten batches of DDWK (Education and Training within Working Areas). It also carried out training related to the technical religion, ten batches of regular training and three batches of DDWK, while the administrative training was organized for ten batches of regular training and five batches of DDWK. It indicates that many training conducted by Manado Religious Education and Training Center, thus it requires a proper training system matching the needs and the training programs organized.

The training organized by Manado Religious Education and Training Center is not based on the training needs analysis; as a result, the implementation of education and training does not meet with the needs. For example, in the case of the training conducted by the Substantive Technical Training for Sociology Teachers of Madrasah Aliyah (senior high school), the background of participants attended were religious education, namely Aqidah Akhlak, so the materials presented by trainers (widyaiswara) was not delivered as expected. There are two possibilities for the non-conformity in this training implementation: the poor planning conducted by the organizers to determine the training or the agency sending the participants had no competence in determining the intended training participants.

The evaluation results of the training implementation at Manado Education and Training Center in 2018, in particular the implementation of Education and Religious Technical training held in Solo, did not comply with the standard of the Decree of the Head of Research and Development Agency, Number 60 of 2012, concerning the Standards for Quality Assurance of Education and Training in the Ministry of Religious Affairs of the Republic of Indonesia. Manado Religious Education and Training Center was ranked 14th or the lowest ranking, below the Papua Religious Education and Training Center established only in 2017. The researcher's consideration is that Manado Religious Education and Training Center in 2018 holds the first place for budget realization among all Religious Education and Training Centers in Indonesia.

As the research problem mentioned previously, the researchers want to conduct a study concerning the management model of the implementation of education and training in Manado Religious Education and Training Center. Such research is vital to improve the quality of the implementation of education and training in Manado Religious Education and Training Center by offering a management model for the organization of education and training that will be reviewed from the planning, the implementation, the evaluation results of education and training.

B. The Objectives of the Study

Based on the formulation of the research problem, this study aims to:

1. Describe and analyze the planning of the education and training in the technical education and religious section in Manado Religious Education and Training Center
2. Describe and analyze the implementation of the education and training in the technical education and religious section in Manado Religious Education and Training Center
3. Describe and analyze the evaluation of the education and training in the technical education and religious section in Manado Religious Education and Training Center

LITERATURE REVIEW

A. The Management Concept of Human Resources

1. The Definition of Human Resources Management

The substance of the national development is thoroughly developing Indonesian and Indonesian society based on Pancasila and the 1945 Constitution of the Republic of Indonesia, towards the national ideals: protecting all Indonesian and Indonesian land; advancing the public welfare; educating the nation; and participate in promoting the world order based on the freedom, eternal peace and social justice. "Human Resource Management (HRM) is part of organizational management focusing on the human resources elements; the task of HRM is to manage the human elements well so that employees are satisfied with their work" (Husein Umar, 2002: 3).

To better understand the HRM, the following definition formulated by experts are presented:

"Simamora (2004: 4) defined HRM as the utilization, development, assessment, rewarding, and management of individual members of an organization or a group of employees". Furthermore, Hasibuan (2001: 10) suggested that "HRM is science and art or consisting of a variety of systematic activities that proceed to regulate the relationship and the roles of employees to be effective and efficient in helping to realize the objectives of companies, employees, and society."

Based on various definition presented above, it can be said that HRM starts from the recruitment, utilization, development, assessment, rewarding, and managing of the individual members in both private and government institution.

B. The Concepts of Education and Training

Education and training is a process of developing human resources to achieve the objectives of an organization or government agency. Soekidjo Notoadmodjo (2003: 27) argued that formal education in an organization is a process of developing the capabilities in the direction desired by the organization. On the other hand, training is part of an educational process aiming to improve the capabilities and specialized skills of an individual or group of people.

The education and training for employees is an integral part of comprehensively developing human resources. Martoyo Susilo (1999: 341) argued that education is a process of enriching knowledge conducted by an organization for its employees. While training is an educational process focusing on the values of the skills and expertise of employees based on their position or occupation. Education and training are considered as a long-term investment for each organization; therefore, each developing organization should conduct or facilitate the process of education and training for its employees by paying great attention to the process. Thus, as the abilities or skills of the employees improve, their performance will inevitably increase.

According to the Law Number 20 of 2003 concerning the National Education System (USPN), article 26 paragraph 4, training institutions are non-formal education, in addition to other education units such as course, study group, playgroup, childcare, community learning center and other similar educational units including counseling, internship, tutoring, scouting, traditional Islamic boarding schools (salafiyah), pedepokan, and studios.

C. The Concepts of Education and Training Management

Management is a process of organizing various events to realize the objectives and as the abilities or skills of individual holding managerial positions to achieve the goals through the activities of others (Andri Feriyanto, Endang Shyta Triana, 2105: 4). Management is the art and science of planning, organizing, arranging, directing, and supervising the resources to achieve the predetermined objectives (Erna Novitasari, 2017: 12).

Schermenrhon in Andri Feriyanto, Endang Shyta Triana, (2105: 5), argued that a manager should conduct the following management process, including 1) Planning that involves formulating the organization's mission and objectives and the best strategies to achieve them. A training institution must have missions and objectives of the training prepared based on the analysis that can be achieved effectively and efficiently; 2) Organizing, a process of dividing tasks, allocating resources, as well as regulating and coordinating the activities for the members of the organization to execute the plan. In training, there is a transparent allocation of tasks, starting from the head of the committee, academics section, administration section, committee members and trainers (widyaaiswara); 3) Leading, encouraging the members of the organization to contribute to the objectives of the group and organization. The leader (the chairman), the person in charge of the training institution, should understand of the policies concerning the implementation of education and training; 4) Controlling, the measurement and correction of the works of individuals or organizations.

D. The Education and Training Model Model

The education and training model can be developed based on each training program in the education and training institution, such as the model developed by Nadler (1982: 12), known as the Critical Events model (CEM), is usually referred to an open model with more detailed and specific steps. Nadler's (1982) model cannot identify or determine all variables when designing the training program, but each step will be evaluated as feedback.

The model developed by Nadler involved: 1) determining the needs of organization, 2) determining the specification of task implementation, 3) determining the learning needs, 4) formulating the objectives, 5) designing the curriculum, 6) selecting the learning strategies, 7) obtaining the learning resources, 8) conducting the training. Whereas Goad (1982: 11) also created a training model involving several stages or the training cycle, consisting of 1) analyzing to determine training requirements, 2) designing the training approach, 3) developing the training materials, 4) conducting the training, and 5) evaluating and updating the training.

When the targets of the training cycle are adults, Goad (1982: 41) argued that the following aspects should be considered: 1) adults learn by doing, meaning that adults always want to be involved, 2) the problems and examples should be realistic and relevant to the learning community, 3) the best learning environment is informal, 4) diversity encourages and tends to uncover the five senses of the training participants, 5) changes in speed and technique should be conducted over time.

Djuju Sudjana (2007: 14) also develop a training model called the participatory training model, comprising: 1) recruiting the trainees, 2) identifying the needs, sources and possible obstacles, 3) determining and formulating training objectives, 4) designing initial and final evaluation tools, 5) arranging the training sequence activities, determining the learning materials, and selecting the training methods and techniques, 6) conducting the training for trainers, 7) evaluating of trainees, 8) conducting the training process, 9) conducting final evaluation of the activities and 10) evaluating the training program.

RESEARCH METHOD

A. Research Method

Qualitative research is mainly observing people in their environment, interacting with them, trying to understand their language and interpretation of the surrounding world (Moleong, 2008: 47). In this study, the management of education and training was observed in the education and training of technical training section in Manado Religious Education and Training Center.

B. The Source of Research Data

This study employed a purposive sampling technique. According to Now Uma (2006: 106), purposive sampling is a technique of data collection by specific considerations. One of which is that the participants are considered to be able to provide the data required in this research, the data related to the management of the education and training implementation in the technical education and religious section in Manado Religious Education and Training Center. The participants involved in this study were: the head of Manado religious education and training center, the head of education and religious technical training section, the head of Education and Training Section for administrative staff, trainers (Widyaiswara) and general staff.

C. Data Analysis

Data analysis consisted of data reduction, data display, and conclusion drawing/verification (Sugiyono, 2008: 142). The data analysis stages were as follows: 1) Data Collection, gathering all data based on the interviews with the participants, both data related to the service and the research on the management of education and training implementation in the technical education and religious section in Manado Education and Training Center. The data collection was conducted by planning, implementing, evaluating, especially for the technical personnel of education and religion; 2) Data reduction, the data gathered was classified, the data that can provide information concerning the management of the implementation of education and training for technical personnel in Manado Religious Education and Training Center was selected. Only data directly related to this research were selected. The researcher then examined the obstacles experienced in the implementation of education and training in for the technical education and religious staff in Manado Education and Training Center for doing systematic data analysis supported by accurate data; 3) Data Display, the reduced data were summarized in tables, diagrams, and flowcharts to describe what was being studied. The results of the interviews were also presented in tables related to coordination implementation. In addition, a recapitulation of the responses provided by the participants was also be created to make it easier to conclude the research results; 4) Conclusion, when adequate data was obtained, the conclusions were drawn related to the management of the implementation of education and training in the technical and religious section Manado Education and Training Center.

RESULTS AND DISCUSSION

A. Results

1. The planning of training in Manada Religious Education and Training Centre

a. The needs of the Organization

Based on the results of interviews concerning the needs of the organization, in this case, Manado Religious Education and Training Center and the stakeholders.

The interview with the head of the Manado Religious Education and Training Center, as follows:

“The programs designed by Manado Education and Training Center are generally based on the needs of the stakeholders, I always coordinate and communicate with stakeholders in our field. This is intended to discover what the stakeholders need to improve the competences of their employees.”

Furthermore, based on the observation results related to the needs of Manado Religious Education and Training Center, it is found that: 1) the training programs are prepared and tailored to the needs of stakeholders. The Education and Training Center organizes a coordination meeting in Manado Education and Training Center Working Area; 2) During the coordination meeting, the committee distributes a list related to the training program needed by each district or city in the

working area of Manado Religious Training Center; 3) the participants in the coordination meeting also convey various constraints they have experienced including finding the solutions for them; 4) Manado Religious Education and Training Center also prepares the needs related to the implementation of the education and training program, such as banners, stationery, and other related administration.

The observations related to the organization needs of Manado Religious Education and Training Center reveals four issues related to the implementation of a coordination meeting with stakeholders and the need analysis for the education and training implementation.

a. Task Implementation Specifications

The interview with the head of the administration section of education and training in Manado Religious Education and Training Center is as follows:

“As the chairman of the committee, I always supervise the task implementation of each committee, such as the academic section, I always ask about the progress of learning in the classroom, I also check whether the administration of training is adequate or not. As for the trainers (widyaiswara), we always communicate in term of the materials for the training. “

The observation results related to the specifications of education and training implementation in Manado Religious Education and Training Center reveals that: 1) Each committee has already been aware of their respective duties; 2) the head of the committee supervises the implementation of the training program; 3) the academic section monitors the process of learning implemented in the classroom; 4) the administrative section does various administrative tasks, such as the education and training schedule, attendance list, list of stationery recipients, and other administration related to the implementation of the education and training; 5) the trainers (widyaiswara) conduct their tasks in the classroom. Based on observation results related to the task implementation specification in Manado Religious Education and Training Center, it indicates that the observation focuses on the committee and trainers (widyaiswara) in Manado Religious Education and Training Center.

b. The Learning Needs

The results of interviews concerning the learning needs with the trainer (widyaiswara) coordinator in Manado Religious Education and Training Center are as follows.

“The learning needs focus on the participants and trainers (widyaiswara). The participants require the learning equipment, schedule, and materials related to the training, while the trainers (widyaiswara) needs the curriculum and syllabus to design the materials according to the indicators in the curriculum and syllabus. The trainers (widyaiswara) are also provided with various learning facilities, such as laptops, LCDs, whiteboards, and newspapers. With these facilities, it is expected that the learning to be effective and efficient.

The observations related to the learning needs in Manado Religious Education and Training Center indicate that: 1) the organizing committee provides the office stationery and other equipment related to the learning; 2) the organizing committee provides newspapers and paper during the learning; 3) the trainers (widyaiswara) prepare materials based on the curriculum and syllabus of the education and training of the religious and administrative technical training; 4) the trainers (widyaiswara) use the internet to download materials and visit the library to search for books and modules related to the training. The observations related to learning needs focus on the needs of the trainers (widyaiswara) in providing education and training materials and the organizers in the Manado Religious Education and Training Center.

c. Formulating the objectives

The results of the interviews related to formulating the objectives of the education and training programs in Manado Religious Education and Training Center with the head of administration are as follows:

“In implementing the education and training in Manado Religious Education and Training Center, the objectives and target must be set before the program. For example, the objective of the education and training for Teaching and Learning Methodology Teachers is creating professional teachers who can employ various teaching methodologies for effective and efficient learning, while the target is 30 teachers mastering effective and efficient learning methodologies. A similar case occurs for other education and training programs; this indicates that there are various targets to be achieved by Manado Religious Education and Training Center in developing the competencies of the employees within the Indonesian Ministry of Religious Affairs.

Based on the observations concerning formulating the objectives in implementing the education and training in Manado Religious Education and Training Center, it indicates that: 1) the objectives of the education and training program have been formulated, as seen in the guidebook and also presented by the committee during the overview; 2) the trainers (widyaiswara) develop the learning objectives consisting of general and specific learning objectives that are usually presented during the learning in the classroom. The observation related to formulating the objectives reveals two objectives, namely: the objectives of the education and training program implementation and the learning objectives that are usually designed by the trainers in Manado Religious Education and Training Center.

d. Determining the Curriculum

The interview results related to the education and training curriculum with the Coordinator of trainers (widyaiswara) in Manado Religious Education and Training Center are as follows:

“The implementation of the education and training programs in Manado Religious Education and Training Center must be based on the curriculum and syllabus established by the Technical Education and Religious Training Center and the Administrative Personnel Education and Training Center at the Ministry of Religious Affairs in the Republic of Indonesia. However, there are some training programs without curriculum and syllabus, so we are trying to develop the curriculum and syllabus so that the training can be conducted properly”.

The observation results related to determining the curriculum in Manado Religious and Education Training Center reveals that: 1) The curriculum and syllabus are provided by the Administrative personnel of Education and Training center concerning Research and Development as well as by the Education and Training Agency of the Ministry of Religious Affairs of the Republic of Indonesia; 2) the organizing committee arrange the schedule of the education training and programs based on the curriculum and syllabus; 4) the trainers (widyaiswara) design the teaching and presentation materials based on the curriculum and syllabus.

The observation results indicate that the curriculum and syllabus in Manado Religious and Education Training are available in Education and Training center of Technical Education and Religion and Education and Training Centre of Administration Personnel of Ministry of Religious Affairs of the Republic of Indonesia.

2. The Implementation of Training in Manado Religious Education and Training Center

a. Learning Strategy

The interview results related to the learning strategy in Manado Religious Education and Training Center with the technical trainer (widyaiswara) are as follows:

“The learning strategy used by the trainers (widyaiswara) in teaching should encourage the participants to be happy and enjoy the learning, so various games are provided so that the participants will enjoy the learning process. The teaching strategies of the trainer (widyaiswara) focus on the ability to involve all participants in the learning so that learning is not monotonous; instead, it is effective and efficient”.

The observations results related to the learning strategy in Manado Religious and Education Training Center indicates that: 1) the trainers (widyaiswara) prepare the learning steps for each session of learning; 2) the trainers (widyaiswara) choose the learning models to be adapted to the learning materials; 3) the trainers (widyaiswara) create games to create a more effective and efficient learning. The observations results related to the learning strategy focuses on the trainers (widyaiswara) starting from the preparation before the learning, selecting the learning models, and preparing the games to be presented during the learning.

b. Learning resources

The following are the interview results related to the learning resources in Manado Religious Education and Training Center with the head of the Education and Religious Technical Education and Training Section.

“The learning resources in Manado Religious Education and Training Center can be the library, internet, and the trainers (widyaiswara) who present the education and training materials. The learning resources can also be the modules. However, many modules are not up-to-date, so they require revising to adapt to the course of education and training. However, the trainers (widyaiswara) are usually able to design the learning material in line with the development of the training course and basic theories are cited from these modules”.

The observations results concerning learning resources at the Manado Religious Education and Training Center reveal that: 1) the learning resources in the Manado Religious Education and Training Center include journals, modules, and books following the education and training courses; 2) these journals are usually accessed obtained the internet; 3) the trainers (widyaiswara) and the training participants visit the library in Manado Education and Training Center for the books.

Based on the results of these observations, the focus is on learning resources, including books, journals, and modules available the library or accessed on the internet in Manado Religious Education and Training Center.

c. The implementation of Education and Training

The interview results related to the implementation of education and training in Manado Religious and Education Training Center with the Head of the Manado Religious Education and Training Center are presented as follows:

“The implementation of education and training in Manado Religious Education and Training Center is based on the preparation have been already conducted such as following the training schedule from the opening ceremony to the closing of the program. The trainers (widyaiswara) must also teach based on the schedule prepared by the committee”.

“During the implementation of education and training in Manado Religious Training Center, each committee and the trainers (widyaiswara) have been aware of what to do. So it is well coordinated between the committee and the trainers (widyaiswara). Should there is a schedule change, coordination, and communication between the committee and the trainers (widyaiswara) are critical. “

The observation results concerning the implementation of education and training in Manado Religious Education and Training Center indicates that: 1) the education and training is conducted based on the predetermined schedule; 2) In general, the trainers (widyaiswara) teach according to the agenda; 3) the implementation of the education and training program begins with an overview and ended with the evaluation and the closing of the program; 4) the trainers (widyaiswara) apply the adult learning model (andragogy) and use games in learning. The results of observations related to the education and training implementation in Manado Religious Education and Training Center generally follows the schedule arranged in advance.

3. The Evaluation and Monitoring of the Training in Manado Religious Education and Training Center

The following are results of interviews with the head of Manado Religious Education and Training Center.

“We always evaluate the implementation of training in Manado Religious Education and Training Center and even involve external parties to improve the implementation of the training. Many issues are discussed in the evaluation; in general, we evaluate the organizing committee, the trainers (widyaiswara) and the training participants. We also try to examine the obstacles experienced in training”.

The interview with the coordinator of the trainers (widyaiswara) in Manado Religious Education and Training Center is presented below.

“I think the evaluation conducted by the Manado Religious Education and Training Center is excellent, at the closing of the program, the head of the center holds an evaluation, the evaluation also involves external parties once the event is completed. So, the evaluation is excellent. Similarly, following-up of the evaluation results, the center always strive to overcome the obstacles faced during the training.

Furthermore, the results of the observations concerning evaluation and monitoring of the implementation of education and training in Manado Religious Training Center shows that: 1) the evaluation of the education and training in Manado Religious Training Center involves external parties related to the training; 2) the evaluation also includes the committee involved in the training; 3) The evaluation also includes the trainer (widyaiswara) involved in the training; 4) the leader always notes the evaluation results related to the implementation of training in Manado Religious Training Center; 5) the head of the center and the participants of the evaluation meeting jointly discuss the obstacles and the solutions to follow up on the challenges in the implementation of the training. The observation results related to the evaluation and monitoring of the training implementation Manado Religious Education and Training Center consists of the evaluation and monitoring on the task implementation of the organizing committee, the trainers (widyaiswara), and the training participants.

Generally, interviews and observations have been conducted on the management of the implementation of education and training in Manado Religious Education and Training Center, starting from the needs analysis to the implementation of the education and training in Manado Religious Education and Training Center.

B. Discussion

1. The Planning of the training in Manado Religious Education and Training Center

a. The needs of the organization

External analysis of the organization needs is related to the education and training programs required by the stakeholders, namely in the Regional Office of the Ministry of Religious Affairs of North Sulawesi, Gorontalo, and Central Sulawesi, District or City Offices of the Ministry of Religious Affairs in North Sulawesi, Gorontalo and Central Sulawesi Provinces, IAIN of Sultan Amai Gorontalo, IAIN Manado, and IAIN Palu, and STAKN Manado.

Every year, Manado Religious Education and Training Center organizes a coordination meeting within the working area of Manado Religious Education and Training Center as part of the education and training needs analysis or AKD. Among the participants attending the event is the head of the Research, Development, Education, and Training of the Ministry of Religious Affairs of the Republic of Indonesia, the head of technical Education and Religious Training Center and head of the Administrative Personnel of the Education and Training Center. The speakers of the meeting are the head of the Ministry of Religious Affairs of North Sulawesi, Gorontalo and Central Sulawesi. Various issues are discussed, but the main focus is the challenges in the implementation of education and training, and the training needed by stakeholders to ensure that the employees within its working need the programs conducted by the Manado Religious Education and Training Center a.

The organization needs are one of the main elements of the tasks and functions of the organization, including the training institution. One of the demands is developing the competencies of the employees. Thus the following should be a significant concern: 1) the competencies specification; 2) the competencies management of; 3) the comprehensiveness of the program. Qualified human resources are needed to create an excellent training, including the executive committee, trainers (widyaiswara). It should also be supported by facilities for the training activities in Manado Religious Education and Training Center (Nana Syaodih Sukmadinata and Erliana Syaodih, 2012: 23). From the description above, it is indicated that one of the organization needs in organizing excellent training is developing the competencies of the committee, trainers (widyaiswara), and training participants in the Manado Religious Education and Training Center.

b. Task Implementation Specification

The task implementation specification or known as the job descriptions of each committee and the trainers (widyaiswara) in Manado Religious Education and Training Center has been understood by each committee, and the trainers (widyaiswara) as the center always evaluate their task implementation when the education and training is completed.

This means that each employee should understand the job description. According to Manullang (2001: 46), generally, the information in the job description includes two items, namely: 1) the nature of the job, in Manado Religious Education and Training Center, the job description of each employee has already been established, such as the duties of the Chairman of the Committee, the academic section, the administrative section, and the committee members for the implementation of the training; 2) the type of job suitable for the position, Manado Religious Education and Training Center always put a great concern to the competencies of the training committee. The chairman of the committee are

usually allocated by the echelon IV official, those who are in the academic section have typically participated in TOT and MOT, while the computer-literate employees generally fill the administration section. The description above indicates that the job description of each employee in Manado Religious Education and Training Center is appropriate as it has been adjusted based on the competencies of the staff.

c. The Learning Needs

Learning is a process of interaction between students, educators, and learning resources in a learning environment. Learning is an assistance provided by educators to enable the process of acquiring knowledge, mastery of proficiency and character, as well as the formation of attitudes and beliefs in students. In other words, learning is a process to help students to learn well. The learning process is experienced by the human being in a lifetime and can be applied anywhere and anytime. Learning and teaching have a close meaning, although it has different connotations. Learning is empowering the students' potency to be competencies. This empowerment activity will not succeed without assistance from others. Learning is a teacher's programmed activity in instructional design, to create active learning emphasizing the provision of learning resources (Syaiful Sagala, 2011: 62).

A preparatory meeting is held before the education and training program to improve the quality of training in Manado Religious Education and Training Center. One of the issues discussed in the meeting is the needs in the learning process both for trainers (*widyaiswara*) and the participants in education and training. These needs are tailored to the training program. Generally, the training program in Manado Religious Education and Training Center consists of Technical Education and Religious Training as well as Education and Training for Administrative Staff.

Setting the objectives is part of the strategic plan in an organization, including a training institution. The strategic plan is described as follows: 1) Determining the mission and objectives of the organization. Manado Religious Education and Training Center has several missions, namely: improving the quality of education and religious technical training as well as administrative training, improving the quality of human resources, improving the quality of infrastructure, improving the quality of information and technology, building networks or partnership, and improving the quality of governance administrative. Whereas the objectives of Manado Religious Education and Training Center is to provide excellent training in term of the participants, human resources, information technology, networking, and administrative arrangements; 2) Developing the profile of organization; the profile of Manado Religious Education and Training Center is not only available in booklet, but also a short video; 3) Analyzing the external environment; Manado Religious Education and Training Center always coordinates and communicates with its working area in designing training programs required by the stakeholders; 4) Conducting internal analysis; this analysis is undertaken to examine the weaknesses and strengths of the organization. Manado Religious Education and Training Center always conducts the internal analysis, both the organizing committee and the trainers (*widyaiswara*) discuss the weaknesses and strengths of the human resources within the organization; 5) Identifying the opportunities and threats; these various opportunities and threats are due to many factors. Manado Religious Education and Training Center always perceives the opportunities as rules that support the implementation of education and training, and always minimize the threats such as inefficient and effective training; 6) devising strategic decision making; every mission in Manado Religious Education and Training Center is expressed as the target and activities. For example, improving the the human resources, the target is the realization of quality human resources, thus the activities are related to learning assistance provided for the human resources in Manado Religious Education and Training Center; 7) Implementing the strategies; this is related to the management activities to conduct the strategies, implementation also means transforming strategies into activities. Activities undertaken by Manado Religious Education and Training Center cannot be separated from the pre-determined mission, so that the vision, mission, activities, and objectives are in line; 8) Reviewing and evaluating; These activities are conducted periodically by the manager, or at critical stages to assess how the organization works in achieving its objectives (Erna Novitasari, 2017: 57). The above description shows that the objectives of the organization have been determined by Manado Religious Education and Training Center, as reflected in its vision, mission, objectives, targets, and activities.

d. Determining the Curriculum

The curriculum is the benchmark of Manado Religious Education and Training Center in designing the education and training. The following are some definition of curriculum in Indonesia.

- 1) Curriculum, according to Law No. 20 of 2003 article 1 paragraph 19, is a set of plans and arrangements concerning the objectives, contents, and materials of the learning as well as the methods used to guide the implementation of the learning activities to achieve the learning objectives.
- 2) The curriculum is a guideline to guarantee the quality and competencies to fit the study program taken (Ministry of National Education No. 045 / U / 2002). This definition defines the curriculum as a guideline the education implementation.
- 3) The curriculum is a set of plans and arrangements concerning the contents and materials of the learning as well as the methods used to guide the implementation of teaching and learning activities (Minister of Education Decree No. 232 of 2000), this definition defines the curriculum as a) plans and arrangements; the contents and learning material, and c) the method used.
- 4) The curriculum is a set of plans and arrangements based on the educational standard regarding the abilities and attitudes, materials and learning experiences, and assessments based on the potential and circumstances of the students (Guidelines for the socialization of KBK, Directorate of PAK, 2004). Based on the description above, it can be concluded that the curriculum is a benchmark that should be used as a basis for designing learning. Similarly, in

Manado Religious Education and Training Center, the education and training are conducted based on the curriculum and syllabus established by Technical Education and Religious Training Center and the Administrative Personnel Education and Training Center of the Ministry of Religious Affairs.

2. The Implementation of Training in the Religious Education and Training Center in Manado

a. Learning Strategies

The success or failure to achieve educational objectives relies on the learning process of students. The learning process conducted by a person depends on his/her views on the learning activities. Some think that learning is an activity to memorize facts so that they are satisfied when they can remember some facts. Some others see the learning is an exercise activity so that they train themselves with various aspects of behavior to make progress even though they do not know the meaning, nature, and purpose of the skills. Learning is a process of change, a behavioral change as a result of the interaction with the environment to fulfill their needs (Suwardi and Daryanto, 2017: 78).

The characteristics of behavioral changes in learning (Slameto in Suwardi and Daryanto, 2017: 78) are: 1) the change occurs consciously, meaning that the learner will be aware of the change or at least feel the difference; 2) the change is continuous and functional, indicating that the changes in a person as a result of learning occur continuously and are not static. One change will lead to the next change which will be useful for life or the future learning process; 3) change is positive and active, meaning that the changes in learning behavior continuously increase and aim for something better; 4) change is not temporary, meaning that changes that occur because of learning are permanent. For example, a child ability to play the piano will not just disappear, but it will continue to develop with more practice; 5) changes in learning are directed, meaning that behavioral changes occur because there are objectives to achieve. Learning changes are directed at conscious behavioral changes; 6) the changes cover all aspects of behavior; meaning the changes occur in a person after the learning process include the changes in the overall behavior. This indicates that the learning strategy is expected to change to the training participants. This is reflected in the learning targets in the curriculum and syllabus in Manado Religious Education and Training Center.

b. Learning Resources

The definition of learning resources is comprehensive. According to Ahmad Rohani and Abu Ahmadi (1995: 152), learning resources are teachers and learning materials such as textbooks or similar resources. Another definition of learning resources is all effort that can, directly and indirectly, benefit the learning process, other than the students who equip themselves when learning in progress.

Learning resources are all that can support the learning process and provides positive changes. This is in line with Arif Sadirman (in Ahmad Rohani & Abu Ahmadi, 1995: 152-153) who argued that learning resources are all types of external resources that allow the learning process to occur. The roles of learning resources (such as: teachers, lecturers, books, films, magazines, laboratories, events, etc.) allows individuals to shift from not knowing to knowing, from not understanding to understanding, from being unskilled to skilled, and help individuals to be able to distinguish between the good and the bad. Thus, anything that can benefit or support and support individuals to change in a more positive, dynamic, or developed can be called learning resources.

c. The Implementation of Education and Training

Education and training is a process to improve both technical and managerial skills. Theory-oriented education, conducted in the classroom, takes longer time and usually answers why. Exercise is oriented toward practice (Hasibuan, 2007: 70). Education is related to the increase of knowledge and understanding of our environment as a whole, while training is an effort to increase the knowledge and expertise of an employee to work on a particular task (Flippo in Hasibuan (2007: 69).

The training begins with the opening, usually officially conducted by the head of Manado Religious Education and Training Center, or the head of the Regional Office of the Ministry of Religious Affairs in North Sulawesi, Gorontalo and Central Sulawesi Provinces, or other officials related to the implementation of the education and training. For example, during the education and training for Islamic senior high school English Teacher, Manado Religious Education and Training Center involves competent parties in the field and collaborates with the trainers (*widyaiswara*) in Manado Religious Training Center.

Furthermore, *widyaiswara* teaching applies lecture and brainstorming methods. The trainers (*widyaiswara*) in Manado Education and Training Center explain both general and specific learning objectives as well as the materials that will be delivered during the education and training activities. Some *widyaiswara* employ brainstorming techniques to increase the participants' enthusiasm for education and training.

Moh. Abdul Mukhyi and Hadir Hadiyanto (1992: 45) suggested several objectives of education and training, namely: 1) Working more efficiently, the participants of the training is expected to be able to work more efficiently in the future as their knowledge will increase after joining the training course, and they can easily do their tasks; 2) Less supervision, the errors in conducting the tasks can be minimized after participating in training thus the level of supervision will be less; 3) Developing rapidly, the development of employees can be left naturally based on their abilities. However, the training will accelerate the employees' development; 4) the stability of employees and decrease in turn over.

3. Evaluation and Monitoring of the Implementation of Training in Manado Religious Education and Training Center

Evaluation and monitoring of the implementation of in Manado Religious Education and Training Center training are conducted regularly. It is held at the end of each training session and after the training completed for the organizing committee, widyaiswara, and training participants. Many parties are involved in the evaluation, including the qualified external parties, for example, the education sector, Manado Religious Education and Training Center invited the Islamic Education Section of the Regional Office of the Ministry of Religious North Sulawesi Province, University of Manado or Sam Ratulangi University, Manado. Generally, the evaluation discusses the challenges experienced in the implementation of the training and the solutions for the following training (follow-up).

The following are the tips for effective time management: 1) When starting a session, set the class rules or learning contracts: a) There are many topics to cover. The instructors are entitled to complete the discussion and proceed to the next session. The instructors and participants should minimize personal experience stories. b) Everyone has the opportunity to speak, but no one should dominate. c) Note the issues that need to be discussed and are not the main focus of the ongoing session. d) Ask the participants to stay focused. e) Ask the participants to help. "Guys, we have 10 minutes left to discuss this topic. We need to refocus. How can we finish this discussion?" f) More practice so that you can use the tool easily and comfortably. g) Try to finish the activity earlier when possible; h) Involve non-participant volunteers to help organize the activities on time. 2) When making preparations, practice the ways of providing direction or activity instructions. Directions or instructions should be easy, clear, complete, and systematic. 3) The use of tools in training; all equipment required must be prepared, connected, and checked before the training begins. Many time is wasted due to lack of equipment preparation. Make sure you know who is there and can help if there are problems. Prepare a back-up strategy if something does not work as the plan (Pranoto, 2003, 112).

From the previous description, it can be interpreted that generally, Manado Religious Education and Training Center always evaluates and monitors the implementation of the training. The evaluation and monitoring includes: the time management as illustrated in the training schedule, the use of tools as shown in the media and learning resources, knowledge or mastery of the materials focusing on the widyaiswara competencies that must be in line with specialization, and the teaching teams who always collaborate in the process teaching and learning in Manado Religious Training Center.

Based on the above discussion related to the development of education and training theory, the brief model of Nadler is presented in Figure 4.11.

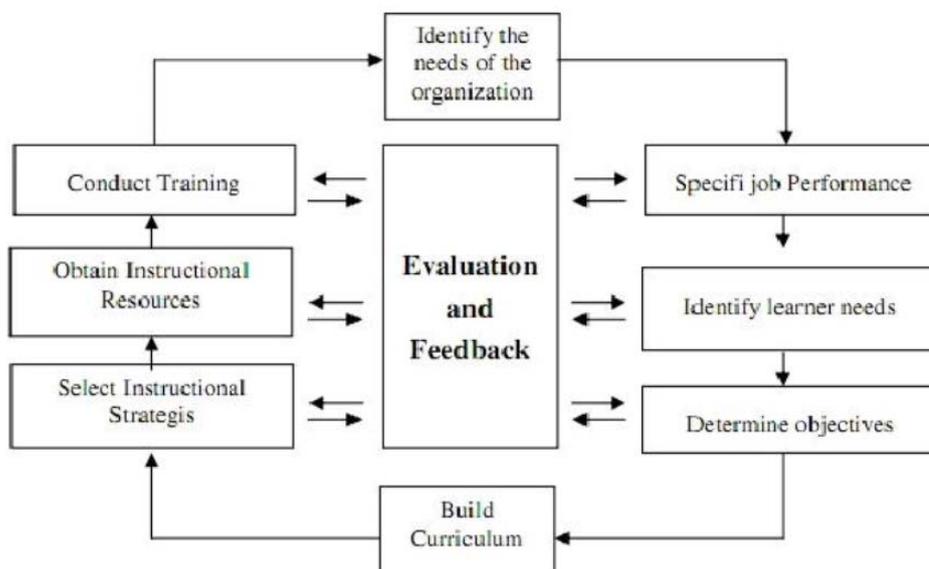


Figure 4.11 The Implementation of Nadler Model of Education and Training

Furthermore, the findings of the implementation of Education and Training in Manado Religious Education and Training Center are illustrated in Figure 4.12.

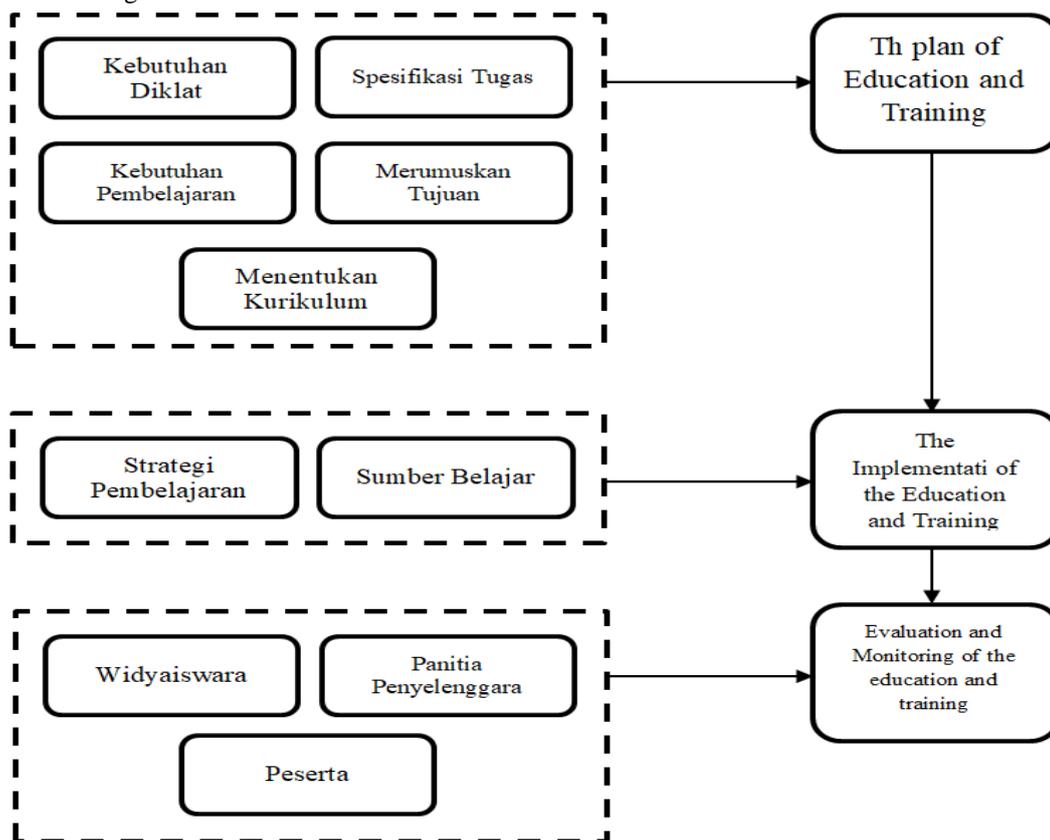


Figure 4.12 The Model of Education and Training in Manado Religious Education and Training Center.

The comparison between the Nadler model of education and training model and the model of Manado Religious Education and Training Center is presented in Table 4.1.

Tabel 4.1 The comparison between the Nadler model of education and training and the model of Manado Religious Education and Training Center

| No | Element | Nadler Training Model | The model of Manado Religious Education and Training Center | Analysis |
|----|---------------------------|--|--|--|
| 1 | Planning | The needs of organization, task implementation specification, learning needs, formulating the objectives, determining the curriculum | The needs of organization, task implementation specification, learning needs, formulating the objectives, determining the curriculum | Generally similar for the planning |
| 2 | Implementation | Learning strategies, learning resources, implementation of the education and training | Learning strategies, learning resources, implementation of the education and training | Generally similar for the implementation of Education and Training |
| 3 | Evaluation and Monitoring | None | The evaluation is conducted for the organizing committee, participants and <i>widyaiswara</i> | There is a difference. Nadler model does not elaborate on evaluation and monitoring while this study has a development model, namely the evaluation and monitoring |

Based on Table 4.1, it can be concluded that there are similarities in the aspects of planning and implementing the education and training, but there is a difference in the evaluation and monitoring aspect. In Manado Religious Education and Training Center, evaluation and monitoring are always conducted after the implementation of education and training. Various

aspects are evaluated but the evaluation focuses on the committee services and the teaching methodology in the *widyaiswara* learning process. The results of the evaluation are then followed-up to provide solution for the problems.

CONCLUSION, IMPLICATION, RECOMMENDATION

A. Conclusion

Based on the research results and discussion, it can be concluded that:

1. Manado Religious Education and Training Center conducts the planning, namely: identifying of training implementation needs, task implementation specification (allocating the task for the committee and *widyaiswara*), the learning needs related to academic and non-academic facilities, formulating the objectives comprising the objectives of the training as well as the general and specific objectives of learning, determining the training curriculum starting from the supported and main training course.
2. Manado Religious Education and Training Center conducts the education and training, namely: *widyaiswara* learning strategy employing an andragogical approach, learning resources such as references and the use of instructional media, and implementing the training based on a predetermined training schedule.
3. Manado Religious Education and Training Center conducts the evaluation and monitoring involving the evaluation of the organizing committee regarding services provided to participants, participants related to learning outcomes before and after training, and *widyaiswara* related to teaching methodology during the teaching and learning. Monitoring is undertaken based on the evaluation results concerning the success and challenges in the implementation of training in Manado Religious Education and Training Center.

B. Implication

1. Manado Religious Education and Training Center always plans as the preparations before the training; this implies the availability of the administrative, academic, and non-academic needs.
2. Manado Religious Education and Training Center always conducts training as planned in the schedule; this implies the successful implementation of effective and efficient training.
3. Manado Religious Education and Training Center always conducts evaluations and monitoring related to the implementation of training; this implies increasing the quality of the training in Manado Religious Education and Training Center.

C. Recommendation

1. The planning of training in Manado Religious Education and Training Center needs to be in line with the activities conducted by the working area of Manado Religious Education and Training Center
2. During the implementation of training in Manado Religious Education and Training Center, there should be coordination and communication between the organizing committee, *widyaiswara*, and the head of the Manado Religious Education and Training Center.
3. In the evaluation and monitoring in Manado Religious Education and Training Center, it is necessary to create a list of obstacles of the training implementation, as well as what has or has not been done to improve the training implementation in Manado Religious Education and Training Center.

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Environmental Disclosure Practices and Stock Market Return Volatility in The Nigerian Stock Market

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Abstract

Volatility of stock market return is of great concern to providers of funds as it increases the uncertainty of their future wealth. Many studies have address of environmental disclosure and the Nigerian stock market but few considered the effect of environmental disclosure on the volatility in the stock market. This study investigated the combined effects of environmental pollution and control policy (EPC), energy policy (ENP), impact of biodiversity (IB), waste management cost (WMC), environmental research and development cost (ERD), cost of compliance to environmental laws (CCEL), firm size (FSZ), and firm age (FA) on stock market return volatility. The study adopted ex post facto research design. The target population for the study comprised 48 companies quoted on the Nigerian Stock Exchange, under the consumer goods and industrial goods sectors, as at December 31, 2016. A sample size of 17 companies was determined using Cochran's formula. Stratified proportionate sampling was adopted to select the number of companies studied from each stratum and samples from each stratum were purposively selected based on companies with higher total asset as at December 31, 2016. The results revealed that EPC, ENP, IB, WMC, ERD, CCEL, FSZ and FAG jointly had significant effect on Stock Market Return Volatility (SMRV). The individually ENP, IB, FSZ and FAG had significant negative effect on SMRV ($\beta = -.053, -.131, -.026, -.006$; $t_{(253)} = -2.28, -5.00, -5.82, -8.67$; $p < .05$); while WMC had significant positive effect on SMRV ($\beta = .113$, $t_{(253)} = 2.43$, $p < .05$). The study concluded that environmental disclosure practices were important factors in determining the stability of the Nigerian stock market. The study recommended that financial reporting council of Nigeria and other regulatory agencies should establish and implement environmental disclosure standards to mandate consistent disclosure of environmental information.

Keywords: Environmental disclosure, Stakeholders, Stock market, Volatility, Investors, Consumer goods sector, Industrial goods sector.

1. Introduction

Volatility of stock market return is of great concern to providers of funds as it increases the uncertainty of their future wealth (Errais & Bahri, 2016). Higher volatility may increase the likelihood of incurring losses and this may cause investors' confidence in the stock market to dwindle. Lack of investors' confidence in the stock market may increase risk premium thereby increasing the cost of

raising capital in the market or motivate the investors to divert their funds to a less risky investment. The diversion of fund from the stock market reduces market liquidity and will increase the cost of raising funds in the market. The increase in risk premium and transaction cost could discourage both domestic and foreign direct investment. The instability of the stock market return could negatively influence investors' decisions and may starve companies using the stock market to raise funds to finance business expansion or take advantage of new business opportunity. Volatility of stock market return may hinder the stock market from effectively performing its role in mobilizing saving from the surplus part of the economy and redistributing it to the deficit side of the economy to motivate economic growth. Information plays a central role in the inner working

Increase in socially responsible investment have forced manager to align their business strategies with the stock market valuation of their environmental performance. One of such market valuation of environmental information is the effect of company-specific environmental news on stock return. According to Indrabudiman (2017) stock return is one of the major factors that motivated investor to invest in a company and it was also the reward of taking the risk to invest in the shares. Deak and Karali (2014) stated that where a company has a good environmental reputation, investors may positively react to the shares of the company thereby increasing stock return. They further stated that the effect of environmental violation penalties may affect the profitability of a company depending on its size, and it may also contribute to its riskiness. Riskier companies are a major concern to investors and may affect their perception of investing in such company as such affects stock return. Stock return of a company is also influenced by the quality of information at the disposal of the investing public. Mwangi and Mwiti (2015) stated that Voluntary disclosure of information is considered to be one of the major factors that affects stock returns.

There are studies that reviewed the place of environmental disclosure and Stock return of companies. Essajee and Wambugu (2016) revealed that financial disclosure increased the level of stock return of companies listed on the Nairobi Stock Exchange. He added that increase in corporate social responsibility disclosure would increase stock return. Jones, Frost, Loftus and Van der Laan (2007) also affirmed that an abnormal market return was generally viewed to be an infringement on the performance of firms and investors expectation about future performance of the firm. Mwangi and Mwiti (2015) considered stock market yield as the gain an individual or institutional investor obtained from his investment in the share of a company. Zhou and Yin (2017) affirmed that the stock market in china penalized firms associated with unfavourable environmental news. Thomas (2001) also submitted that the adoption of environmental policy and prosecution for breach of environmental standards have significant explanatory power in the analysis of excess return. Grewal, Riedl, and Serafiem (2015); Brammer, Brooks and Pavelin (2006) opined that the stock return of companies with sufficient nonfinancial disclosure could be higher than those of companies with minimal nonfinancial disclosure.

1.1. Statement of the Problem

Stock market return is influenced by the stability of share prices in the market. Where share prices are highly volatile, the predictability of stock returns becomes difficult and that can affect investors' confidence. Share price volatility affects the proper functioning of the financial system and negatively affects stock market performance. High volatility above a certain level will increase investment's risk hence the possibility of losses becomes apparent. Many studies have been carried out to address environmental disclosure and the Nigerian stock market return but few considered the effect of environmental disclosure on the volatility in the stock market return. This study investigated the combined effect of environmental pollution and control policy (EPC), energy policy (ENP), impact of biodiversity (IB), waste management cost (WMC), environmental research and development cost (ERD), cost of compliance to environmental laws (CCEL), firm size (FSZ), and firm age (FA) on stock market return volatility.

1.2. Objective of the Study

The main objective of this study was to determine the effect of environmental disclosure practices of companies on the volatility of the stock market return in the Nigerian stock market.

1.3. Research Question

This study answered the research question

How effective is environmental disclosure in influencing the volatility of stock market return of companies quoted on the Nigerian Stock Exchange?

1.4. Hypothesis

The study hypothesis was tested at 5% level of significance

H₀. Volatility of stock market return is not significantly influenced by environmental disclosure of companies quoted in the Nigerian Stock Exchange

2. Review of Literature

2.1. Theoretical Framework

2.1.1. Signaling Theory

Signaling theory was propounded by Spence in 1973. The theory had been adopted in explaining the behavior of individuals or organizations with access to different information (Connelly, Certo, Ireland, & Reutzel, 2011). Fundamentally, signaling theory is concerned with minimizing information asymmetry between parties (Bae, Masud, & Kim, 2018; Su, Peng, Tan, & cheung, 2014; Spence, 2002).

2.1.2. Political Economy Theory

This theory was propounded by Jevons in 1871. Political economy is the study of production and trades and how it is influenced by law, custom and government; and political economy theory has been the most widely used theory to explain why organizations seem to yield to government or public pressure for the disclosure of information about the impact of their operations within and without the communities in which they operate (Liu & Anbumozhi, 2009; Deegan, 2002; Cormier & Gordon, 2001; Guthrie & Parker, 1990; Dowling & Pfeffer, 1975). Political economy theory has been used to explain the disclosure of social and environmental information by corporate organizations (Deegan & Unerman, 2006).

Signaling theory was adopted for this study because it explained the behavior of individuals or organization with access to different information (Connelly, Certo, Ireland, & Reutzel 2011). It also shows how corporate organizations disclosed information to notify the investing public about their capability in running the operations of the companies.

2.2. Empirical Review

Dutt and Humphery-Jenner (2013) investigated stock market return volatility, operating performance and stock return in the USA. The study found that low volatile stocks earned higher returns than highly volatile shares. Deak and Karali (2014) reviewed stock market reaction to environmental news in the food industry in the US. The study found that positive or negative events that are directly connected to companies' activities led to increase in share prices and returns more than environmental events that were outside the control of the companies. Haider, Hashmi and Ahmed (2017) studied the impact of systematic risk factors on stock return volatility in Pakistani stock exchange. The study concluded that variation in some microeconomics indices will induce volatility in stock

return. Che (2018) studied types of investors in Norway stock exchange and their impact on stock return volatility. The study found that foreign investors, because of the volume of their transaction and the little time in which they kept their investment, spurred volatility in stock return which is in contrast to individual investors' activities that reduced stock return volatility because they have minimal volume of transaction. Chaklader and Gulati (2015) carried out a study of corporate environmental disclosure practices of companies doing business in India. The study found out that bigger company in India disclosed environmental information for fear of scrutiny from the public, media, government and the various stakeholders including investors in the share of those companies. They also concluded that environmental information helped companies to sustain themselves in a global market over a longer period of time.

In Nigeria, Okoli (2012) reviewed return-volatility interaction in the Nigerian market. The study found that while volatility in local variables could influence stock market volatility, international variables do not have significant influence on stock return in Nigeria. This implied that international volatility is not transmitted across borders. Emenike (2010) modelled stock returns volatility in Nigeria using GARCH. The result of the study showed an evidence of volatility clustering in the Nigerian stock exchange return series. Volatility makes it difficult for investors to hold stock for fear of uncertainty. Okey and James (2018) investigated how monthly stock return could influence volatility in the Nigerian capital market. The study found a significant volatility of stock return in the Nigerian stock exchange.

3. Research Methodology

The study adopted *ex post facto* research design. The target population for the study comprised 48 companies quoted on the Nigerian Stock Exchange, under the consumer goods and industrial goods sectors, as at December 31, 2016. A sample size of 17 companies was determined using Cochran's formula. Stratified proportionate sampling was adopted to select the number of companies studied from each stratum and samples from each stratum were purposively selected based on companies with higher total asset as at December 31, 2016. Validated data were extracted from the financial reports of the 17 companies and other published documents for the period of 15 years (2002-2016) which constituted the 255 firm-year observations used for this study.

4. Data Analysis, Interpretation and Discussion

4.1. Data Analysis

The result of the data analysis is shown in Appendix 1

4.2. Interpretation of Results

This subsection presents the result of the regression analysis to examine the relationship between volatility of stock market return (VSMR) and each of the Environmental Disclosure Practices Indicators as well as the control variables. In this case, the dependent variable is volatility of stock market return (VSMR) while the independent variables are Environmental Pollution and Control Policy (EPC), Energy Policy (ENP), Impact on Biodiversity (IB), Waste Management Cost (WMC), Environmental Research and Development Cost (ERD), Cost of Compliance with Environmental Law (CCEL), and Firm Size (FSZ) and Firm Age (FAG) as moderating variables. The hypothesis for model three is stated as follows:

H_{01} : Volatility of stock market return is not significantly influenced by environmental disclosure of companies quoted in the Nigerian Stock Exchange

This is functionally stated as follows:

$$VSMR_{it} = \beta_0 + \beta_1 EPC_{it} + \beta_2 ENP_{it} + \beta_3 IB_{it} + \beta_4 WMC_{it} + \beta_5 ERD_{it} + \beta_6 CCEL_{it} + \mu_{it} \dots \text{Model 3}$$

In order to select the most appropriate model for hypothesis without the effect of moderating variables, hausman test was conducted to determine whether the unique errors (error term) are correlated with the repressors. The null hypothesis for the test suggested the appropriateness of random effect while the alternative hypothesis suggested fixed effect. The result of the hausman test showed a *p-value* of 1.000, that is 100. % percent which is more than 5% level of significance adopted for this study. The result suggested random effect model as the most appropriate model for hypothesis without the effect of moderating variables. To confirm the result of the hausman test, lagrangian multiplier (LM) tests was conducted. These test was conducted to determine the most appropriate model between the random effect and the pooled ordinary least squares (OLS) regression. The null hypotheses of this test is that OLS is an appropriate model and the alternative hypothesis suggests random effect model as the appropriate model. The results of the LM tests showed a coefficient and *p-value* of 992.29 (0.000), which is less than the 5% level of significance adopted by this study. The results also suggested random effect model as the most appropriate model for hypothesis three without the effect of moderating variables.

To determine the robustness of the model, diagnostics test for cross sectional dependence, heteroscedasticity, and auto correlation was carried out. According to Hsiao, Pesaran, and Pick (2017) panel data are assumed to be independent across individual observation and where this assumption does not hold for panel data, the estimators based on the assumption of cross sectional independence be inconsistent. The null hypothesis for cross sectional independence is that the residuals of the model are uncorrelated over time. The test was carried out using Pesaran's test of cross sectional independence and the result showed a *P-value* of 0.000, which is less than 5% percent level of significance adopted for this study. The result rejected the null hypothesis of cross sectional independence and showed that the standard errors of the model are correlated over time, this suggested that the model has cross-sectional dependence problem.

The test for heteroscedasticity is carried out to ensure that variation in standard error is constant across all observations. Where heteroscedasticity is present in a panel data, the efficient of the estimators is weakened. The null hypothesis states that the standard errors of the model are constant over time. The result of the heteroscedasticity test showed *p-value* of 0.000 which is less than the 5% adopted for this study. This indicates the presence of heteroscedasticity; that is the standard errors of the model are not constant over time.

The model was also tested for the presence of autocorrelation, among the residuals and the coefficients of the model, using Wooldridge test for autocorrelation in panel data. The null hypothesis for the test states that there is no first order autocorrelation. The result of the test showed a *P-value* of 0.000 which is less than 5% level of significance adopted for this study. The result suggested the rejection of the null hypothesis and the acceptance of the alternate hypothesis that showed the presence of autocorrelation.

All the diagnostics test conducted for the model, without the effect of moderating variables, showed the presence of cross sectional dependence, heteroscedasticity, and autocorrelation therefore such OLS, fixed effect model, and random effect model would not be appropriate estimators for the model. In order to correct this problem, the Linear Regression (PCSEs) was used to estimate the effect of environmental disclosure practice and volatility of stock market return of companies quoted on the Nigerian stock market.

The results of the model adopted to test the hypothesis, without the effect of moderating variables, is shown on table 4.1 and is interpreted as follows:

The results showed that while environmental pollution and control policy (EPC) (with *coefficient* = -0.062 and *p-value* = 0.000), energy policy (ENP) (with *coefficient* = -0.62 and *p-value* = 0.015), and impact on biodiversity (IB) (with *coefficient* -0.091 and *p-value* = 0.000),

value = 0.000) have negative and significant influence on volatility of stock market return, Waste management cost (WMC) (with *coefficient* = -0.030 and *p-value* = 0.241), have negative and insignificant influence on the volatility of stock market return. Environmental research and development cost (ERD) (with *coefficient* = 0.040 and *p-value* = 0.015) has a positive and significant influence on the volatility of stock market return; and cost of compliance with environmental laws (CCEL) (with *coefficient* 0.021 and *p-value* = 0.294) has a positive and insignificant influence on the volatility of stock market returns.

The coefficient of the regression result measures the magnitude and the direction of relationship between the dependent and the independent variables. Environmental pollution and control policy (EPC) with coefficient of -0.062, energy policy (ENP) with a coefficient of -0.62, impact on biodiversity (IB) with a coefficient of -0.091, and Waste management cost (WMC) with a coefficient of -0.030 implies that a unit increase in EPC, ENP, IB, and WMC could result in 6.2%, 62%, 9.1%, and 3% decrease in the volatility of stock market returns in the shares of companies quoted in the Nigerian stock market respectively. A unit increase in the disclosure of environmental research and development (ERD), and cost of compliance to environmental laws (CCEL) could induce an increase of 4% and 2.1% in the volatility of stock market return respectively.

The explanatory power of environmental pollution and control policy (EPC), energy policy (ENP), impact on biodiversity (IB), waste management cost (WMC), environmental research and development cost (ERD), and cost of compliance to environmental laws (CCEL) combined on the volatility of stock market return in the Nigerian Stock Market is 0.069 which implies that only 6.9% of volatility in volume of transaction is caused by the combined influence of the explanatory variables while the remaining 93.1% is caused by other variables not considered in this study. The *F-stats* with a *coefficient* and *p-value* of 4.12 (0.001) which is less than 5% level of significance adopted for this study is an indication that all explanatory variables (EPC, ENP, IB, WMC, ERD, AND CCEL) jointly and significantly influence the dependent variable (VSMR).

The parameter estimates obtained from the Linear Regression (PCSEs) are given in the equation for model three without the effect of moderating variables is shown as follows:

$$\text{VSMR}_{it} = 0.392 - 0.062\text{EPC}_{it} + 0.62\text{ENP}_{it} - 0.091\text{IB}_{it} - 0.030\text{WMC}_{it} + 0.40\text{ERD}_{it} + 0.021\text{CCEL}_{it} + \mu_{it} \text{-----Model 3}$$

The study also considered the effect of firm size and firm age on environmental disclosure and volatility of volume of transactions. This is functionally presented as follows:

$$\text{VSMR}_{it} = \beta_0 + \beta_1\text{EPC}_{it} + \beta_2\text{ENP}_{it} + \beta_3\text{IB}_{it} + \beta_4\text{WMC}_{it} + \beta_5\text{ERD}_{it} + \beta_6\text{CCEL}_{it} + \beta_7\text{FSZ}_{it} + \beta_8\text{FAG}_{it} + \mu_{it} \text{-----Model 3}$$

In order to select the most appropriate model for hypothesis with the effect of moderating variables, hausman test was conducted to determine whether the unique errors (error term) are correlated with the regressors. The null hypothesis for the test suggested the appropriateness of random effect model (REM) while the alternative hypothesis suggested fixed effect model (FEM). The result of the hausman test showed a *p-value* of 0.969, that is 96.9 % percent which is greater than 5% level of significance adopted for this study. The results suggested random effect model as the most appropriate for hypothesis three with the effect of moderating variables. To confirm the result of the husman test, Lagrangian multiplier (LM) tests was conducted. The test was conducted to determine the most appropriate model between the random effect model and the pooled ordinary least squares (OLS) regression. The null hypotheses of this test is that OLS is an appropriate model while the alternate hypothesis suggested random effect model as the most appropriate model. The result of the LM tests showed a coefficient and *p-value* of 895.31 (0.000), which is less than the 5% level of significance adopted by this study. The result also suggested random effect model as the most appropriate model for hypothesis three when considering the effect of moderating variables.

To determine the robustness of the model, diagnostics test for cross sectional dependence, heteroscedasticity, and auto correlation was carried out as in the model without the effects of moderating variables.

All the diagnostics tests conducted for model with the effect of moderating variables, showed the presence of heteroscedasticity, and autocorrelation; as such OLS, fixed effect model, and random effect model would not be appropriate estimators for the model. In order to correct this problem, the random effect model with cluster was used to estimate the effect of environmental disclosure practices on the volatility of stock market return in the Nigerian stock market taking into consideration the effect of moderating variables. The result is also shown on table 4.1 in appendix I and interpreted as follows:

The results showed that environmental pollution and control policy (EPC) (with *coefficient* = -0.026 and *p-value* = 0.526), energy policy (ENP) (with *coefficient* = -0.042 and *p-value* = 0.503), have impact on biodiversity (IB) (with *coefficient* -0.025 and *p-value* = 0.523), environmental research and development cost (ERD) (with *coefficient* = -0.000 and *p-value* = 0.993), and cost of compliance with environmental laws (CCEL) (with *coefficient* -0.007 and *p-value* = 0.853) have negative and insignificant influence on the volatility of stock market returns in the Nigerian stock market; while waste management cost (WMC), (with *coefficient* = 0.005 and *p-value* = 0.928), and firm size (FSZ) (with *coefficient* = 0.011 and *p-value* = 0.482) have a positive and insignificant influence on the volatility of stock market returns. Firm age (FAG) (with *coefficient* = -0.011 and *p-value* = 0.000) has negative and significant influence on the volatility of stock market returns in the Nigerian stock market.

The coefficient of the regression result measures the magnitude and the direction of relationship between the dependent and the independent variables. Environmental pollution and control policy (EPC) with coefficient of -0.026, energy policy (ENP) with a coefficient of -0.042, impact on biodiversity (IB) with a coefficient of -0.025, environmental research and development cost (ERD) with a coefficient of -0.000, cost of compliance to environmental laws (CCEL) with a coefficient of -0.007, and firm age (FAG) with a coefficient of -0.011 implies that a unit increase in EPC, ENP, IB, ERD, CCEL, and FAG could result in 2.6%, 4.2%, 2.5%, 0%, 0.7%, and 1.1% decrease in the volatility stock market return in the Nigerian Stock Market. On the other hand, waste management cost (WMC) with a coefficient of 0.005, and firm size (FSZ) with a coefficient of 0.011 implies that a unit increase in WMC, and FSZ could result in 0.05%, and 1.1% increase in the volatility stock market return of shares.

The explanatory power of environmental pollution and control policy (EPC), energy policy (ENP), impact on biodiversity (IB), waste management cost (WMC), environmental research and development cost (ERD), cost of compliance to environmental laws (CCEL), firm size (FSZ), and firm age (FAG) combined on the volatility of stock market return of shares in the Nigerian Stock Market is 0.168 which implies that 16.8% of volatility of stock market return of shares in the Nigerian stock market is caused by the combined influence of the explanatory variables while the remaining 83.2% is caused by other variables not considered in this study. The *wald-test* with *p-value* = 0.000 which is less than 5% level of significance adopted for this study is an indication that all explanatory variables (EPC, ENP, IB, WMC, ERD, CCEL, FSZ, and FAG) jointly and significantly influence the dependent variable (VSMR).

The parameter estimates obtained from the random effect model with cluster are given in the equation for model two with the effect of moderating variables shown as follows:

$$\text{VSMR}_{it} = 0.694 - 0.026\text{EPC}_{it} - 0.042\text{ENP}_{it} - 0.025\text{IB}_{it} + 0.0005\text{WMC}_{it} - 0.000\text{ERD}_{it} - 0.007\text{CCEL}_{it} + 0.011\text{FSZ}_{it} - 0.011\text{FAG}_{it} + \mu_{it}$$

Comparing the models of hypothesis, with and without the influence of moderating variables, it is shown by the result that the model with the influence of moderating variable explained more appropriately the relationship between environmental disclosure practices

and volatility of stock market return of shares in the Nigerian stock market. The explanatory power of the independent variables in the model with moderating variables is 16.8 % which is greater than that of the model without moderating variables (6.9%). The *wald-test* (31.75(0.000)) and (62.34(0.034)) of the models, with and without the moderating variables respectively, confirmed the superiority of the model with the moderating variables.

4.3. Discussion of Findings

The regression result in Table 4.1 showed that environmental disclosure indices (EDI) had a negative and significant influence on Stock Market Return Volatility (SMRV) as shown by *wald-test* = 62.34, *Adj. R²* =16.8, and *P-value* = 0.000. The significance of the *P-value* at 5% level of significance adopted for this study supported the acceptance of the alternate hypothesis that suggested that volatility of stock market return is significantly influenced by environmental disclosure of companies quoted in the Nigerian Stock Exchange. As a result, the study concluded that Volatility of stock market return is significantly influenced by environmental disclosure of companies quoted in the Nigerian Stock Exchange. This result is in line with the *A priori* expectation of the study and also aligned with a similar study.

A similar study conducted by Zhang, Djajadikerta, and Zhang (2018) to check if sustainability engagement affects stock return volatility in Chinese financial market and concluded that sustainability news release was found to affect positively stock return volatility. Saleh, Zulkifli, and Muhamad (2011) also found a positive relationship between corporate social responsibility and stock market return. On the contrary, Nwangi and Mwititi (2015) found no relationship between voluntary disclosure and stock returns of companies quoted in the Nairobi stock exchange.

Considering individual effect of environmental disclosure indices on stock market return, the result showed that environmental pollution and control policy (EPC), energy policy (ENP), impact on biodiversity (IB), environmental research and development cost (ERD), and cost of compliance with environmental laws (CCEL) had negative and insignificant influence on stock market return volatility. While waste management cost (WMC), and firm size (FSZ) had positive and insignificant influence on stock market return volatility, firm age (FAG) had negative and significant influence on stock market return. Investors in stock market are not only concerned with the returns on their investment but majorly concerned with the certainty of such return. A volatile financial market could make financial planning, based on investment in the stock market, to be difficult as providers of funds may find it difficult to determine the state of their investment with some degree of certainty. Where the stock market returns become highly volatile, providers of fund may ask for higher return to compensate for the high risk or divest their fund to less risk venture. The stability of the market increases the confidence of the investing public, and as such it is important for management to provide all necessary information to assist investors to make informed decision with regard to investment in the company's shares.

5. Conclusion and Recommendation

5.1. Conclusion

The main objective of this study was to determine the impact of environmental disclosure on the volatility of stock market return in the Nigerian stock market and the results showed that environmental disclosure indices jointly and significantly affect volatility of stock market return in Nigeria.

5.2. Recommendation

To ensure that companies consistently disclose environmental information, adequate laws and penalties must be created and enforced by policy makers. Managers should be aware of the impact of their operation on the environmental and design operational strategies to minimize externalities generated by its operations. Financial analysts should also consider environmental factors in reviewing financial statements and advising the investing public. Researchers and scholars should explore the subject of environmental disclosure, especially in the developing nations with aim of proffering solutions to the ever growing impact of companies' activities on the environment.

5.3. Suggestion for Further Studies

This study focused on the impact of environmental disclosure on volatility of stock market return in Nigerian stock market using data from the consumer and industrial sector of the Nigerian economy for a period of 15 years covering 2002 to 2016. It is suggested that future studies should extend the research to include quoted firms in other sectors of the economy whose operations have significant impact on the environment using a larger time frame.

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Appendix I

Table 4.1: Result of Regression Analysis

| SMRV | WITHOUT CONTROL VARIABLES | | | | WITH CONTROL VARIABLES | | | |
|---------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| | Pooled OLS | Fixed Effect | Random Effect | Linear Reg. (PCSEs) | Pooled OLS | Fixed Effects | Random Effects | Random Effects (Cluster) |
| EPC | -0.062 (-0.98) {0.327} | -0.049 (-1.15) {0.252} | -0.050 (-1.19) {0.235} | -0.062 (-3.50) {0.000} | 0.021 (0.33) {0.739} | -0.024 (-0.58) {0.563} | -0.026 (-0.63) {0.526} | -0.026 (-0.63) {0.526} |
| ENP | -0.062 (-0.60) {0.547} | -0.045 (-0.68) {0.500} | -0.045 (-0.69) {0.493} | -0.62 (-2.44) {0.015} | -0.053 (-0.56) {0.576} | -0.041 (-0.65) {0.519} | -0.042 (-0.67) {0.503} | -0.042 (-0.67) {0.503} |
| IB | -0.091 (-1.48) {0.141} | -0.065 (-1.60) {0.111} | -0.065 (-1.64) {0.102} | -0.091 (-5.85) {0.000} | -0.131 (-2.30) {0.022} | -0.015 (-0.37) {0.709} | -0.025 (-0.64) {0.523} | -0.025 (-0.64) {0.523} |
| WMC | -0.030 (-0.27) {0.784} | -0.020 (-0.32) {0.749} | -0.021 (-0.34) {0.737} | -0.030 (-1.17) {0.241} | 0.113 (1.09) {0.276} | -0.001 (-0.02) {0.985} | 0.005 (0.09) {0.928} | 0.005 (0.09) {0.928} |
| ERD | 0.040 (0.51) {0.612} | 0.004 (0.07) {0.944} | 0.006 (0.10) {0.921} | 0.040 (2.43) {0.015} | -0.013 (-0.18) {0.859} | 0.003 (0.06) {0.951} | -0.000 (-0.01) {0.993} | -0.000 (-0.01) {0.993} |
| CCEL | 0.021 (0.27) {0.791} | 0.006 (0.14) {0.889} | 0.006 (0.15) {0.884} | 0.021 (1.05) {0.294} | 0.018 (0.25) {0.806} | -0.007 (-0.19) {0.851} | -0.007 (-0.19) {0.853} | -0.007 (-0.19) {0.853} |
| FSZ | - - - | - - - | - - - | - - - | -0.026 (-2.25) {0.026} | 0.024 (1.32) {0.187} | 0.011 (0.70) {0.482} | 0.011 (0.70) {0.482} |
| FAG | - - - | - - - | - - - | - - - | -0.006 (-4.89) {0.000} | -0.013 (-3.85) {0.000} | -0.011 (-3.73) {0.000} | -0.011 (-3.73) {0.000} |
| Constant | 0.393 (22.53) {0.000} | 0.385 (34.86) {0.000} | 0.386 (6.12) {0.000} | 0.392 (22.53) {0.000} | 1.110 (6.43) {0.000} | 0.605 (3.20) {0.002} | 0.694 (3.73) {0.000} | 0.694 (3.73) {0.000} |
| Adj. R ² / Overall R | | 0.088 | 0.087 | 0.069 | 0.211 | 0.142 | 0.168 | 0.168 |
| F-stat (Prob) | | 5.03 (0.000) | - | 4.12 (0.001) | 0.000 (0.236) | 7.57 (0.000) | - | - |
| Wald-test (Prob) | | - | 31.75 (0.000) | | - | - | 62.34 (0.000) | 62.34 (0.000) |
| Hausman Test | | | 0.05 (1.000) | | | | 2.34 (0.9688) | |
| Testparm (rho)/LM test | | | 992.29 (0.000) | | | | 895.31 (0.000) | |

| | | | | | | |
|-------------------------|--|--|-----------------|--|--|-----------------|
| Heteroscedasticity Test | | | 40.05 (0.000) | | | 157.6 (0.000) |
| Cross-Sect. Dependence | | | 0.000 | | | 0.000 |
| Auto-correlation Test | | | 359.965 (0.000) | | | 1869.39 (0.000) |

Source: Authors Computation, 2019 using STATA 15.

The Influence of Cooperative Learning Model CRH Type with Audio Visual Aid to Social Skills and Learning Outcomes of Grade IV Students Elementary School

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Abstract- This research aims to determine the influence of cooperative learning model type *course review horay* with audiovisual media against social skills and student learning outcomes. This research was conducted at Jepara II Surabaya Elementary School in Lesson 2018/2019.

This research uses a quantitative approach. This type of research is a quasi-experimental research with a non-equivalent design (pretest and posttest) control group design. The research uses two classes, which are experimental classes and control classes. A research sample is a grade IV A student as an experimental class and IV B as a control class. The research instruments used are social skills observation sheets and student learning tests. The data analysis techniques used include the normality test, homogenization test, an independent samples t-test.

The results showed that there was an influence of cooperative learning and the type of *course review horay* was assisted audio visual on social skills and student learning outcomes. The results of independent samples of t-test students' social skills showed that $T_{\text{count}} 4.762 > T_{\text{table}} 2.02280$. The results of the student study results independent samples t-test showed that $T_{\text{count}} 11.483 > T_{\text{table}} 2.02280$. It can be concluded that the cooperative learning model of the *course review horay* has an audio-assisted visual impact on social skills and student learning outcomes.

Index Terms- Cooperative Learning Model Type Course Review Horay, Audio Visual Media, Social Skills, Learning Outcomes.

I. INTRODUCTION

Learning is a series of processes of activities undertaken by a lecturer on the participants in delivering knowledge, in which there is an interaction between teachers and participants in order to realize the purpose of learning (Aqib, 2008 p. 45). The implementation of learning is closely related to the involvement of teachers and students, in the process of activities also as a facilitator to the emergence of new ideas to students as part of community members through the process of teaching-learning in schools.

Active learning certainly involves a lot of students' activities because learning is not separated from an activity, for example, in a learning activity, a teacher gives a problem that

should be resolved through group discussion activities (Nasution, 2011 p. 74). In students' learning activities are expected to conduct learning activities to improve cognizing ability and social interaction with other students. Social interactions with other students are of course faced with other individual diversity in class situations, so students are also taught or directed to practice their social skills, which is very important considering the need for Social skills in diverse people's lives, which will eventually face the students in their lives.

Social skills are crucial to always be taught in class because students are part of a human being that is not separated from social life, therefore the human being is called a social creature. Social skills alone are the ability of individuals or citizens to connect with others, and are able to solve problems so that they can adapt to the community or surrounding environment harmoniously (Cartledge & Milburn, 1992 p. 8). Fact in the field, especially in the school where the research will be conducted is a school with most of the participants of the students from outside the city and even outside the island which certainly has a variety of characters and diversity that still carries the regional character, so that there is often a gap between students that is shown by low social skills in interpersonal, where the police still occur (insulting, mentioning with a title not good/racist) because cannot refrain, still likes to be selfish when the discussion, cannot accept another opinion, shame expressed opinion, has not been able to cooperate well with the group, the quality of work in the team less, less concerned about the environment, taste Responsibility to the task less, less active in asking or answering, and many other social problems. This has been the researcher attest after initial observations in class with the social skill category based on the opinions of Cartledge & Milburn (1986), which is obtained by 44% of the category of interpersonal behavior, 47% of self-conduct category and 45% category of behavior on tasks. In addition to social skill issues, another problem is that the low student learning outcomes are known from odd semester results in the 2018 school year/2019, where many student learning outcomes are still under the submission criteria, known as much as 67% of students are given grades under the school's submission criteria (77).

Regarding the importance of developing students' social skills and learning difficulties in understanding the material, researchers will implement a cooperative learning model of the type *course review horay*. The cooperative learning model is a

model that requires students to cooperate in small groups (4 persons in one group) in completing the task of the Teacher (Slavin, 1995 in Isjoni, 2014 p. 15)). While the type of *course review horay* according to Miftahul Huda (2013, p. 229-230) is the development of a cooperative learning model, where the implementation of making the climate in class become fun and festive, this is due to the necessity of students Shout "Horee!!" or shouted (which they made) when they managed to answer the question and correct it in answer. In addition to implementing cooperative learning model *course review horay*, researchers also used audio-visual assistance as a medium in learning so that the presented material is interesting and clear, this is because audiovisual media is a medium that uses the sense of hearing and vision simultaneously in a learning process (Munadi, 2013 p. 56). The hope of researchers with cooperative learning model type *course review horay* assisted audiovisual can affect social skills and student learning outcomes so that students can develop their social skills and student learning outcomes more optimal.

II. METHOD

This type of research is experimental quasi-research or pseudo-experimentation. The population in this research is all grade IV students at Jepara II Surabaya Elementary School, while sampling is conducted by testing the homogeneity of the population. Prior to testing the homogeneity, first conducted a test of normality to social skills data and student learning outcomes using the One-Sample Kolmogorov Smirnov test. After two samples have been obtained through a homogeneity test, then determine the control and experiment classes, where the control class is a class whose learning is not given treatment, while the experimental class is a class with the treatment CRH Type Cooperative learning model with audiovisual aid.

The research procedure was conducted in three phases, namely: a) the preparatory phase consisting of initial observations, the determination of the experimental and control classes, and determining the material; b) Implementation stage by implementing pretest, application of action on experimental class, and implementing Posttest; c) The data analysis phase by collecting and analyzing data, concluded data analysis results. The technique of collecting data on this research is by using observation methods and tests. Analysis of student's social skills data by calculating the percentage of all data on the observation results of the student's social skills during the learning process,

which was further measured using the Independent Sample test T-Test (Test T) aimed at knowing the influence of the Model cooperative Learning CRH Type Assisted audiovisual to the social skills of the students. Data analysis to measure students' learning outcomes by using the achievement value of each individual, the average grade value, and the classical learning submission value. Students' initial skills were measured using a pretest while students' final abilities were measured using posttest. Furthermore, the measured test of the Independent Sample T-Test (Test T) aims to determine the influence of the CRH-type cooperative learning model with audiovisual aid to student learning outcomes. To help analyze the analysis packages used for the *SPSS 21.00 for Windows*.

III. RESULT AND DISCUSSION

A. Results Of Social Skills Analysis And Discussion

Results of the analysis of students' social skills in the experimental class of the recapitulation of the entire category of students' social skills in one class, at the initial observation obtained by the data, the category of Interpersonal conduct of 126 or 44%, the score against oneself amounting to 134 or 47%, behavior on tasks of 130 or 45%. However, after the implementation of the cooperative learning model of the audiovisual assisted CRH type in the data experiment class shows the interpersonal behavior category of 244 or 85%, the self-behavior score of 222 or 77%, the behavior of the tasks of 233 or 81%. With the average acquisition score on the social skills of students in a class of 16 at the beginning of observation to 29 after given treatment.

While the results of data analysis of students' social skills using the independent Sample t-test (Test T) shows that the value of T_{count} students' social skills were obtained at 4.762 and the value of the above data is 2.02280, referring to the basic decision making stating that if the value of $T_{count} > T_{table} = H_0$ is rejected and H_a accepted means the value $4.762 > 2.02280$, which means that hypothesized (H_0 is rejected and H_a is accepted). Reinforced with the next table stating that the value of $sig. (2-tailed) < 0.05$, namely $0.000 < 0.05$ which means the influence of treatment. The results of the social skill students of experimentation classes and control classes can be seen in Figure 1. Following:

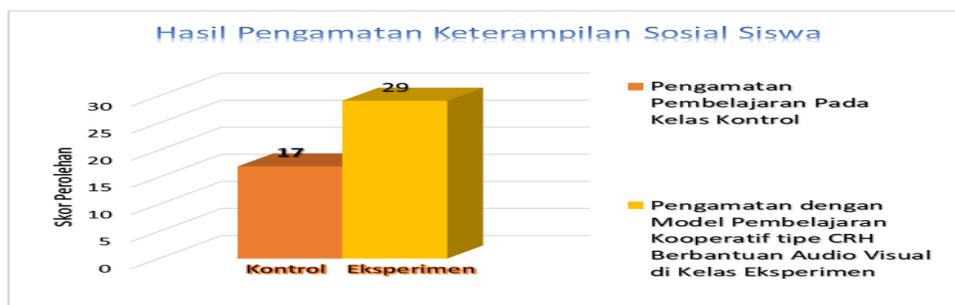


Figure 1. Histogram Social Skills Value Of Classroom Students Control And Experimentation

A. Analysis Of Student Learning Outcomes

The assessment of student learning is done through two stages, namely through pretests and posttest assessments. The analysis of

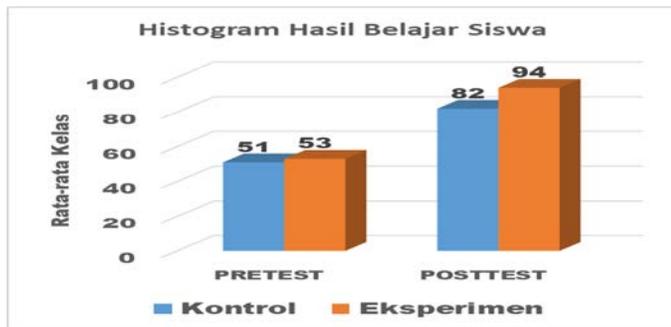
student learning outcomes is used to measure the ability of students in the cognitive realm, as shown in table 1 below:

Table 1. Control Grade Student Learning Abilities

| No | Control class | Value | | Experimental classes | Value | |
|---------|---------------|---------|----------|----------------------|---------|----------|
| | | Pretest | Posttest | | Pretest | Posttest |
| Average | | 51 | 82 | Average | 53 | 92 |

The test results of normality pretests and Posttest show that all data is a normal distribution. Further analysis of student learning results from pretests and posttest results in both classes obtained the average value pretest control class and experimentation is 51 and 53 (under the Criterion of Class 77), but after learning the average value Posttest the control class to 82, and the experimental class to 94 (exceeding the criteria of the 77-class submission). The posttest value of the control class and experimentation was a significant difference, proving that by setting up a cooperative learning model with audio-assisted CRH type, the student learning results significantly improved and more from learning without treatment.

While the results of the analysis using the Independent Sample t-test (Test T) shows that the students' learning results are obtained at 11.483 and the value of the above data is 2.02280, referring to the basis of decision making stating that if the value of $T_{count} > T_{table} = H_0$ is rejected and H_a is accepted means the value $11.483 > 2.02280$, which means that hypothesized (H_0 is rejected and H_a accepted). Reinforced with the next table stating that the value of sig. (2-tailed) < 0.05 , namely $0.000 < 0, 05$ which means the influence of treatment. The results of learning pretests and posttest students can be seen in Figure 2.



Picture 2. The Experiment Results Of Student Learning Histogram Control Class

IV. DISCUSSION

Students' social skills are measured by calculating the percentage of all data on the observation of the student' social skills during the learning process, which is further measured using the Independent Sample t-test (Test T) test which aims to determine the influence of the CRH-type cooperative learning model for audio-visual aid to students' social skills. Early observations of the students' social skills in the control class acquired the social skills score of students with a Interpersonal

behavior category of 128 or 44%, the self-behavioral score of 133 or 46%, the task's behavior of 129 or 45%, with the average acquisition score on the social skills of a student in a class of 16. Further observations on the control class when learning without treatment are acquired by the students' social skills score under the 133 or 46% Interpersonal behavior category, self-behavior score of 138 or 48%, behaviour against Duty of 137 or 48%, with the average acquisition score on the social skills of students in a class of 17. The average increase in the social skills scores on the initial control class of observation and after 1 study only (score 16 to 17), As for each category of the Interpersonal behavior is only 2%, the self-behavior category is also 2%, and the task behavior category is 3%.

An early observation of students' social skills in the experimental class was obtained in a score with a 126 or 44% Interpersonal behavior category, the self-behavior scores of 134 or 47%, duty-to-task behavior of 130 or 45%, with an average acquisition score on the students' social skills in a class of 16. Further observations of the experimental class when learning with cooperative learning models of CRH type Audio visually assisted by a student's social score with a category of Interpersonal behaviors of 244 or 85%, behavioral scores Against oneself of 222 or 77%, behavior on tasks is 233 or 81%, with the average acquisition score on the social skills of students in a class of 29. The average increase in the social skills scores in the early experimental class observation and after learning at the rate of 13 (score 16 to 29), while for the social skills of the Interpersonal behavior category increased by 40%, the self-behavior category also increased by 30%, and the behavior category On duty increased by 36%.

The results of data analysis of students' social skills using the Independent Sample t-test (Test T) show that the value of T_{count} students' social skills were obtained at 4.762 and the value of the above data is 2.02280, referring to the basis of decision making stating that if the value of $T_{count} > T_{table} = H_0$ is rejected and H_a is accepted means the value $4.762 > 2.02280$, which means that hypothesized (H_0 is rejected and H_a is accepted). Reinforced with the next table stating that the value of sig. (2-tailed) < 0.05 , namely $0.000 < 0.05$ which means the influence of treatment.

Preliminary observations of student learning outcomes in the control class and experiment classes show control-class student learning outcomes with a total of 24 students. The acquisition of Pretest value in the control class got an average value of 51 with a maximum value of 62 and a minimum value of 35, then the acquisition of Posttest value got an average value of 84, with a maximum value of 93, and a minimum value of 72.

As for the experimental class with a total of 24 students, the acquisition of Pretest value was obtained an average value of 53

with a maximum value of 67 and a minimum value of 32, hereinafter the acquisition of Posttest value gets value An average of 92, with a maximum value of 95, and a minimum value of 87, this result is very significant when seen as a difference with the control class, this is because the experiment class has been given treatment so that resulted in the increasing value of students, so indirectly the value of the school's prescribed criteria has been greatly exceeded.

The results of the analysis using the Independent Sample t-test (Test T) showed that the value of the students' study results were obtained at 11.483 and the value of the above data is 2.02280, referring to the basis of decision making stating that if the value of $T_{\text{count}} > T_{\text{table}} = H_0$ is rejected and H_a is accepted means the value $11.483 > 2.02280$, which means that hypothesized (H_0 is rejected and H_a is accepted). Reinforced with the next table stating that the value of sig. (2-tailed) < 0.05 , namely $0.000 < 0.05$ which means the influence of treatment.

V. CONCLUSION AND SUGGESTION

CONCLUSION

Based on the discussion of research results, it can be concluded that:

1. There is the influence of cooperative learning model type *course review horay* the review is assisted audiovisual against the social skills of students. This can be proved by the results:
 - a. Assessment of the validator against learning devices, audio-visual media, and research instruments that obtain a good category.
 - b. Valid and reliable social skill instruments.
 - c. There is a significant influence on the social skills of students by showing the results of the students' social skills in the interpersonal behavior category of 126 or 44% to 244 or 85%, self-behavior of 134 or 47% to 222 or 77%, and behavior on tasks of 130 or 45% to 233 or 81%.
 - d. Testing results of the social skills hypothesis of students who showed data that the value of $T_{\text{count}} > T_{\text{table}} = H_0$ is rejected and H_a is accepted, the value of $4.762 > 2.02280$, (H_0 is rejected and H_a is accepted) (no influence).
2. There is the influence of cooperative learning model type *course review horay* assisted audiovisual towards student learning outcomes. This conclusion is evidenced by the results:
 - a. assessment of the validator against learning devices, audio-visual media, and research instruments that gained a good category.
 - b. Valid and reliable learning test instruments.
 - c. There is a significant influence on student learning outcomes by showing students' learning results when the

initial observation (pretest) is obtained the average value of 53 and increases significantly when posttest, the average value obtained of 92.

The results of the test hypothesis of student learning results that show the data that the value of $T_{\text{count}} > T_{\text{table}} = H_0$ is rejected and H_a is accepted, the value of $11.483 > 2.02280$, (H_0) is rejected and (H_a) is accepted (no influence).

SUGGESTION

Based on the results of the research and the above conclusions, researchers provide the following advice:

1. Teachers, are expected to take advantage of innovative learning models such as *course review horay* method and utilize media assistance, especially utilizing technological sophistication in learning activities, as they will provide positive impacts on social skills and learning outcomes, and can motivate students to learn.
2. Students, hopefully with a cooperative learning model type *course review horay* assisted audiovisual can develop and improve students' social skills and learning outcomes, as well as motivate students in learning.
3. For researchers who do experimental research, the results of this research should be used as a reference for classroom learning.

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The Effect of Product Quality on Organic Vegetable Purchase Decision-Making

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Abstract- Indonesia began to show efforts to start a healthy life by cultivating organic food. Since it was first introduced in Indonesia in 1997 organic vegetables are healthier and safer for the body than non-organic ones. The demand for organic food has increased throughout the world which is increasing by around 20 percent per year so that the demand is able to create a potential market for organic products. Therefore, researchers want to figure out to what extent the quality of organic vegetables influences consumer purchasing decisions. Based on the background, the formulation of the problem in this study is whether the quality of organic vegetable products has an effect on consumer purchasing decision-making. Based on the results of data analysis, the regression model formed is $\hat{y} = 6.56 + 0.37 PQ$. This model shows a positive relationship between product quality and purchasing decisions. The results of hypothesis testing indicate that product quality has an effect on purchasing.

Index Terms- organic vegetables, purchase decision making

I. INTRODUCTION

Indonesia is an agrarian country with a total area of 1,990,250 km² and ranks 13th out of the total area in the world (https://id.wikipedia.org/wiki/Daftar_negara_menurut_luas_wilayah). The total area of Indonesia ranks second after China (in the scope of Asia) and is the largest region in Southeast Asia. This is at risk of narrowing agricultural land into residential land, while the agricultural sector is a strategic sector and plays an important role in the national economy and the survival of the community, especially in its contribution to GDP, employment providers, and domestic food provide (<https://agribisnis14.wordpress.com/2015/03/03/alih-fungsi-lahan-pertanian/>).

Indonesia began to show efforts to start a healthy life by cultivating organic food. Since it was first introduced in Indonesia in 1997 organic vegetables are healthier and safer for the body than non-organic ones. In general, organic vegetables are vegetables that have health standards that are recommended for consumption because they are good for long-term health (Islam, 2014).

Some big cities such as Jakarta, Bandung, Surabaya, and Malang have sprung up places for selling organic food such as vegetables, fruit and rice and there are restaurants that have special food menus from organic food. The increase in organic food sales is triggered by consumer awareness and a healthy lifestyle with the slogan 'back to nature'. Consumers are increasingly aware that the use of non-natural chemicals such as fertilizers, synthetic chemical pesticides, and growth hormones used in agricultural

production has a negative influence on human health and the environment. Organic vegetables are produced by a different process from non-organic vegetables. People sometimes cannot distinguish organic and non-organic vegetables because its taste, color and appearance almost resemble non-organic vegetables (Sinne, 2012).

Image 1 Organic Label



*Source: SNI OKPO (2007)

The Organic Food Safety Authority (2012) considers that organic food is a labeling term stating that a product has been produced in accordance with the standards of organic (natural) production and is certified by an official authority or certification body. The main purpose of organic farming is to optimize the health and productivity of life on land, plants, animals and humans. The demand for organic food has increased throughout the world which is increasing by around 20 percent per year so that the demand is able to create a potential market for organic products (Deliana, 2012). Therefore, researchers want to figure out to what extent the quality of organic vegetables influences consumer purchasing decisions. Based on the background, the formulation of the problem in this study is whether the quality of organic vegetable products has an effect on consumer purchasing decision-making.

II. THEORETICAL FRAMEWORK

ORGANIC AGRICULTURE

The growing number of organic agriculture in Indonesia shows the awareness of farmers and various parties engaged in the agricultural sector on the importance of health and environmental sustainability. Organic farming is agriculture that does not use chemicals but organic matter, instead. Consumers of organic plants are still limited to consumption by health conscious people. Many organic agricultural products are marketed through promotions and exhibitions that aim so that in the following years more people will switch to organic plants.

Organic agriculture according to the Indonesian National Standard (SNI) 2005 is a holistic production management system

that enhances and develops agro-ecosystem health, including biodiversity, biological cycle, and soil biological activity. Furthermore, IFOAM (International Federation of Organic Agriculture Movements) describes organic farming is a holistic agricultural system that supports and accelerates biodiversity, biological cycles and soil biological activities.

According to IFOAM (2006) the purposes of organic agriculture include:

1. Producing food with high nutritional quality and sufficient amount
2. Training patience and self-awareness in carrying out organic farming activities
3. Creating effective interactions with natural systems and cycles that support all existing forms of life
4. Restoring and fertilizing the soil so as to help preserve biodiversity to create a friendly and healthy environment
5. Encouraging recycling in farming systems by activating the life of microorganisms, flora and fauna and soil

Budiharsana (2005) states that consuming organic foods brings several benefits to the body, such as preventing disease, cleansing the body, resting organs, reducing body weight, making skin brighter, slowing down the aging process, helping the body's detoxification process and many others.

There are several reasons that make organic food highly recommended, including:

1. The survey results prove that organic food is far more beneficial for health.
2. The University of Copenhagen's research results revealed organic food is rich in antioxidants, protects against the risk of cancer, prevents premature aging, and prevents accumulation of toxins in your body.
3. It is proven that pesticide residues will never be washed clean because they have been absorbed into the fruit/vegetable.
4. According to WHO research results - about 3 million people / year suffer from poisoning from active pesticides.

III. PRODUCT QUALITY

The products offered by the company will affect the company's activities starting from designing, conducting production and operating systems, creating marketing programs, distribution systems, advertising and directing salespersons to sell. In general, the definition of the product is everything that can be offered to the market to meet consumer needs. According to William. J Stanton in Alma (2004: 139), products are a set of tangible and intangible attributes including color, price, product name, store name that sells (retailer) and factory service and retailer service received by the buyer to satisfy needs and desire. Whereas according to Kotler (2005: 84) the product is everything that can be offered to satisfy a consumer's needs and desires.

Factors Affecting Product Quality

According to Assauri (2001: 123), the quality of a product is influenced by the following factors:

1. Function of a product : what the product is used or intended for.
2. Outward form : the outer form factor contained in a product is not only visible from the shape but the color and packaging.
3. The cost of the product concerned : Costs for the acquisition of an item, for example, the price of goods and the cost of the goods reaching the buyer.

Product Quality Dimensions

According to Tjiptono (2008: 25) there are eight dimensions of product quality as follows:

1. Performance
2. Features
3. Durability
4. Reliability
5. Service ability
6. Aesthetics
7. Conformity with Quality (Perceived quality)

IV. PURCHASING DECISION

Kotler (2007: 223) states Purchasing Decision is several stages carried out by consumers before making a product purchase decision, while according to Chapman and Wahlers (1999: 176), Purchase Decision means consumers' desire to buy a product. Consumers will decide which products to buy based on their perception of the product related to the ability of the product to meet their needs. Several factors can influence consumer purchasing decisions, including:

- a. Personal Factors, which includes reference groups, family, roles and status.
- b. Social Factors, which includes work, economic conditions, lifestyle, personality and self-concept.

V. RESEARCH METHOD

Research Design

This research employed an explanatory research design and carried out based on primary data collected from the questionnaire. This research used a quantitative approach that works with numbers, data in the form of numbers, analyzed using statistics to test hypotheses or answer specific research questions and to predict that certain variables affect other variables (Creswell et al., 2010). The SPSS 23.0 statistical method (Statistical Product and Service Solutions) was used in analyzing data.

Population and Sample

The population in this study is the people of Malang who consume vegetables. Sugiyono (2008) suggests that sample is part of the number and characteristics possessed by the population, whereas according to Ferdinand (2006), the sample is a subset of the population, consisting of several members of the population.

Purposive sampling technique was used. According to Indiantoro and Supomo (1999), purposive sampling using a particular consideration, generally adjusting to the purpose of a study. The purposive sampling method requires that the respondent must have a criterion that is in accordance with the

research objectives. Criteria for samples that are suitable for the purpose of this study are:

1. Respondents have bought organic vegetables
2. Respondents aged over 18 years with reason that respondents aged over 18 years are able to
3. make a decision to make a purchase.

The determination of the sample of this study is based on the guidelines proposed by Kuncoro (2003). Sample determination is influenced by the analytical tool used. The analytical tool in this study uses Multiple Linear Regression, because the population is not known exactly, so the researchers determine the size of the sample taken based on the proposed rules of Roscoe (1975) in Sekaran (2006), namely:

1. A sample size of more than 30 and less than 500 is appropriate for most studies.
2. In multivariate research (including multiple analysis), the sample size should be several times (between 5-10) greater than the number of variables in the study.

Based on these statements the number of samples taken by researchers is a minimum of 75 respondents.

Operational Variables
Tabel 1
Operational Variables

| Variables | Indicators | Items |
|---|---------------------------|--|
| Product Quality (PQ) Hidayati, 2014 | Performance PQ 1 | PQ 1.1 Organic vegetables have a better nutritional content PQ 1.2 Organic vegetables are safe for consumption |
| | Features PQ 2 | PQ 2 Features of organic vegetables (settled brand) |
| | Durability PQ 3 | PQ 3 Durability of organic vegetables |
| | Reliability PQ 4 | PQ 4 Reliability of organic vegetables |
| | Services ability PQ 5 | PQ 5 Service ability of organic vegetables |
| | Aesthetics PQ 6 | PQ 6.1 The aesthetics of organic vegetables is looking fresh PQ 6.2 The aesthetics of organic vegetables have striking colors PQ 6.3 The aesthetics of organic vegetables have a tastier and softer taste PQ 6.4 The aesthetics of organic vegetables appear more natural PQ 6.5 The aesthetics of refined and less fibrous organic vegetables |
| | Perceived quality PQ 7 | PQ 7 Compliance with specifications on organic vegetables |
| Purchase Decisions (PD) Tangkalung, 2015 | Product selection | PD 1.1 Product purchases PD 1.2 Purchase other products |
| | Purchase frequency | PD 2.1 Repurchase now PD 2.2 Future repurchases PD 2.3 Repurchase of other products |
| | Purchase quantity | PD 3.1 Little purchases PD 3.2 Multiple purchases |

VI. RESULTS AND DISCUSSION

General Characteristics of Vegetable Consumers in Modern Markets

The general characteristics of vegetable consumers taken as respondents in this study are based on gender, age, marital status, education level, income level, number of family members, and employment. Based on gender, the majority of respondents were females as many as 60 respondents (80%), while male respondents were 15 (20%). Women are more dominant than men in buying vegetables, because in this case women are more knowledgeable about household needs while most men are busy to make a living for their families.

Based on age, most of them are respondents who have an age interval of 26-35 years (41%). The second largest percentage is adults aged 36-45 years (34%) and adolescents aged 15-25 years are third (25%). Overall, vegetable buyers are dominated by young mothers who begin to pay attention to the health of their families. The marital status of vegetable respondents was mostly married with 48 people (79.75%), while those who were unmarried were 27 people (20.25%), because respondents stated that people who were married had to provide healthy and clean food for his family. The number of respondent family members is 1-4 people (67%) and more than 4 people (33%). Most consumers have a family of no more than four so that consumers in fulfilling family needs are quite adequate, especially in consuming vegetables.

Based on the level of income obtained from the work of respondents, most of them earn IDR 2,000,000 per month – IDR 3,000,000 (as many as 46 respondents). Monthly income greatly affects them in buying vegetables in the modern market because most respondents who shop for vegetables in the modern market say they are able to shop for vegetables, although not regularly (every day).

Most of the respondent's education was Diploma graduates who acted as housewives. Level of education also encourages a person to have a better, healthier and better-quality lifestyle. Viewed from education, vegetable buyers are those with relatively good education and from the middle to upper class.

The Effect of Product Quality on Purchasing Decisions

Based on the results of data analysis, the regression model formed is $\hat{y} = 6.56 + 0.37 PQ$. This model shows a positive relationship between product quality and purchasing decisions. The results of hypothesis testing indicate that product quality has an effect on purchasing (Sig. <0.05).

The quality of organic vegetable products includes good and safe nutrients. Organic vegetables that also have clear brands are in demand by consumers. Organic vegetables have a longer resistance than non-organic vegetables and the community believes in the reliability of organic vegetables. The community also prefers to buy organic vegetables that look fresher with a softer taste. The results of the analysis show a coefficient of determination of 0.8. This shows that 80% of the diversity of purchasing decision variables is influenced by product quality. The remaining 20% is influenced by other variables that have not been included in the regression model.

VII. CONCLUSION

Based on the results of the analysis and discussion presented in the previous chapter, this study presents answers to the research problems as follows: It is evident that the quality of organic vegetable products which includes performance, features, durability, reliability, service, aesthetics, conformity with quality has a positive and significant influence on purchasing decisions. This shows that high product quality tends to create high consumer purchasing decisions.

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Prevalence of Agro-chemical Poisoning; with special reference to Organophosphates and Carbamate Insecticide Poisoning among Hospital Admissions of Nuwaraeliya District General Hospital, Sri Lanka from 2014 to 2018

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Abstract- In year 2016, there were 12,629 pesticide poisoning cases and 348 (2.75% of admissions) deaths were reported in government hospitals in Sri Lanka. Institution based descriptive study was carried out in District General Hospital, Nuwaraeliya, Sri Lanka to identify the prevalence (2018) and trends (2014-2018) of organophosphates and carbamate poisoning among hospital admissions. The study revealed that mean age of patients poisoning with organophosphate and carbamate was 31.36 (SD = 15.20) and highest number of the poisoning patients were identified in the 17- 49 years group. Proportion of male intoxication with organophosphate and carbamate was very highly significance than females ($p = 0.000$). There were 210 (93%) live discharges from the hospital, 6 (2.6%) transferred out for further treatments and 10 (4.4%) deaths. These deaths accounted for 1.4% of total hospital deaths ($n = 677$) in 2018. The average number of days of hospital admission was 3.2 per person. Trend of females admitted following intoxication of organophosphate and carbamate was reduced from 2014 to 2018 whereas trend of male was slightly increased. Not much fluctuation observed in the trends of variation with respect to gender and deaths. Collaboration among field health service and agriculture extension service is urgently required to prevent or control this situation in the country.

Index Terms- Agrochemical Poisoning, Organophosphates, Carbamate, Insecticide, Hospital Admissions, Nuwaraeliya, Sri Lanka

I. INTRODUCTION

With the advancement of intensive agriculture, use of agro-chemicals was remarkably increased worldwide. From those, more than 75 active ingredients are used as pesticides. With that, [exposure](#) to pesticides can occur and it can be through [inhalation](#), [ingestion](#), and dermal contact ⁽¹⁾. According to UN data, an average of about 200,000 people dies from the toxic exposure of pesticides per year across the world ⁽²⁾. The world health organization declared that pesticides-related intoxications in developing countries, have the highest percentages of acute

human intoxications either intentional suicidal or occupational exposures, as well as chronic intoxications ⁽³⁾. Occupational exposure can be occurred when preparing for use, storing, application and handling equipments such as sprayers.

In year 2016, there were 12,629 pesticide poisoning cases and 348 (2.75% of admissions) deaths were reported in government hospitals in Sri Lanka ⁽⁴⁾. On the other hand, it represents 0.2% of total hospital admissions and 0.72% of total deaths.

Pesticides are commonly used to commit [suicide](#) globally and locally, since they are inexpensive, widely available, and effective. It is estimated that two-thirds of all pesticide-related deaths worldwide are the result of suicide ⁽¹⁾. In Sri Lanka, organophosphates and carbamates are used as pesticides in agriculture and those have been identified as popular compounds to be ingested by community for suicides.

Organophosphates are chemical substances acted as cholinesterase inhibitors which affect on neuromuscular transmission of animal. Those are available in the forms of liquid, aerosols and or dusts and widely used in global agricultural sector as pesticides. In human, it can be absorbed through digestive system, mucous membranes and even through skin ⁽⁵⁾. Carbamates are mechanically and structurally similar to organophosphates and widely used as an insecticide. Exposure to carbamate is also similar to the organophosphate.

“Over the counter” availability of organophosphate and carbamate become a common modality of poisoning among the agricultural community ⁽⁶⁾.

Although agricultural extension workers are well educated to enable farmers to improve their crops using pesticide, they are unable to provide adequate knowledge on protective techniques, safe use and health hazard ⁽⁷⁾. The act no 33 of 1980 and amendment act no 6 of 1994 regulate the process of licensing, importing, packaging, labeling, storing, formulating, transporting, sale and use of pesticides in Sri Lanka.

Although it is well recognized that acute pesticide poisoning is a major public health problem in developing countries, surveillance of this condition in developing countries is scarce. The data available are not adequate to address the nature of the

problem and are usually limited to ad hoc studies that are neither compatible nor comparable with each other, making estimates and evaluations difficult to undertake ⁽⁸⁾.

An island wide study conducted in 1988, revealed that hospital admissions due to agro-chemical poisoning, stood at around 11 000 – 15 000 each year and the number of deaths during the same period varied from 900 to 1500 each year. About 75% of poisoning were due to self ingestion while accidental and occupational poisoning formed the balance. ⁽⁹⁾ In 2016, total number of hospital admissions due to toxic effects of pesticide was 12,629 (59.8% - male, 40.2% -female). The majority (70.5%) was in 17-49 years age group. There were 348 total deaths ⁽⁴⁾.

Principal agricultural districts like Kurunegala, Jaffna, Vavuniya, Nuwara-Eliya and Badulla recorded the highest incidence of poisoning ⁽⁹⁾. A study conducted to have time series analysis in Hospital admission data within the period of 1995-2008 showed that Hambantota, Monaragala, Nuwara Eliya and Colombo districts show an increase in the rate of admissions after pesticide poisoning ⁽¹⁰⁾.

Since Nuwaraeliya has been identified as a ‘hot spot’ for agro-chemical poisoning in Sri Lanka in most of the previous studies, analysis of recent hospital data on organophosphate poisoning is a timely need.

Burden of agrochemical poisoning mainly associated with the farming community. Nuwaraeliya is a home for series of food crops including up country vegetables such as Carrots, Beetroot etc. It has been revealed that high input farming practices are commonly available in the district and as a result, the chances for agro-chemical exposure is higher in its’ community.

District General Hospital, Nuwaraeliya (DGHNE) is the largest hospital and only tertiary care hospital in Nuwaraeliya district. It caters it service for people belonged to Nuwaraeliya district and some part of Badulla district ⁽¹¹⁾. As a starting point, analysis of admission data regarding organophosphate and

carbamate poisoning in DGHNE, would be important to understand the extent of poisoning among the community.

The study aimed to identify the Prevalence of Organophosphates and carbamate poisoning among hospital admissions in DGHNE in 2018 and to describe the trend of Organophosphates and carbamate poisoning among hospital admissions in DGHNE from 2014 to 2018.

II. METHODOLOGY

Institution based descriptive study was carried out in DGHNE, which is the biggest hospital in Nuwaraeliya district where primary, secondary and tertiary care provided for its catching population. Study period was 1st to 15th of May 2019. All the existing data of diagnosed patients poisoning with organophosphate and carbamate within the period of 2014 to 2018 were included in the study. Available secondary data of 2014 to 2018 in Indoor Morbidity and Mortality Report (IMMMR) was obtained and analyzed using Microsoft excel spread sheet and SPSS version 20.

Administrative permission was obtained from the Director of DGHNE to collect the data and to conduct the study.

III. RESULTS

Total number of 226 subjects were diagnosed as poisoning with organophosphate and carbamate in DGHNE during 2018. It represented 0.41% of total admissions. Mean age of patients poisoning with organophosphate and carbamate was 31.36 (SD = 15.20) years and range was from 1 year to 83 years. Mean age of female was 29.85 years (SD = 16.29) and it was 31.9years for males (SD = 14.92). There was no significance deference in mean age of two sex (95% CI for age = 29.37-33.35).

Table 1: Distribution of victims according to the age groups

| Age (years) | <1 | 1 - 4 | 5 - 16 | 17 - 49 | 50 - 69 | 70+ | N/Av | Total |
|---------------|----------|----------|-----------|------------|-----------|----------|----------|------------|
| Female | 1 | 0 | 9 | 37 | 6 | 1 | 0 | 54 |
| Male | 0 | 2 | 16 | 129 | 20 | 5 | 0 | 172 |
| Total | 1 | 2 | 25 | 166 | 26 | 6 | 0 | 226 |

Highest number of the poisoning patients were identified in the 17- 49 years group and 2nd was 50-69 years group. Twenty eight (12.4%) poisoning patients were below 16 years of age. Seventy six percent (n= 172) of those 226 patients were males. Proportion of male intoxication with organophosphate and carbamate was very highly significance than females (p = 0.000).

Out of these 226 patients, there were 210 (93%) live discharges from the hospital, 6 (2.6%) transferred out for further treatments and 10 (4.4%) deaths. These deaths accounted for 1.4% of total hospital deaths (n = 677) in 2018.

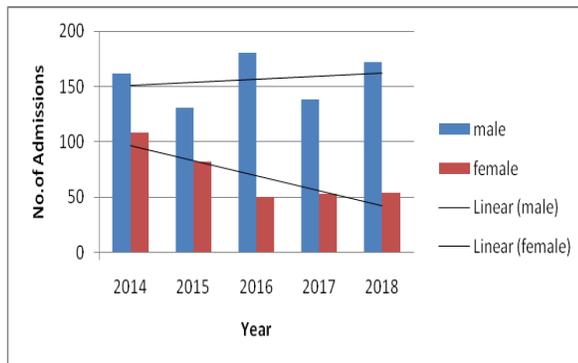
Table 2 : The deaths according to the age group.

| Age group | <1 | 1-5 | 5-17 | 17-50 | 50-70+ | 70+ | N/Av | Total |
|----------------------|----|-----|------|-------|--------|-----|------|-------|
| | - | - | - | - | - | - | - | - |
| | 4 | 16 | 49 | 69 | | | | |
| Female deaths | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| Male deaths | 0 | 0 | 0 | 2 | 2 | 5 | 0 | 9 |

Out of ten deaths, nine were males. Both age groups categories of 17-69 years and above 70 years claimed for 5 deaths per each. Total in-patient days counted for all patients admitted following organophosphate and carbamate poisoning in DGHNE in 2018 was 733 days. The average number of days of hospital admission was 3.2 per person.

Trend of females admitted following intoxication of organophosphate and carbamate was reduced 2014 to 2018 whereas trend of male slightly increased (Figure 1).

Figure 1: Male- female admissions following poisoning with organophosphate and carbamate and the trendline 2014-2018



From 2014-2018, the mean age of male and female admissions following organophosphate and carbamate poisoning was not very much fluctuated (Figure 2).

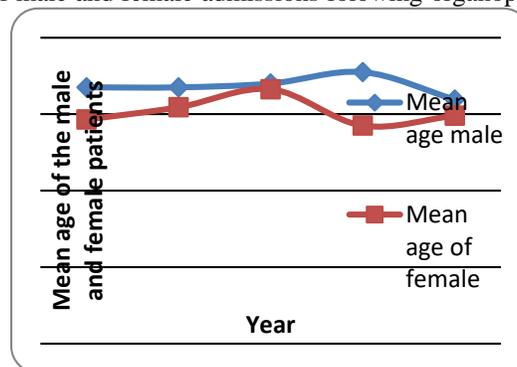


Figure 2: variation of median age of the male and female patients admitted following poisoning with organophosphate and carbamate 2014-2018

There is no very much fluctuation in total deaths of DGHNE due to poisoning with organophosphate and carbamate 2014-2018. The detailed information are illustrated in Table 3.

Table 3: Total deaths of DGHNE due to poisoning with organophosphate and carbamate 2014-2018

| Year | Male | Female | Total no. of deaths |
|------|------|--------|---------------------|
| 2015 | 8 | 0 | 8 |
| 2016 | 8 | 1 | 9 |
| 2017 | 6 | 1 | 7 |
| 2018 | 4 | 3 | 7 |
| 2019 | 9 | 1 | 10 |

IV. DISCUSSION

Organophosphate and carbamate poisoning causes huge burden to health in people of developing countries. Although the burden of this was totally preventable, it seems to remain as same for long period of time. This may be due to unavailable or inadequate preventive and control measures.

In DGHNE, poisoning cases following organophosphate and carbamate represents 0.41% of the total admissions and it has been accounted for 733 in-patient days. This is an economic burden to the country since it generates a considerable amount of cost to the health care sector which is a scarce resource for country like Sri Lanka. On the other hand, patients should bear the cost of lost man days due to hospitalization. It affects his and his/her household economy as well and the indirect consequences may be many more.

There were 10 deaths due to pesticide poisoning in 2018, which accounted for 1.4% of total deaths. Strictly adhere to protective measures, strong pesticide regulatory system and strong social support would have a role in preventing those admissions and deaths.

Most of the victims of organophosphate and carbamate poisoning were male and belongs to 17-69 age groups (85% of total). Those belong to labor force of the country and to young generation (Mean age 31.36 and 95% CI = 29.37-33.35) who would otherwise contribute to country's economy. Therefore, the total loss due to this hazard is immeasurable.

From those, 12.4% of victims were below 16 years of age and belong to future of the country. Limited issuing of the pesticides, providing proper knowledge on safe storing and safe use, social support and adolescence counseling would have definite role in preventing poisoning among those. The community should have adequate access to safety information.

Field staff in health and agriculture sectors such as midwives, PHIs and field level agricultural extension officers is the main sources of implementing successful preventive programs. In order to implement effective preventive program among the community, it is essential to revisit the responsibilities of these field level officers dealing with specially, farmer community, who frequently interact with agro-chemicals.

Inter-sectoral collaboration between agriculture, health, social and education services would give a better outcome in

preventive measures. Well established field health service and agriculture extension service in Sri Lanka will definitely achieve the success, if they continue to work together.

The number of deaths and victims of agro-chemical poisoning were higher than the most commonly addressed infectious diseases in the health sector. Unfortunately, there is no separate allocation in the health budget to implement effective programs to prevent or control this pathetic situation. Health managers and policy makers have to look in to this matter with an urge since this is a completely preventable scenario.

On the other hand, even though agricultural extension has a role to play in ensuring farmer well being, it can be observed that component is missing in today's production-oriented agricultural extension service. Therefore, it has become an essential and urgent need to incorporate farmer safety and well being also into its agendas in order to sustain the agricultural production process and save lives. Not only production related information, but also adequate attention should be paid to disseminate the knowledge on farmer safety and health such as protective techniques, safe use and health hazard of pesticides through competent field level agricultural extension officers.

V. CONCLUSION

Organophosphates and Carbamate insecticide poisoning is a totally preventable health hazard. It represents the considerable percentage of hospital admissions and hospital deaths in DGHNE. It mainly affects the young generation and work force and the prevalence remains quite same for a long period. Adequate protective measure is a must to implement immediately.

VI. ACKNOWLEDGEMENT

The generous support given by the Director, Deputy Director, and Medical record officers in DGHNE is greatly acknowledged.

VII. LIMITATIONS OF THE STUDY

Occupation of the victims and the mode of intoxication (occupational exposure, suicidal or homicidal) could not be explored in this study.

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Risk Factors of Internet Gaming Addiction in Adolescent: A Literature Review

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Abstract- Internet gaming addiction has received attention as a public health problem. Several studies have shown that internet game addiction adversely affects adolescents, such as anxiety disorders, depression, social disorders, mind problems, somatic complaints, rule-breaking behavior, aggressive behavior, academic problems, drug use and causing poor family relationships. This literature review aims to collect the results of the latest research related to risk factors for internet game addiction in adolescents. The results of the review literature are expected to be input into public health promotion and prevention programs, especially those related to game addiction. Literature search was conducted in three databases: PubMed, Scopus and Proquest with keywords: *cause, risk factor, adolescent, teenager, juvenile, youth, "online game", "online gaming", "internet gaming", "internet game" and addiction*. Merging keywords using boolean operators AND and OR. 13 articles were found that met the inclusion criteria. From the review results, it was concluded that addiction to internet games in adolescents can be caused by internal factors and also influenced by family factors, school environment and peers. Therefore, to prevent adolescents from being addicted to internet games, the role of parents and teachers needs to be improved.

Index Terms- Internet gaming disorder, internet gaming addiction, video game addiction, risk factors, teenagers

I. INTRODUCTION

Internet gaming addiction has received widespread attention as a public health problem that needs to be watched out. After the American Psychiatric Association (APA) included Internet gaming disorder in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) in 2013, the latest WHO also included game disorder as one of the criteria for mental illness in International Classification of 11th revised Diseases (ICD-11). However, unlike the DSM-5, the game disruption in the ICD-11 does not only refer to online games but also offline games [1].

Conceptually, addiction can be defined as primary, chronic, neurobiological development and its manifestations are influenced by genetic, psychosocial, and environmental factors, which are characterized by impaired control or compulsive involvement in certain behaviors even though the sufferer knows of the danger that can be caused [2]. While internet game addiction is the use of internet games repeatedly and continuously which can cause a significant impact on work and social functions [3].

Someone who experiences internet game addiction shows changes in the frontal lobes of the brain that control attention, executive function, and emotional processing, and these changes

are considered comparable to the brains of a heroin and cocaine addict [4].

Teenagers are an age group that is vulnerable to problematic internet use, including internet games [5]–[7], and adolescents who are more vulnerable to being addicted to internet games [8], [9]. Other studies also report that the age group of adolescents and young adults (16-30 years) is more at risk of game addiction than older age [10].

Internet gaming addictions in adolescents have a negative impact on anxiety disorders, depression, social disorders, thought problems, somatic complaints, rule-breaking behavior and aggressive behavior [11], academic problems [12]–[14], involved in consuming drugs and having poor family relationships [13]. Adolescents related to internet addiction and the use of problematic internet games have also reportedly attempted suicide attempts [7].

Although there are reports that show that excessive gaming is only temporary or is not a permanent condition [15], given the magnitude of the negative impact caused by internet gaming addiction, early prevention and identification among risky individuals still need to be done. Therefore, this literature review aiming to summarize the latest findings related to risk factors for internet game addiction in adolescents. The results of

the review literature are expected to be input into public health promotion and prevention programs, especially those related to game addiction.

II. METHOD

The literature search is carried out on three databases, namely: PubMed, Scopus and Proquest using keywords: cause, risk factor, adolescent, teenager, juvenile, youth, "online game", "online gaming", "internet gaming", "internet game" and addiction. Merging keywords using boolean operators AND and OR. The inclusion criteria chosen as the basis of the study are as follows: (1) written in English, (2) sample is adolescents (3) published as original articles but not in the form of reviews or case reports, (4) full text, (5) open access, (6) articles published from 2014 to 2019.

III. RESULT

Based on the search results with keywords that have been determined in three databases (PubMed, Scopus, and Proquest), it was found that 581 articles were then filtered to obtain 13 articles that were in accordance with the inclusion criteria. The search process and selection of articles used for this review literature can be seen from Figure 1.

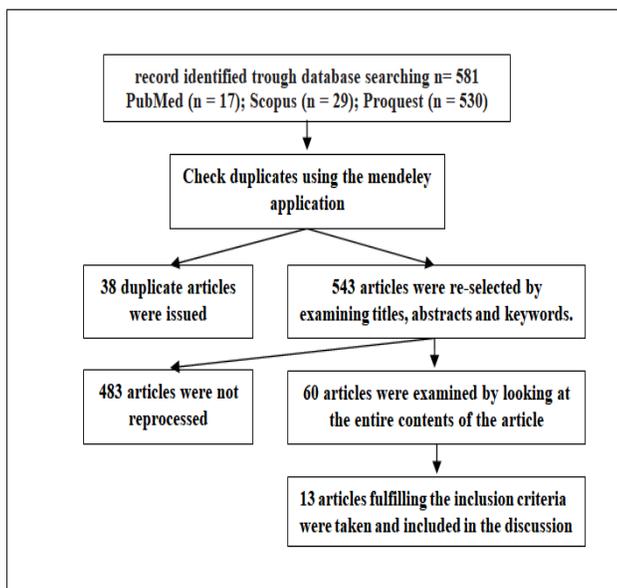


Figure 1. Search process and selection of articles

IV. DISCUSSION

Based on the results of a review of 13 articles that have been selected, there are several interrelated factors that can cause teenagers to become addicted to internet games. These factors are explained as follows:

Family Conflict

Conflicts that occur in the family can be a cause of adolescents falling prey to internet gaming addiction. This is evidenced from the results of research that shows that adolescents who have greater conflict that occur in families have a significant positive influence on internet game addiction in

adolescents [16], and reinforced by the results of other studies that also showed that significant gaming addiction was associated with those who had families that were not harmonious [17], [18].

Parental Control

Adolescents who have parents who are highly committed to work tend to be less concerned about their children's activities and hardly oversee the frequency of their children's play. Teenagers who have parents who are too busy working are found to be inclined to play games excessively [18].

Parenting

Internet gaming addiction can be influenced by family attitudes towards their child's game play behavior. A study found that adolescents who live in a family environment that is too free for adolescents to play online games either alone or with family members tend to become problem game players. The study also found that adolescents with problematic game behaviors started playing games from an age that was too young and had family members either parents or siblings who also liked to play games [18].

Youth Aggressiveness

Increasing aggressiveness of adolescents can be caused by conflicts that occur within the family which can then become predictors of internet game addiction. There is a significant indirect effect of family conflict on internet game addiction through adolescent aggressiveness. It was concluded that adolescents with higher levels of aggression due to family conflict were more likely to develop internet game addiction [16].

In addition, the aggressiveness of adolescents with internet game addiction is supported by the results of other studies, that externalizing symptoms are found to have a significant relationship with game addiction. The study found that both reactive aggression and proactive aggression had a significant influence on problematic games [19].

Attention Problems

A study involving 144 adolescents in United States found that attention problems can cause pathological games in adolescents. There are two reasons given to explain how the concentration of attention disorders can cause pathological games in adolescents, the first reason is that with associated impulse dysregulation can make teenagers more difficult to escape from video game play so that teens with attention deficit disorder problems can spend more when playing video games than those who don't. The second reason, generally adolescents with attention deficit disorder have lower academic values than normal adolescents, lack of satisfaction due to these academic achievements can lead to a compulsive nature of playing video games. [20].

Game type

The type of internet game chosen also affects the risk of game addiction in adolescents. The risk of gaming addiction is significantly higher in teens who prefer multi-player online games [17], [19], [21], [22] and shooting action games [21], [22]

Problematic game players have a strong desire to get an aggressive experience that allows them to shoot and kill freely. The virtual nature of internet games allows them to carry out violent and aggressive actions such as fighting, shooting, and killing with the support and appreciation of their playing friends [18].

Peer Victimization

Teens who experience victimization of peers are more at risk of experiencing addiction to internet games both directly and indirectly. The results of a longitudinal study for 2 (two) years involving 323 students in China showed that students who experienced peer victimization in grade 7 significantly experienced deviant peer affiliation in grade 8, then significantly had normative beliefs about aggression and internet game addiction in class 9. In addition, students who experienced peer victimization in 7th grade also had significant normative beliefs about aggression and addiction to internet games in 9th grade [23].

Teenagers who experience victimization such as bullying, physical, verbal, or relational aggression or get threats from their peers will lose their social position among their peers and feel isolated so that teens who experience victimization may play internet games to meet their psychological needs that can cause dependency excessive [23].

In addition, normative beliefs about aggression can also strengthen potential pathways that explain how victimization has an indirect effect on internet game addiction. Adolescents who experience peer victimization become addicted to internet games can be mediated by deviant peer affiliations, namely associating with friends who are involved in deviant behaviors such as stealing, fighting, and using alcohol, as a result these teenagers tend to have normative beliefs about aggression and in turn become teens who are at risk of becoming addicted to internet games [23].

Gaming Duration

Teenagers who play internet games for longer periods of time can develop problematic game behaviors compared to those who play games for less time [24]. Teens who experience clinical cases of internet game addiction can spend 5 times more hours playing games per week than comparison cases that don't have problems [22].

The amount of time that adolescents spend playing online games is significantly influenced by the motive for playing online games higher than non-problematic game players [24]. In addition, the amount of time spent by teens to play games can be influenced by the amount of time playing their peers' games [25].

Access to Game Devices

One factor that causes teenagers to become addicted to internet games is the ease of access to gaming devices. One study found that the majority (96%) of adolescent clinical cases of game addiction had a personal computer (PC) or game console in their room [22]. The presence of computer devices at home is found to be associated with longer game play times [25].

The ease of access to this gaming device will cause teens to have more opportunities to play games, so they can spend

more time playing games. The longer the teenager spends time playing internet games, the greater the likelihood that the teenager will become addicted to the game [24].

In addition, other studies have found that teens who live in cities spend more time playing internet games. These results are related to the ease and better support for access to gaming devices obtained by teenagers in urban areas compared to teenagers living in rural areas. [25].

A study in Hong Kong also found that teenagers who live in areas that have many internet cafes, have many opportunities to play games and also become more easily influenced by marketing strategies carried out by internet cafe owners, so that they can increase the motivation, frequency and duration of teenagers to playing games. The ease of access to internet cafes or internet cafes is considered to be a factor in increasing the interest of teenagers to play games [18].

Maladaptive Cognition

Maladaptive cognition related to games causes teenagers to feel smarter and smarter because they play games, and become obsessed with achieving higher status or rankings in games, so they will be able to spend more time playing games (Wong & Lam, 2016). In line with these results, other findings also found that maladaptive cognitions related to games such as overestimating gifts and game identity, feeling excessive dependence on games to meet self-esteem needs, and making games as a method of gaining social acceptance had a linear positive relationship with symptoms of game addiction in teenagers. Teenagers who are addicted to the game will be more motivated to fulfill their psychological needs and to forget the problems that occur in real life through the world of virtual games [24].

Adolescents who have maladaptive cognitive related games tend to have preoccupations with unfinished goals in the game being played, so plan ahead to complete the game. In addition, teens also feel more in control when playing games [22]. Maladaptive cognition related to games causes teenagers to experience game addiction not only in the form of positive expectations of confidence, but also negative expectations of the game's beliefs such as the belief that someone will not be able to overcome the problems they face without playing games [22].

Academic and School Environment

Smaller commitment to schools was found to have a significant negative influence on internet game addiction. With the results of the findings it was concluded that greater commitment to schools could be a factor that could prevent adolescents from becoming addicted to internet games [16].

One study found that game addiction was significantly more likely to occur in those who had poor academic performance [17]. With poor academic results, teenagers will feel failed and feel inferior, so they have the possibility to escape to internet games, and risk being addicted to internet games [18], while students who have better academic progress in school and positive attitudes toward school will spend less time playing video games [25].

Academic demands on schools can also determine the possibility of teenagers to experience addiction to internet games. Students who are educated in schools that have lower academic

demands tend to have a higher likelihood of becoming internet game addicts more than students who are educated in schools with higher academic demands and have denser activities [21].

Shyness

Having excessive shame is found to be the cause of adolescents experiencing game addiction, even teenagers who have excessive shame are predicted to have a 1.6 times higher chance of experiencing game addiction than adolescents who do not have excessive shame [19].

Game as a Coping Strategy

When adolescents are unable to solve various problems such as anger and frustration, anxiety and depression experienced in real life, teens choose to play games to eliminate the negative influence of the problem [18]. Increased anxiety associated with symptoms of mental illness can also cause adolescents to make video games as coping mechanisms [26], and using internet games as a coping mechanism was found to have a positive relationship with symptoms of internet game addiction [26].

Sense Of Coherence

Sense of coherence affects the amount of time teenagers spend playing games. Younger boys (13-15 years) with weak and moderate sense of coherence were more likely to play action games or war games for 5 hours or more per day compared to boys who had a higher sense of coherence. The possibility to play action games and war games for five hours or more per day is also found in younger girls and with a weak sense of coherence [27].

A sense of coherence has more influence on the time spent playing games in male adolescents compared to adolescent girls. From comparisons between groups of boys and groups of women with the same age range (13-15 years) at a level of weak coherence it is known that men have a higher probability of playing action games or war games for 5 hours or more per day. And the same results were found in the same age group and moderate levels of coherence.

V. CONCLUSIONS

Internet gaming addiction in adolescents is not only caused by internal factors such as aggression, excessive shame, impaired concentration, lack of sense of coherence, maladaptive cognition associated with games and excessive motivation to play games, but is influenced by the family environment, school environment and peers.

In addition, excessive play time and continuous causes teens at risk of experiencing addiction to internet games. The amount of time spent by teenagers to play internet games is caused by the many opportunities for playing games, which are caused by the support of playing games and because of the lack of attention from those around them.

Stopping or completely prohibiting teenagers from playing internet games may not be the right solution, because internet games have become part of today's technological advances. But supervision of children and restrictions on playing time can be a better solution. In addition, efforts need to be made to improve the relationship between parents and children and provide a

variety of other positive activities that can reduce the time teenagers play games.

Some studies only link the risk of game addiction to the duration of child play in one day, but we did not find a study that measured how many months or how many years a teenager who is at risk can become addicted to games when playing internet games consistently every day. Therefore we propose that further research can be conducted on this subject.

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“One and Only One Currency May well Save the World Economy”

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ABSTRACT

The main objective of this research study is to determine that circulation of all national currencies is a fence to the growth of world economy due to the flexible exchange rates, lack of international trades, foreign investments, and new technology, inflation, and currency crises. This research study is conducted through qualitative analysis method by introducing a lumpy descriptive theory of One Common Currency May well save the World Economy. This theory is tested and supported by Authors' supporting arguments, written books, expert views, scholar journals, official reports, academic research websites, and previously researched papers. The study contains the solution to the problem by hosting a global currency in the world market. In this research findings, global currency tends to remove exchange rates such that prices of goods and service will not be affected by the conversion cost. Throughout this research discoveries, an increase in international trade, improvements in production and technology, zero inflation, increasing employment were the notable outcomes of applying global currency. Since the world economy has not experienced the flow of global currency that is why significant examples of Euro Union are presented to supports the effects of a single currency. Based on these findings, these indicators are assumed to be the factors of world economic growth. On the other hand, there are a few contradictions to the use of global currency in the world economy. This research study found out that global currency will not increase international trade because there will be too much competition which new and old firms in the developing countries which will not be able to race with firms from developed countries. Employment will not increase because there will be only substitution of skilled labor in the market. New technology will replace human labor force which will increase unemployment. Only one type of inflation will be removed but not all types of inflation such as the excessive demand and limited supply inflation. Together, the concept of global currency is supported to draw a conclusion of global currency impacts on the world economic growth.

Key Words: Economic growth, Currency crisis, Price Discrimination, International Trade, and Exchange Rates

1. INTRODUCTION

The world was consisted of 76 countries in 1947 with almost 70 currencies but today, there exist 193 countries with 180 currencies that has been a big change during the last 60 years. The increase amount of international trade and financial assimilations motivated weak currencies' nations to join other strong currencies. For example, around 12 European countries agreed on a single currency, Argentina, Hong Kong engage a currency board with U.S. and many other countries are adopting to dollars such as Ecuador, and El Salvador. Besides, Estonia and Bulgaria agreed on currency board with German Mark but now entered in to Euro Union. The very remarkable examples that happened much earlier of join currencies are the French franc zone in Africa, the Eastern Caribbean Currency Union, Panama with the United States, and a few others (Alesina 2006). The idea of a single currency is not that much new because it been existed and remained undebated in various forms since 1700s due to the complexity of a single currency theory. In 1930s. Keynes and White researched on single currency that exposed much more to the attention but MIT economics professor Kindle Berger made it much more branded by saying “World Money with World Monetary Authority” (Neuby 2017). The lumpy idea of using a particular currency around the world became recommended since “1960” which was later introduced after the Second World War (Whit Bourne 2014).

The motivation of using common currency arises because the use of many currencies has been a common problem to the economic growth of all countries. Numerous money crises caused by the use of national currencies. In “1971”, the United State deferred the “convertibility” of US dollars into Gold for foreign central banks that obliged other national currencies to depreciate against US dollar as crisis happened (Jahnsen 1973). During “1919”, the French crisis took place when the Franc was “unpegged”, as a result, the exchange rate of Franc declined against other national notes and inflation took place in the country (Schartz 1997). The use of national currencies is a source of currencies crisis such that affects not only the economy of a country of origin but also other most economic associated countries.

The use of national currencies is believed to decrease the growth of world economy by a simple change in the values of currencies. The change in values affect the prices of goods and service both in domestic and global markets which cause price discriminations. The

variation in prices causes inflation which lowers the amount of foreign investment, decreases exports and increases imports. In such situation, countries who use different currencies do not better off each other and face a drop in the level of international trade that offsets the growth of world economy. If national currencies are not replaced, the global economy will face big challenges toward its growth such as unexpected global currency crises. Thus, the use of a global currency is a mean to grow the world economy by removing the exchange rates.

The practice of national currencies around the world is a notable obstacle to the growth of world economy by having their different faces of values. The unstable exchange rates of these currencies source the economic problems such as loss of market, price increase, inflation, decrease in foreign investment, and decrease in net exports and supply. To illustrate it, the sharp drop of Russian “ruble” affected the economies of Armenia, Georgia, Kyrgyzstan, Turkmenistan, Uzbekistan, Moldova and Ukraine (Walker 2015). The fall of Russian currency threatened the regional market as well as affected negatively other countries’ currencies. A change in one country currency affects other countries’ currencies which is a serious economic threat to the world economic growth. In 2015, the currency of china devalued by more than 2 percent which shocked the global market, decreased china’s products prices and also appreciated the US currency that reduced the US exports (Group 2015). Thus, the flexible exchange rates create challenges to the world economy which is a major barrier to the world economic growth.

In addition, price discrimination is a barrier to international trade due to the existence of many currencies. Why the same products have very difference prices in different countries? It is not only the addition of custom duty or other transportation cost to the price of products but it is the cost of exchanges that added to the price of products. It is the difference of currencies’ values that increase the prices of same products. Suppose a Japanese car is priced ten thousand dollars in United States but the same car is priced four hundred thousand Soms in Kyrgyzstan. Exchanging the Kyrgyzstan Som to dollar by the current exchange rate which is one dollar equals sixty eight Som, it becomes five thousands and nine hundreds US dollars. The prices differ because of the different values of Japanese Yen, US dollar and Som. As a result, many Japanese cars could be sold in Kyrgyzstan compared to the United States. These different prices will reduce the number of Japanese exports which is a barrier to international trade.

The use of currencies is not the only problem to the world economy but it is also the problem of each country economy. If the use of national currencies affects the world economy, it will affect all domestic economies which will result in lowering imports and exports. It will also increase unemployment, poverty, and inflation that affect the national societies. Since the problem is severe both to the economic growths and societies that is why the research on using a common currency is essential in order to find a better solution for it. Exposing the problem and finding solution will be an advantage to global economy. This research study states that global currency will eliminate the conversion costs, enhance international trade, the increase of foreign investment, and remove currency crises. All these discoveries will grant the opportunity to the growth of world economy.

The Concept Summarized: One Global Currency as a Mean to World Economic Growth

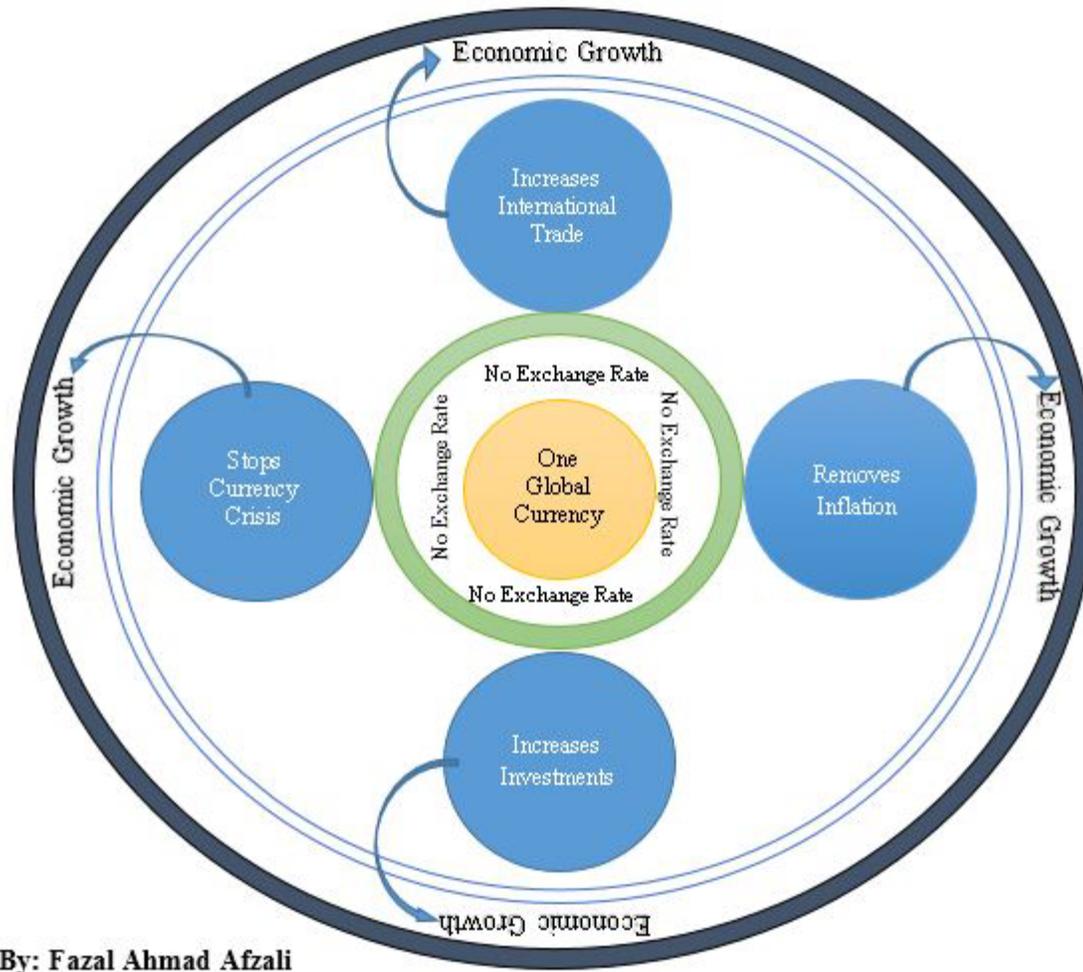
“One and Only One Currency Could Save the World Economy” suggests that let the world to have one common currency such that all national currencies would be converted to it in all international transactions with a fixed exchange rate. The fixed exchange rate means that no national currencies will be appreciated or depreciated against this one global currency which this fixed rate would be allocated by international monetary organization. The objective of this global currency is to oblige all international investors and consumers to pay through global currency with stable exchange rates against their national currencies. Besides, the global currency will be the only conversion currency through a secure rate which means that all the national currencies are banned to convert each other among themselves as this is also one of the main objectives of the global currency. To put it in example, suppose that Afghanistan and India have regular trade connections and both have their national currencies. To pay after the trade, both national currencies should be converted to one global currency with a fixed exchange rate and also Afghanistan and India should not be allowed to convert their national currencies among themselves either through stationary or floating rates because then the idea of a single global currency remains not beneficial and insignificant.

On the other hand, the national currencies are the cultural heritages and values that most of the countries are in deep interest of keeping such cultural legacies. Due to its ethnic importance, it seems impossible to remove all the national currencies but instead to pick one as global currency for all national and international transactions will be an option, however, so many national currencies put all the domestic and world economies in great challenge to their growth as noticed above. So the existence of national currencies will be just symbolic for cultural importance and besides valuable only in domestic economies to remain their cultural vibrant and easy domestic payment system.

The author “I” believe that one global currency will be a mean to develop the world economy through several solid channels. The existence of one global currency will allow to international trade to increase because there will be no any currency conversion risk that investors will lose during currency converting. One world currency will be the best option to stop world or countries’ currencies crisis because all the previous crises were triggered by the appreciation and depreciation of national currencies against each other’s. Furthermore, the presence of one global currency will also enhance both domestic and foreign direct investments through elimination

of exchange risks and conversion costs. Finally, it is strongly believed that inflation will be removed due to the inexistence of price discrimination which is caused by conversion costs. So one global currency is believed to bring such significant changes that all of them are strong factors of world economic growth in many ways.

Global Currency Module in Figure



By: Fazal Ahmad Afzali

Objective of the Study

This research study establishes the theory of using a single note as a mean of world economic growth. The purpose of this research is to expose the negative impacts of all national currencies around the world. It will also provide a general understanding of using global currency in the world economy. It will indicate the impacts of using one common currency on global economic growth. This research study will focus to find a proper explanation for two questions. First, how the flow of global currency will grow the world economy? The question asks if the world economy has one single currency, what factors will grant the growth to the world economy. Second, does the practice of one global currency motivate the world economic growth? This looks for factors that really enhance the growth or if these factors are sufficient for the growth of world economy. Answering these questions will be the final result of this research study.

Many economic terms are challenging to understand in research papers. In order to avoid these ambiguities, a few key terms that will be misunderstood are defined as follow.

Economic growth takes place when Per capita output grows over time such that growth rate does not incline to reduce, somatic wealth per worker raises over time, the rate of profit to wealth is nearly continuous, the ratio of physical wealth to productivity is nearly continuous and the portions of labor and bodily wealth in national income are nearly continuous (Barro 2004)

Currency crisis: The risk due to appreciating or depreciating of currencies of countries. The devaluation of currencies are caused by “pegging” or other policies such as central banks policies (Kuepper 2018).

Prince discrimination occurs when a firm or firms sell the same type of products at very different prices due to customer benefits, tariffs, and maybe currency appreciations and depreciations (Simonm P. Anderson 2008).

The fixed exchange rate is a regime where government has already agreed to buy to sell any amount of currency at a preset rate which in such case, the rate is connected to one or a bag of currencies (Labonte 2004).

Limitation and Delimitation:

The limitation on this research is lack of prior research studies on the use of common currency in the world economy. There are not many research papers, books, or journals written to support my research topic that is why it was challenging to find enough published resources. Lack of experts who have knowledge on currencies risks. During this research, it was quit challenging to access expert on conducting interview.

This research paper is delimited to understand the problem in both domestic and world economy. Single economy is not focused only because the problem is common between them. National currencies risks and crisis are used to know the existence of the problem. Other irrelevant economic risks and crises are not focused in this research. The use of one common currency is used as a solution to the problem. Other solutions are not focused because common currency is chosen as the best fit.

Methodology

This research study follows the qualitative secondary data to support and test the hypothesis of using global currency in the world economy because the quantitative analysis was not possible due to the inexistence of such relevant data and research type. The secondary data is collected from books, scholarly journals, and online search engines to support the presence of the problem and find the solution of the problem (ACAPS 2012). Particularly, these data sources are from International Monetary Fund, World Bank, United Nations, research institutions and other government websites. The data collected from these assigned sources is mainly about the problem of many currencies and the demand for the use of one common currency in the world economy.

This is a conceptual method which theoretical assessments are used to investigate the problem and find solution through texts and behavioral views of experts written in documents and online research engines. Arguments and views that had close connection to the problem and solution were benefited during this research. Specific illustrations of similar situations are sourced in this study. For instance, the Euro union, US Dollar, West African monetary zone and central African economic and monetary community (Volcker 2002). The method uses a collection of different understandings and making a new interpretation for this problem solution.

LITERATURE REVIEW

In 1961, Robert A. Mundell introduced the theory of “A Theory of Optimum Currency Areas” where he proposed one single currency for a specified region such that the currency zone is not clarified in his research theory. He conveyed his theory through analyzing the example of Canada and United States as one region and East and West. He summarized that application of a single currency in a specific region would be set by the will of central establishments at the cost of unemployment in deficit countries but regions or countries with flexible exchange rates or in other words countries with different national currencies would set the employment at the expense of inflation. He argued that both pacing inflation and unemployment would be possible partially between these two regions such as Canada and United State or East and West. Finally, he noted that the currency area is no the world which definitely means that one and only currency is not hypothesized by Robert Mundell (Mundell 1961).

In June 2006, Richard N. Cooper researched on the proposal of a common currency in rich democracies such as the United States, European Union, and Japan. This research exposed three justifications for proposing a common currency in industrialized democracies. The first projection suggests that international financial transactions will grow relatively with international trade in goods and services such that exchange rate will be even more significant. The second prognosis determines that the real shocks will not be unbalanced in these large economies. The third prediction is that financial markets will be changeable as they were before in the past (Cooper 2006).

In May 2001, Kenneth Rogoff conducted a research on the suggestion of a global currency with coming up unexpected findings. The author argued that the exchange rate affects the prices wildly specially on domestic goods and services and they can impact foreign direct investment and trade which a global currency can eliminate these impacts. But there is a disagreement on the effects of exchange rates, says that exchange rates have impacts on the prices on the long run not in short run. Besides, it is well revealed by the author that markets of goods and services are less assimilated that one can picture because additional to other costs, currencies costs are also existed in the market such that make the current accounts smaller comparing to saving and investment. Thus, global currency can remove them but there are still two sides of the coin. The author also pointed some basic implications for exchange rates such as the loss of independent monetary policy (ROGOFF 2001).

F. A Hayek discovered very deep understandings about global currency in his book titled: Denationalization of money, Argument defined 1999. One of the remarkable advantage of denationalization was preventing governments who protect the currencies against the harmful consequences and prevent them from engaging them. Besides, the governments will not be able to hide the depreciation of the money, avoid money outflow, capital, and other resources that tend to destroy common market (HAYEK 1974).

In 2010, Richard W. Rahn introduced the theory of “A Constant Unit of Account” which is similar to idea of one Global currency. This research paper is a re-glance on the same issue of one world one currency. He pointed that in an idyllic world, we would have one currency that will not allow inflation or deflation, and also no political influence by any countries. The existence of such currency will diminish the costs of transaction, investment and exchange and further any relevant risks. The author argued that it may not going to happen in such conceivable future (Rahn 2010).

In 2003, Michal Šoltés researched on the advantages and challenges of a single currency in Europe through a contribution in discussion. It is resulted that there has been an increase in the trade growth and macroeconomic development in the Euro zone or in the Euro-Union. Besides, it also provided a significant growth in competition, specialization, and modification of production. On the other hand, a single currency in Europe gave rise to various abilities of member states to cope with economic changes (Šoltés 2003).

In 2014, Paluku Kazimoto discovered significant inferences in the study of the role of single currency for the country’s economic development: A case study of the East African Community. The author researched through a descriptive analysis which the data obtained from expert arguments and ideas. The final result showed that adopting a single currency will enhance the economic development of East African Community through enhancing currency stability, reduction of financial risks, transaction costs, exchange rates, improving price transparency, and drop of inflation (KAZIMOTO 2014).

Research Gap:

Throughout this very limited literature review, the researcher discovered a few and unique remarkable gaps in the study of One and Only Currency Could Save the World Economy. First, one single currency is not proposed by any previous researchers in the history of economic theories that is a distinctive and supportive gap in this study. Second, many previous researchers introduced global currencies only for specified regions or continents which had good feasible predictions such as Europe Union and United States and Canada but again not proposed for the whole world. Third, the result of this study is completely different form other relevant “not the same” studies. For example, the authors only pointed the issue of inflation and price stability but this study contains more than those. Fourth, the researchers who completed research regarding global currency are not in full favor of one currency application but this papers highlighted significant inferences that request its application not today but maybe in the near future. Fifth, this is a completely different theory of the author and that is why it is different in many aspects compared to other researchers.

2. Findings

Hosting a single currency means stable exchange rates and no conversion costs because there will be only one currency circulating in the world economy. It is estimated that the annual conversion cost of currencies is four hundreds billion dollars (Bonpasse 2006). This amount of money is charged unequally because weak currency countries are charged more comparing to strong currency countries. Thus, by bringing this change, several economic factors will face an increase such as international trade, investment, shifting new technology, removing currency crises, and low inflation.

2.1 One Global Currency Enhances International Trade:

The flow of global currency will increase the cross border trade among countries which is a good step for the world economic growth. This is argued that international trade is increased when a single currency substitutes several national currencies because it eliminates the exchange charge that take place during transactions. Assessments shows that countries with same note conduct trade three times

more than those with different currencies (Rose 2000). To illustrate, the introduction of Euro greatly increased the regional trade. The existed exporters increased their production because of no exchange costs and the domestic firms also started to export because of the less cost opportunity (Volker Nitsch 2008). The increase of international trade will let each country to access goods and services without much cost and limitations.

The statistical evidence indicates that there is a durable connection between global trade and economic development. It is argued that trade and economic growth are depended on each other. If the trade grows, the economy grows and if the economy grows, the trade grows (Sharma 2013). Trade is assumed to assist the proficient distribution of resources, develop technology, increase competition in both markets and improve productivity. The concept of economy identified trade as an important channel that affects the growth of economy (Matthias Busse 2012). Berg and Krueger argued in their research survey that openness of international trade has strong relation with the growth of economy (Ramstetter 2006). Thus, the increase of international trade motivates the economic growth through two factors. First, it increases the productivity of a country and second it allows countries to allocate their resources efficiently (Daumal 2011).

On the other hand, new firms will not cope with in increased competition in both domestic and international markets though they are not concerned of exchange rate risks that affect the price of goods and services. There will be very small chance for new firms to compete with firms that existed for long time in the markets because of less proficiency in production and knowledge about the market, lack of technology and lack of labor experience (Suranovic 2002). Goods and services provided by old firms have lower prices comparing to new industry. The small business administration announced that fifty percent of small business are failed in the first year and ninety percent fail in five years (P. Schaefer 2018). It is read from these arguments that increase in international trade harms the domestic industries which affect the domestic economy. So in one hand, one global currency increases international trade which is a factor of economic development but on the other hand, the global currency creates too much competition in both domestic and international market which is a barrier for new firms to compete and survive.

The same time, it is reasoned that increased production and international trade always do not contribute to economic growth especially for underdeveloped countries because international trade will exist twofold economies which developed countries will offset the production, exports and even domestic production which is not gainful for poor countries (Suman 2019). The reason behind this is that poor countries are less able to compete with developed countries in terms up production because of skilled labor and technology deficiency. Increasing production and international trade by global currency will remain the economies of underdeveloped countries the same which are also part of the world economy. One can argue that global currency can stop currency crises which increase production and international trade but they will affect the economies of countries both positively and negatively.

2.2 One Global Currency Increases both Domestic and Foreign Direct Investment

The use of global currency increases the amount of both domestic and foreign investments which is another leading factor of world economic growth. The global currency influences the foreign investment in three ways. The inexistence of exchange rates, the elimination of transaction cost that occur during converting one currency to another currency and clear prices which the prices of goods and service are based on the quality not based on the country currency power (Marián Dinga 2011).

The increase of investment due to global currency existence fosters the economic growth by increasing employment in the countries. The Investment as an economic growth factor tends to increase employment by establishing small businesses in countries when they find opportunities. It is also argued that when a company opens a branch of existed business in a foreign country, it creates new jobs. The United States is a good example because 5.3 million Americans work in foreign invested businesses (Thomas 2013). The employment increases the income of people as people incline to save some amount which is an increase in private saving of the country. Having said that foreign investments increase employment in host countries but it is still argued that foreign investments does not increase net addition in employment. The employment due to foreign investments is just substitution of employees. For instance, Japanese auto companies invested in the United State substituted the employees from US Auto companies. There is no increase in employment by these foreign direct investments. Thus, those US Auto factories lost their market toward Japanese companies (Kurtishi Kastrati 2013). If the foreign investment does not increase employment then employment does not affect the growth of host country economy which is pushed by one global currency.

Foreign investment transfers modern technology from one country to another that influences economic growth. Foreign firms that invest in other countries are great and better in technology compared to domestic firms such that improve the productivity of domestic firms (Carol Newman 2013). European and Japanese companies started to produce speed trains in China by mid 2000s such that the local firms gained the technology brought by these foreign investing companies and now competing with the same companies (Hill 2012). The standard neoclassical growth model undertakes that low-cost technology is transmitted by locating common production functions through countries. The model assumes that improvements in technology results in economic growth (Carol Newman 2013). Thus increasing investment increases technology which results in economic. It is also possible that foreign investments will transfer poor technology which will decrease the interest of domestic firms in production and also it will also lead unskilled labor force comparing to the appropriate technology (Tran 2015). If shifted technology raises unemployment, then it negatively affects the host country economy because it will increase poverty and lower national income. Also, if poor technology is transferred, the labors remain unskilled and quality of production decreases. Thus, it is argued that the transfer of technology does not contribute to the economic growth of host country. So global currency helps to growth the world economy by increasing foreign direct investments through the increase of employment and new technology but still, there are disagreements regarding poor technology shifts and unemployment substitutions.

2.3 One Global Currency Eliminates Currency Crisis:

Not only those, global currency will abolish currency crises that weaken the economies of developing countries. The answer for the question of how a currency crisis takes place would be that a currency crisis occurs when a typical currency faces decrease in value that affects the economy of that country negatively through uncertainty of exchange rates (Kose 2013). There will not be national currencies in the circulation anymore and the exchange rates are not existed thus, crises will not take place. One of the ways how global currency eliminates the currency crisis is that it removes the variability in exchanges because only one currency is flown in the world economy (Biznisa 2013). Since there will not be currencies conversions which mean no devaluations and valuations because only a single note is used, thus, there will not be currency crises. So global currency will eliminate the currency crisis. The removal of currency crises is a long term economic supporter for the world economy.

The world economy has faced several currency crises which the two notable crises are 1998 Russian Crises and 1997 Asian Crises (Ray 2015). During the Asian crisis, many countries' economies were affected such as Philippines, Hong Kong, Malaysia, and Singapore (Woo 2000). Russia, a notable case of the Asian crisis which is affected badly because it lost fifty percent of its industrial production and the economic situation changed to poorer (Gromyko 1998). Countries who are depended on international trade are affected by currency crises because they are interdependent in economic resources. So finally, one currency could remove currency crises through fixed exchange rates.

2.4 One Global Currency Abolishes Inflation

More to the point, global currency will decrease the level of inflation around the countries which will help the world economy to grow. Inflation is the lost value of money which affects the prices of goods and service to rise above average (ReserveBank 2004). Printing more money also increases the level of inflation in a country and countries who print more money have higher inflation (Ragan 1999). In the existence of a single currency, money will not lose its value because there is only one note which has its own value in every country. Prices will not change due currency conversion because there is no exchange of currencies that affect the price of goods and products. Printing more money will not be in the control of each country because only the organization International Monetary Fund will provide printed money (Michael D. Bordo 1999). The sources that cause inflation will be eliminated by using a single currency in all countries.

Now the real question is that how the removal of inflation by global currency will contribute to the growth of world economy. Inflation decreases investments because investors will not have returns on their investments due to the additional rise in purchasing power of consumers (Allians 2010). Also, inflation misleads the future profit of investment which allocates higher prices of goods and service used in investing projects that lessen the amount investment and economic growth (Gokal 2004). Since inflation is removed by global currency which means that in nonexistence of inflation, investment and profits will increase. Many models resulted that inflation has negative effects on saving because, in high level of inflation, there will not be enough income to save that upset the increase of investment (Vaibhav Chaturvedi 2008). Instability of upcoming prices will decline the amount of investment which will decrease capital in the economy. Investors will tend to invest in short term investments rather than long term investment that will shrink the growth of economy

(Munyeka 2014). Thus, it is only the global currency that eliminates the inflation and leads the world economy to growth by saving and investment.

Nevertheless, that global currency removes inflation but it will be only one type of inflation. There are still other rationales of creating inflation in countries which would spread to all countries. When the demand exceeds the supply of goods and services or when there is limited supply for goods and services, in such cases the prices increase of the same goods and service which create inflation (Amadeo 2019). Inflation is not removed because of currencies effects on goods and services price, it is simply by the excessive demand. There will be still negative effects on investment and saving which again will prohibit the world economy to grow. So global currency will not remove inflation completely but it will remove only currencies' inflation which is not enough to the growth of world economy.

Discussion

This study was carried out to test the negative impacts of flowing national currencies on the growth of world economy. It was intended to determine how a common currency contributes to the world economic growth. It was projected to uncover the various aspects of using global currency in all countries for the purpose of economic growth of each country which will grant growth to the global economy. The research study found different views that a common currency will empower the world economy through removing exchange risks, increase of international trade, increase of both domestic and foreign investments, transfer new technology, increase of employment, remove inflation and remove currencies crisis. However, there are still different beliefs that oppose the arguments that a common currency will not fully contribute to the growth of world economy.

Based on the research, the study showed that using global currency grows the world economy by removing the exchange risks that were involved in national currencies. Hence there are not numerous currencies that is why the cost of conversion is removed. Removing conversion cost motivates several economic activities for the betterment of world economy such as the increase of international trade, investment, and production. Together, these economic activities contribute to the economic growth of the world economy as they were found through this research study. In a previous research regarding common currency, it is argued that a single currency removes both direct and indirect costs of exchanging currencies (Economics 2019).

This research found that global currency will boost the level of international trade because traders do not face exchange risks and conversion costs. The export will increase which will inflow cash to the country of origin. International trade increases employment abroad which will increase labor income and remove poverty. Earlier researches showed that a shared currency increases trade with a very high level and provides more gains for customers in the union (Rose 1999). Thus, the global currency empowers the world economy by increasing international trade because trade is the basic factor of economic growth. On the other hand, the study also showed that if there is much international trade across countries then there will be more than enough goods and services which discourage the domestic firms of countries to produce. One reason is that domestic firms do not have efficient technology and labor skills to produce the quality products. Second reason is that there will be so much competition between foreign and domestic firms which new firms will not be able to compete with foreign firms (Suranovic 2002). International trade creates imbalances in producing goods and service between developed and developing countries. As result, new and domestic firms will be stopped and foreign firms will control the market. Thus global currency will not contribute to the growth of world economy by increasing international trade, instead, it will fail to grow the world economy well enough.

The study revealed that the existence of global currency enhances both domestic and foreign investment which are the basic dimensions of both domestic and global economic growths. Since the world did not experience a common currency that is why Euro as common currency for European Union is a proper example. The flow of Euro increased the internal investment because of better price stability, sound free finances, small interest rates, investment and employment, and securing full benefits of the EU's inner market, better price transparency, improved competition and great and runny financial marketplaces inside the Union (Currency 2017). The investments create more jobs both in the country of origin and abroad which increase the labor income. Studies conducted for the same purpose showed the similar interpretation. To illustrate, in 2013, foreign investment hired six point one million people in the United States (J. R. Schaefer 2016). This supports that investment increases employment either domestically or abroad. This study showed that increase of labor income rises the amount saving which rotates the cycle of investing as this is another factor of growing the economy. The practice of global currency boosts investments which increase employment and labor income as they are the core supporters of world economy. The research revealed a different view that the increase of investment does not increase jobs because it just substitutes labors from one firm to another firm (Kurtishi Kastrati 2013). It is revealed that a country who opens a firm in another country hires only skilled labors and does not hire unskilled labors. Skilled labors are those who are hired somewhere else in firms. The foreign firms invite those skilled labor from other firms and hire them in their own firms which is just a substitution. If the firms just switch the labor, this means that there is no increase in employment and it will remain the same. According to the study, investment does not increase employment and thus, investment is not a factor of growing economic growth.

The study found that new technology is shifted through trade and investing channels which improve productivity. Developed countries move technology to developing countries which provides the opportunities to produce more and increase exports (Carol Newman 2013). Similarly, another study showed the same result but with different interpretation which claims that the considerable rise in living standards is due to recent innovations through submission of new technologies since the industrial revolution which also helped the growth of economies (OECD 2007). New technology improves productivity and increase labor skills which are good pointers of economic development. There is a positive relation among technology, production, employment, and investment. If technology increase production, both investment and employment increase which supports the economic growth of world economy. Although, global currency shifts new technology to developing countries which increases productivity and labor skill. The study showed that one negative effect of moving new technology will increase unemployment because the new technology will replace labors. Previous study also outlined the same meaning which says that new technology decreases employments of unskilled labor in some industries because the application of new technology requires training and skills (OECD 2000). One skilled labor will work instead of two labors or some technological machineries will work instead of human. Thus, technology shifts will affect the world economic growth negatively through the increase of unemployment and poverty however it improves productivity and labor skill.

Not only had those, the study revealed that crises which come from currencies will be eliminated by the use of global currency. The world economy faced several financial crises due to the use of national currencies that reversed the world economy several times (Jahnson 1973). Hence, each country will have only one currency that is why there will be no devaluation and valuation which will prohibit the currency crises. The study showed that currency crises harms the production, investment and increase poverty by high level of unemployment. Thus, removing currency crises will remain the world economy as balanced.

Further, the study exposed that global currency removes inflation as it is a negative factor for economic growth. Hence the economy has only one currency which eliminates the exchange risk, that is why there will be no effects on the prices of goods and service and thus inflation is removed. Study found that high inflation leads economy to decline because the high priced products will not be sold both in domestic and foreign markets (Gokal 2004). Thus, it results in reduction of investment, employment and also reduction in saving because labor income just meet their living needs of employees. Removing inflation was found the reason for world economic growth. On the other hand, the study showed that only one type of inflation is removed by the global currency which occurs in depreciation and devaluation of national currencies. Conversely, there are other types of inflation that cannot be removed by global currency such as the excessive demand and limited supply inflation (Amadeo 2019). When country has more demand than supply of goods and services, than the prices of the same goods and services rise as inflation takes place. So the study addressed that global currency does not eliminate the inflation completely, it eliminates only one type of currency. Thus, eliminating currency inflation is not enough for the growth of economy.

The study revealed more than it was expected at the very beginning. The research study was supposed to find solution that global currency will contribute to the growth of world economy by removing exchange risks, increasing international trade, investment and removing currency crises but shifting new technology and removing inflation were unexpectedly found through this research. Also opposing views were not expected at the beginning but through this study, there are views that reject the mention results of global currency such as decreasing innovations, increasing unemployment as well as poverty and inflation will not be removed completely.

After all, comparing both sides of the study, the problem is yet not solved because the two sides of the arguments balances each other at some points. Through this research study, the problem of growing the world economy by replacing national currencies to global currency is not enough however the world economy will face great changes in its economic development. Thus, this study needs more addition to uncover more unknown aspects of using global currency in the world.

1. CONCLUSION

This study investigated the importance of global currency for the growth of world economy based on the conceptual method. Scholar books, researched journals, academic research websites, and official reports were used to study the problem and solution. The study focused on the economic problem of national currencies which was found out that national currencies put barriers to the world economic growth. The challenges that the economy suffers are exchange risks, lack of international trade, investment, technology, inflation and currency crises. In order to find the solution to the problem, this research revealed that replacing all national notes by a single currency will provide opportunities to the world economic growth.

Throughout this research, it was studied that circulating global currency grows the world economy through several eliminations. First exchange risks are removed which motivates the trade and production in the countries. Second, investment increases which provides job opportunity around the world. Third, new technology will be shifted throughout the countries which let countries to improve productivity. Fourth, generally, currency crises will be removed which the world economy already suffered. Fifth, inflation becomes lower which avoid price discrimination and increase saving and investment. The research found out that global currency provides the mentioned opportunities and thus, the world economy will see a positive push toward the growth.

In spite of all those, the research also revealed that global currency will provide too much competitive market through increased international trade. New and old firms that lack skilled labor and technology will not cope with technologically efficient firms. Production and innovation will be stopped in developing countries and international trade will not increase equally. The study also revealed that unemployment will increase because new investment will just substitute the skilled labor in the countries. Global currency will remove only currency inflation but the other types of inflation will still exist such as the excessive demand inflation.

After all, the research conducted for the problem of global currency was not answered completely through these discoveries because global currency is a complex issue which needs more research to find a good solution. The issue has positive and negative sides which both are equally important to the growth of world economy. It is recommended that each side of the issue should be studied more to find the importance one over other. Thus, the results from this research does not recommend any decision for practicing the global currency for the world economy yet.

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Understanding The Study of Light and The Image Formation by Low Cost Teaching Aids

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Abstract- Learning science is an intellectual search for truth in nature. Innovation in teaching physical science needs some effective methods. Activity centered learning is now accepted as an innovative method for imparting physical science in school curriculum. Today's students are mark's oriented. They are neither thinking independently nor analyzing the concepts or facts. Their rational attitude and imagination are not developed properly. These essential qualities can be well developed among the students by using innovative teaching aids and simple experiments on physical science. While teaching of chapter 'light', properties of light and images form by lens and plane mirror becomes more difficult for students to understand. For well understanding of all the concepts, we make some simple experiments by using working Models which have very low cost. They are very easy to prepare and portable. Development of low cost teachings aids from our surrounding not only arise curiosity and interest but also provide an opportunity of self study to the learners. Students really enjoyed it. They can't realize that they are learning a difficult part through it. As per my experience, these instruments, innovative teaching aids and simple experiments played a major role in teaching of physical science in school curriculum.

Index Terms- Light, image, mirror, lens, reflection, refraction.

I. INTRODUCTION

“Nature gives a valuable Gift to man, that he may enjoy the Beauties of Form, color and motion, made possible by light”

Light is everywhere in our world. The world usually refers to visible light, which is visible to the human eye and is responsible for the sense of sight. The main source of light on earth is the sun. Observation of images in various mirrors is related to light. It is only due to the presence of light that all of us can enjoy various natural wonders like sunset, sunlight, rainbow, etc. Students already have ideas about light, but the study of light still have magic for them.

When the teacher teaches study of light viz. direction of light, reflection, refraction, images formed by plane mirror and lenses only with the help of chalk on black board, he face some crisis to make it understand for the students. Though some school belonging to city area have practical facilities, but those instruments are kept only for decorum purpose at the laboratory. Further the students are not allowed to touch the instruments due to high cost, As a result the emerging skill of student is blocked. Rural area school doesn't have the facilities to show these

experiments. Its a big challenge for teacher. So inventors decide to study the properties of light problems, image formation problems. He started to prepare an image model and innovative simple experiments which gives practical experience to students.

II. OBJECTIVE OF STUDY

1. Preparation of model, to see various properties of light and their experiments.
2. Preparation of image model, to see various images due to lens and their experiments.
3. Preparation of model, to see the dispersion of light..
4. To see the path forming light rays.
5. To see the path of refracting light rays by using convex and concave lens.
6. To see the laws of reflection of light rays by using plane mirror.
7. To see the types of reflection of light rays.
8. To see the images in two parallel plane mirrors.
9. To see the images at different angles by using two plane mirror.

III. NULL HYPOTHESIS :

No change was found in mean of pre-test and post-test.

IV. METHODOLOGY

For this research, We have selected the students of New English School, Kamothe where I am working. We have select students from 10th – C class. We use one group post test sampling method. So we selected 30 students as sample by a test (upper level average marks).

We use experimental method for this paper, first. The specific properties of light of std.8th to 10th are taught for group by regular method by using drawing board, help of chalk and some instruments. An evaluation test (Pre-Test) taken using by traditional method and after some week evaluation test (Post-Test) on same concept taken when student used new teaching aids making by teacher for understanding properties of light and image formation. Scores have been recorded and compared. All this process completed in 3 months.

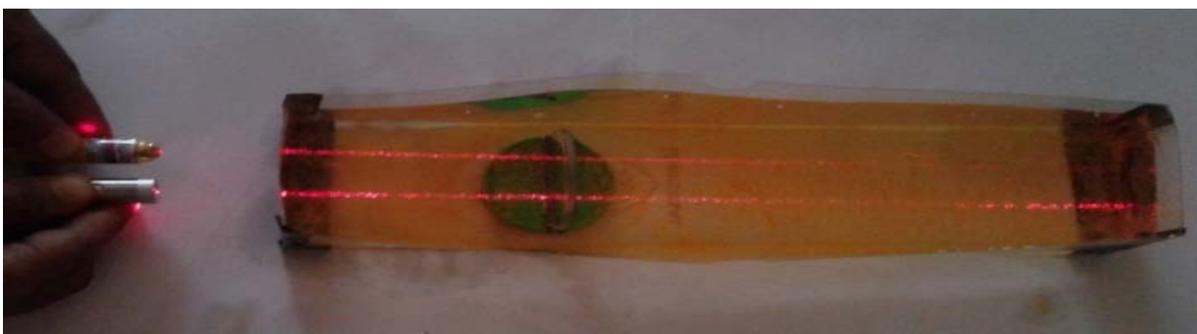
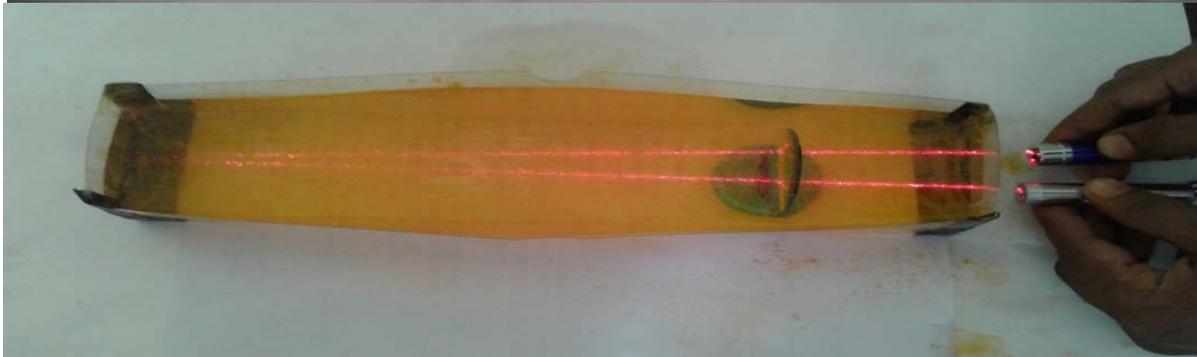
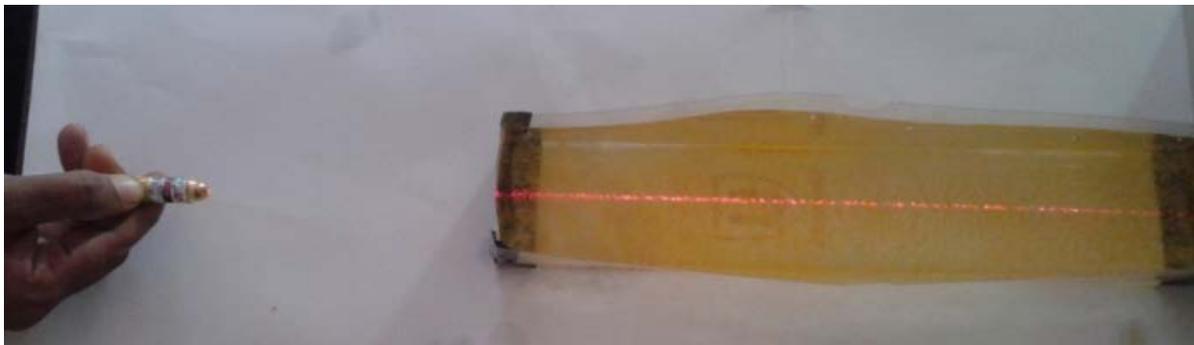
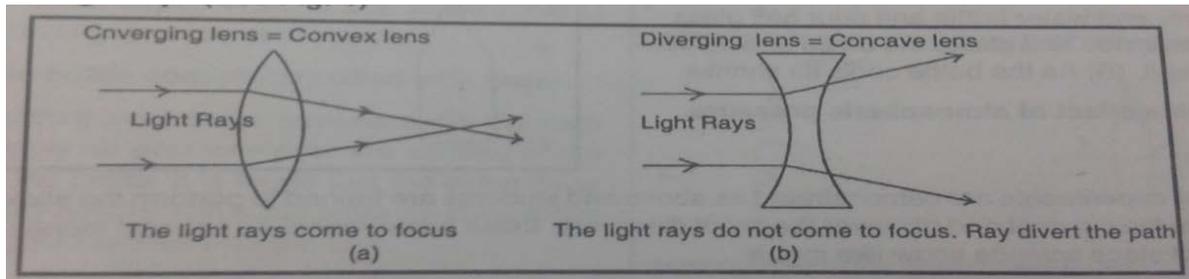
Construction and working of model (Teaching Aids) :

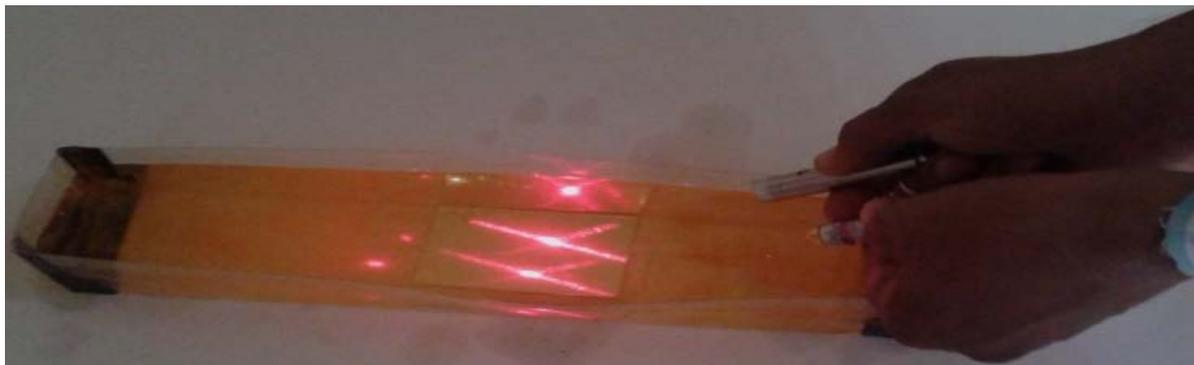
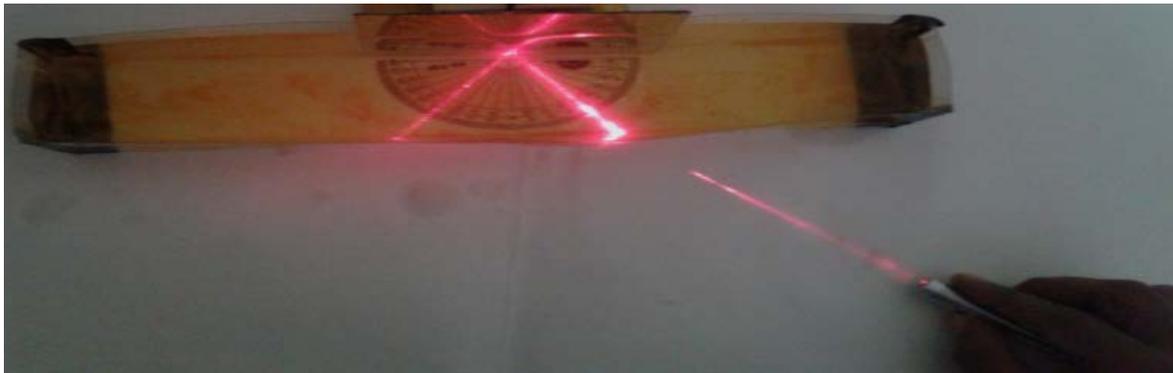
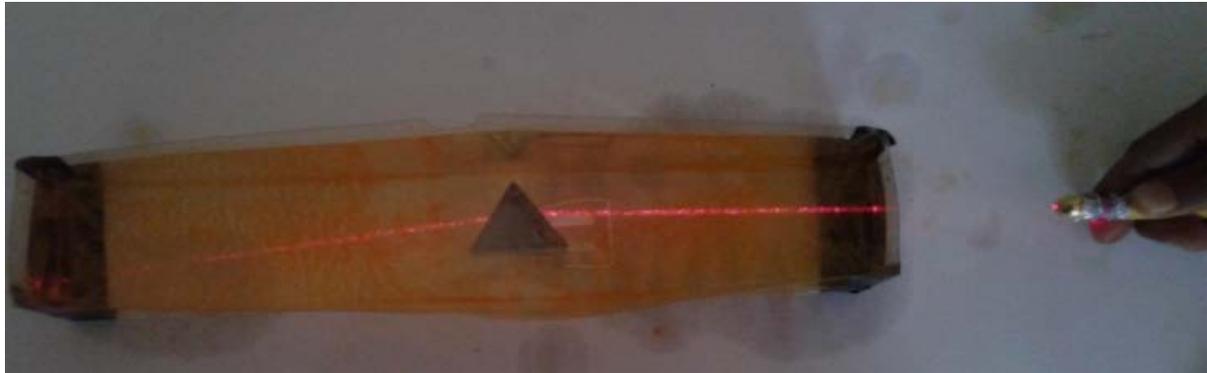
1) Model 1 : Take any wastage plastic box of rectangular shape. Fill the box with water . Convex and concave lens , plane mirror , glass slab, prism and laser torch are used for viewing the light rays .

one can easily understand following experiments in very short period.

1. Path of light ray
2. Refraction by convex lens
3. Refraction by concave lens
4. Laws of reflection .
5. Types of reflection.
6. Refraction by glass slab or prism.

Working: Inventor prepared a model . By entering the light ray through laser and some optical instruments by which





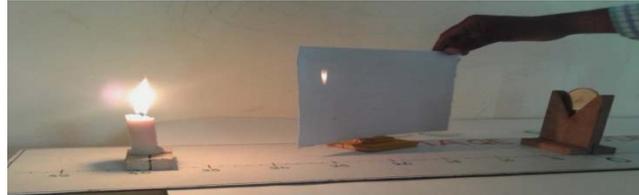


- 2) Model 2: Image model - Take a piece of wastage plywood of rectangular shape. Draw a horizontal line on it. Mark a center point noted as 'O'. Then draw a marking scale at both sides of center by using permanent markers. Use candle and different optical instruments as convex lens, concave lens, concave mirror.

Working: Inventor prepared an image model. By entering the light rays of burning candle on optical instruments

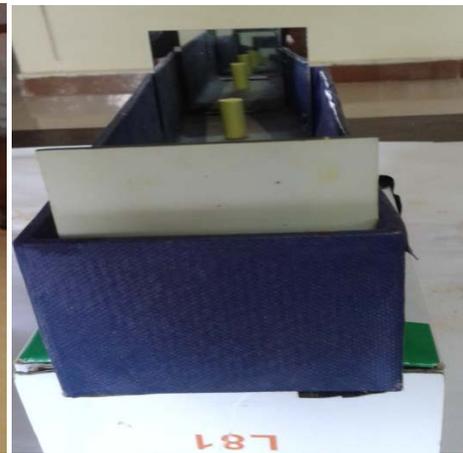
by which one can easily understand the following experiments in very short period. Here object means flame of candle and F_1 means focal length of lens.

1. Position of the object : At infinity
2. Position of the object : Beyond $2F_1$
3. Position of the object : At $2F_1$
4. Position of the object : Between F_1 and $2F_1$
5. Position of the object : At focus F_1
6. Position of the object : Between F_1 and optical center O



- 3) Model 3: Take two rectangular shaped plane mirrors. Put both mirrors in parallel position keeping some distance in the box. To see images, use piece of colored chalk.

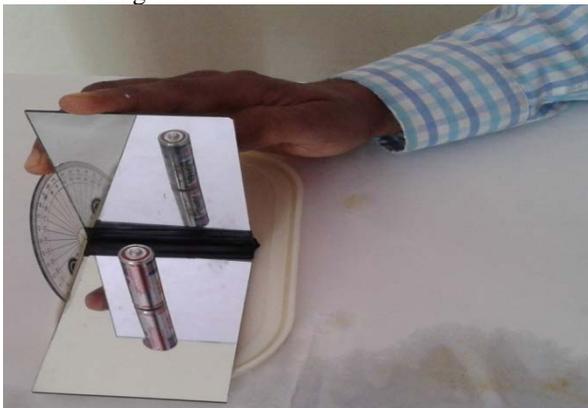
Working : Put a small piece of colored chalk at the center of two parallel plane mirrors. Then observe the images of colored chalk.



4) Model 4: Take two rectangular shaped plane mirrors, one plastic plate and protractor. Join these mirrors by a electric tape . Then fix the protractor vertically at center 0 in between two mirrors. Use wastage dry cell of clock , toys etc and see the images at different angles..

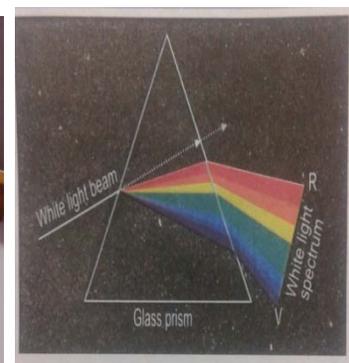
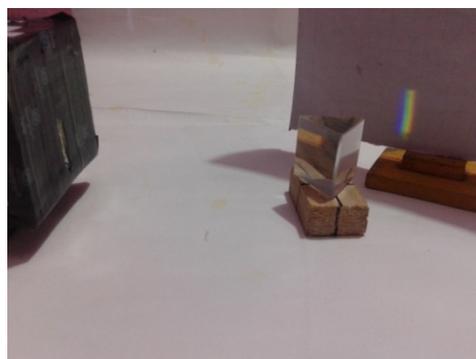
Working : Put a dry cell (object) vertically on the center of horizontally placed plane mirror.

- I) Then observe the images of dry cell at 90° .
- II) Then observe the images of dry cell at 60° .



5) Model 5: Take one paper box . Make a slight cut on one side of box. Also make a plane white paper stand . Use small torch and prism to see the dispersion of light.

Working : Put a torch in a box. Put a prism in front of a cut side of a box . When one switch on the torch , we see colors spectrum on white paper.





V. OBSERVATION

i) Verification of laws of reflection by using plane mirror.

| Sr.No. | Incident Angle | Reflected Angle |
|--------|-----------------|-----------------|
| 1. | 30 ⁰ | 30 ⁰ |
| 2. | 50 ⁰ | 50 ⁰ |

ii) Nature of image formed by convex lens for various position of object.

| Sr.No. | Position of object | Position of image | Size | Nature of image |
|--------|------------------------|---|-------------------------------|-------------------|
| 1. | At infinity | At focus F ₂ | Highly Diminished, small size | Real and inverted |
| 2. | Beyond 2F ₁ | Between F ₂ and F ₂ | Diminished | Real and inverted |
| 3. | At 2F ₁ | At 2F ₂ | Same size | Real and inverted |

| | | | | |
|----|-------------------------|-------------|--------------------------------|-------------------|
| 4. | At focus F ₁ | At infinity | Infinitely large and Magnified | Real and inverted |
|----|-------------------------|-------------|--------------------------------|-------------------|

iii) Images formed by two parallel plane mirrors.
- We see infinite images of object.

iv) Images formed by two plane mirror.

As $\theta = 90^\circ$, We see three images.

As $\theta = 60^\circ$, We see five images.

By this process we got the data by test for this research . We take analysis of this data and wirte difference in regular method and innovative teaching aids method .

Data Analysis :

In data analysis ,we calculated mean of marks for both method . This compare with graphically .

1. Mean for Pre-Test = Sum of marks of all student / Total number of students

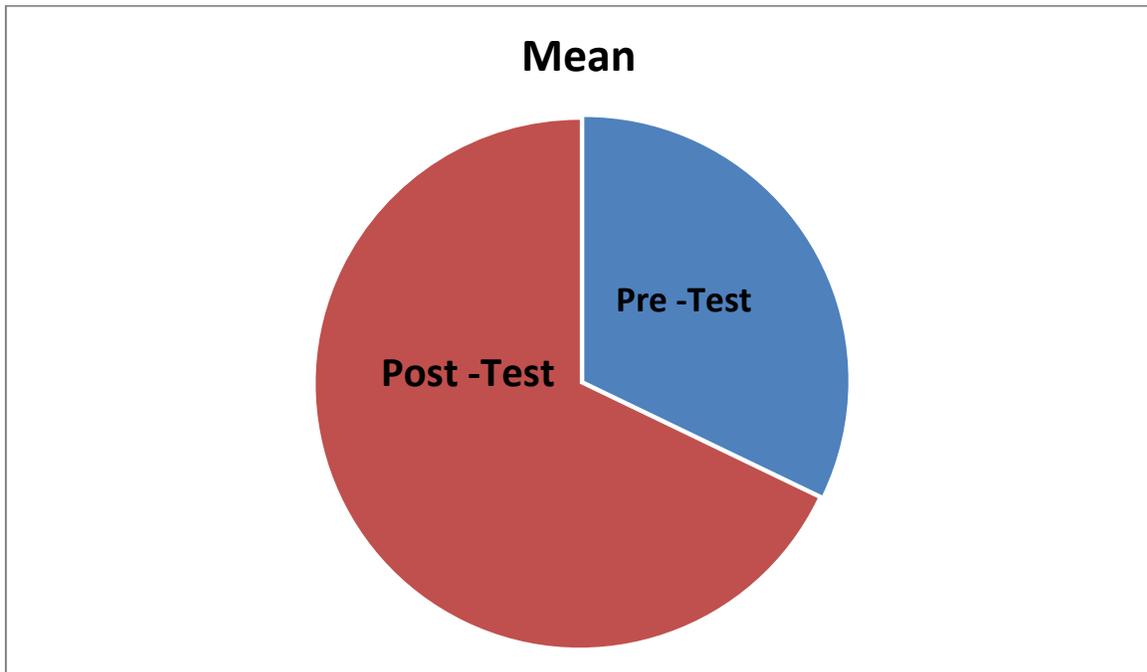
$$= 200 / 30$$

Mean for Pre-Test = 6.66

2. Mean for Post-Test = Sum of marks of all student / Total number of students

$$= 422 / 30$$

Mean for Post-Test = 14.06



VI. CONCLUSION

In traditional method, one can learn properties of light and image formation by using apparatus like using Drawing board and blackboard-chalk. But it took more time at least $\frac{1}{2}$ hr. to 1 hr and also one can't see the light rays visible. He sees only drawn path of light rays. These are the main drawbacks of this traditional method. But comparatively with the help of innovative teaching aids, it removes all these drawbacks.

When we compare mean of pre-test and post-test. We saw an increase of marks in post-test than pre-test. So that our null hypothesis is rejected i.e. We got an increase in the marks of students in post-test by students handling novel teaching aids for understanding the study of light and image formation. Following are the advantages of the low cost teaching aids.

VII. ADVANTAGE OF THE LOW COST TEACHING AIDS

1. The teaching learning process becomes more fruitful with the help of low cost teaching aids.
2. One can understand all the concepts (primary, secondary and higher level) related with light and optics with the help of novel teaching aids.
3. One can see the light rays visible. It is very interesting for learners.
4. Each experiment takes hardly one or two minutes.
5. Experiments are performed in sunlight in daytime without using electricity.
6. It is an easy, superior and understandable method than traditional method.
7. It is a low cost teaching aid which costs about Rs.70 to Rs.150 approx.
8. The arrangements of instruments are very easy.
9. It can be made by student and teacher easily.

10. It is portable that it can be easily used in every place viz... classroom, lab, seminars etc.
11. It creates scientific attitude among the students.

VIII. FUTURE SCOPE

We can make available a plenty of these low cost teaching aids in laboratories, then each and every student will get individual experience of it. Also one will get inspiration from these teaching aids.

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Annexure: 1) Marks of test .

| Sr.No. | Name of student | Pre -Test | Post- Test |
|---------------|------------------------|------------------|-------------------|
| 1 | Prajakta Jadhav | 4 | 12 |
| 2 | Kadam Shruti | 6 | 13 |
| 3 | kadam Vishakha | 6 | 14 |
| 4 | Kare Jyoti | 8 | 16 |
| 5 | Kumbhar Shruti | 9 | 15 |
| 6 | Lokhnade Pranita | 7 | 14 |
| 7 | Mane Pratikha | 8 | 16 |
| 8 | Mane Nikita | 6 | 13 |
| 9 | Mhatre Sidhika | 7 | 18 |
| 10 | Misal Shailaja | 8 | 16 |
| 11 | More Megha | 6 | 12 |
| 12 | Parkhe Pravini | 7 | 14 |
| 13 | Patil Ashwini | 6 | 13 |
| 14 | Roman Rutuja | 9 | 16 |
| 15 | Rote ashwini | 8 | 14 |
| 16 | Salunkhe Amruta | 6 | 15 |
| 17 | Sapkal Shivani | 5 | 13 |
| 18 | Shinde Sneha | 7 | 15 |
| 19 | Thitame Smita | 9 | 15 |
| 20 | Sobale Prajakta | 6 | 14 |
| 21 | Aher Sanket | 5 | 12 |
| 22 | Bhosale Abhishek | 5 | 12 |
| 23 | Chavan Rushikesh | 7 | 12 |
| 24 | Dhotre Abhishek | 6 | 14 |
| 25 | Jagdale Sujay | 5 | 14 |
| 26 | Jagdale Sanjay | 6 | 13 |
| 27 | karjekar Pravesh | 7 | 14 |

| | | | |
|----|-------------------|---|----|
| 28 | Pisal Mayur | 7 | 16 |
| 29 | Khandalgle Pratik | 8 | 13 |
| 30 | Zore Rushikesh | 6 | 14 |

2) Test paper

Rayat shikshan sanstha 's New English School ,Kamothe

Pre –Test

Std. –10th

Sub .: Science

Marks : 20

Time: 40min

Q.1. Fill in the blanks . 06

1. Light travels along line.
2. Alens always forms erect, virtual and smaller images than the object.
3. Two plane mirror are arranged parallel to each other to get.....images.
4. Angle of reflection is always to the angle of incidence.
5. When the object is at infinity,a convex lens forms the image at.....
6. The splitting of white light into its seven constituent colures is called.....

Q.2. State whether the statements given below are True or False. 02

1. The image formed by plane mirror is laterally inverted.
.....
2. Rods are sensitive to bright light.
.....

Q.3. Answer the following questions. 12

1. Write the types of reflection?
.....
2. What is the angle of incidence of a ray if the reflected ray is at an angle of 90⁰ to the incident ray?
.....
3. When the angle between two plane mirror is 60⁰ ,how many multiple images will be formed by mirrors ?
.....
4. Write the two uses of concave mirror?
.....
.....
5. Which lens are using for correcting Myopia and why?
.....
.....
6. Give scientific reason- Letters appear laterally inverted in a plane mirror ?
.....
.....

The Effect of Realistic Mathematical Education Approach to Mathematical Learning Outcomes On Fraction Material for Third Grade Students

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ABSTRACT

This study was to determine the effect of applying realistic mathematical approaches to learning outcomes. This research is an experimental study with a quantitative approach, the method used is *quasi experimental*. The design of this study is *nonequivalent control group*. The subject of this research was third grade students of Artodung Pamekasan State Elementary School. The data collection technique is a test technique, the tests used in the form of *pretest* and *posttest* are in the form of multiple choices with the number of each of the 20 items. Test instruments were tested for validity and reliability before being used for research. After research, the results of the study were analyzed using the normality test, homogeneity test, and hypothesis testing. The results of the research conducted at Artodung Pamekasan State Elementary School obtained the results that there was an influence from the realistic mathematical approach to the mathematics learning outcomes of third grade students, this was evidenced by the increase in the average value of the experimental class learning outcomes greater than the control class $22.5 > 16.06$. Besides that, it is also proven by the results of $-t_{hitung} < -t_{tabel}$ at the 5% significance level located in the negative H_0 rejection area, which is $-2.195 < -1.68107$. So it can be concluded that H_a is accepted and H_0 is rejected.

Keywords: realistic mathematical approaches, mathematical learning outcomes, fractions.

INTRODUCTION

Learning mathematics in elementary schools requires an innovation and creativity of the teacher in processing learning, for example by applying a learning approach that is fun for students or by using media that is attractive to students. Not only that, the provision of real-world context problems that can be imagined by students can also support the learning process.

This is also adjusted to the thinking stage of elementary school students who are still in the concrete operational stage so that they still need the help of concrete objects or problems of real-world contexts that can be imagined by students to facilitate understanding the material presented.

There is an approach that can be applied to mathematics learning is *Realistic Mathematic Education (RME)* or commonly called Realistic Mathematics Education (PMR).

The PMR approach was developed by Freudenthal in the Netherlands and received a fairly good response there, besides that in America also had implemented PMR in a number of schools and obtained good results. According to Romberg & de Lange (in Hadi, 2005: 8).

In addition to the translation of PMR, fractions are an important problem in research. Fractions are a product of a part of a number that cannot be expressed in a number so it must use fractions. Fractions are interpreted as part of something intact (Heruman, 2007: 43).

The researcher made observations at Artodung Pamekasan State Elementary School to find out whether there was any influence "Effect of Realistic Mathematics Education Approach (PMR) on Mathematics Learning Outcomes of Fractions". In this school the media constraints used are not media that are often encountered by students but manipulative media in the form of circular or rectangular images with some shading in some parts which later students are asked to determine the size of the fraction indicated by the flat build. Besides that, the use of media tends to be only when planting the initial concept, then when the material deepens the teacher does not always use the media. Learning that has been carried out has used several examples of real world context problems, but unlike PMR here the problem of world context is not used as a starting point in learning but only as an example of students' description. This is evidenced by student learning data, namely the low semester exam results that have not yet reached KKM, which is 75. Of the 25 students only 10 students meet KKM while the rest are still below the KKM.

In 2017 the realistic mathematical approach was examined in Banjarjo 1 Bojonegoro by Desi Wulandari, who stated why this realistic mathematical approach can be said to be important, this is due to the inaccuracy of a teacher in applying a learning approach during the teaching and learning process resulting in fatal learning. can only cause students to fail in achieving learning goals. in this fraction material students are required to understand an abstract concept. therefore to introduce this material, it needs to be linked to the real world context or concrete things so that there is no misconception. one way to deal with it according to researchers is to apply a realistic mathematical approach to be able to help students to be able to understand how fractions.

Characteristics of PMR 1. Use of context The real world context, in PMR is used as a starting point in mathematics learning. 2. The use of models for progressive mathematicians, the model in PMR serves to bridge in changes from concrete mathematics to formal or more abstract mathematics. 3. Utilization of student construction results, Students play an active role in the process of rediscovering mathematical concepts, this is evidenced by the freedom of students to develop problem-solving strategies based on students' own thinking. 4. Interactivity, Learning requires a communication between students and students with their teachers. 5. Linkages, mathematical concepts do not consist of separate parts, but are interrelated between concepts with one another.

thus this realistic mathematical approach is expected to be suitable to be used in this study with its characteristics that this learning approach can be used as a starting point for students to understand the fractions in which third grade is the beginning of fraction conceptualization and is a basis of fraction learning. besides that the realistic mathematical approach prioritizes the process and most importantly the material is associated with the real world context in the form of examples and a problem and then guided in discussions and in the end can provide solutions to the problems they obtain.

based on this background, the formulation of the problem in this study is how the influence of the realistic mathematics education approach (PMR) on the learning outcomes of mathematics in the fractions of third grade students of Artodung Pamekasan State Elementary School.

METHOD

The type of research used in this study is a type of experimental research. The type of quantitative research that will be applied aims to measure the influence of independent variables, namely the realistic mathematical approach and the dependent variable is the result of learning mathematics. The form of design in this study uses the *Pretest-Posttest Control Group Design* (Emzir, 2011, : 98).

The *Pretest-Posttest Control Group Design* can be described as follows.

Table 1. Research Design

| Kelompok | Pretest | Variabel perlakuan | Post-test |
|-----------------|----------------|---------------------------|------------------|
| Eksperimen | O1 | X | O2 |
| Kontrol | O3 | - | O4 |

Source:(Sugiyono, 2016:76)

Information:

- O1 : *Pretest* results in the control group
- O2 : *Posttest* results in the experimental group
- O3 : *Pretest* results in the control group
- O4 : *Posttest* results in the experimental group
- X : Treatment

In the experimental group the learning was done by applying a realistic mathematical approach while the control group applied a conventional learning model.

In this study the research subjects were third grade students A and B class of Artodung Pamekasan State Elementary School. The research sample used was 20 students for the control class and 20 for the experimental class. The timing of the research is carried out approximately between March and April 2019 in the even semester 2018/2019.

There are two research instruments to be carried out in this study, namely: 1. Test sheets, in this test sheet containing questions about mastery of the material with almost the same level of difficulty, the test sheets in the test are in multiple choices with three answer choices, A, B, C with the number of questions as many as 20 questions. Questions were given to the experimental class which received treatment and control classes that were not treated. 2. This observation sheet aims to determine the extent of the influence of realistic mathematical approaches to student learning outcomes. The observations that will be made are the researcher acting as a beginner teacher in third grade, then the class teacher or peer researcher observes the implementation of the application of realistic mathematical approaches when learning takes place.

The techniques used to collect data by researchers are two: 1. Observation techniques, aiming to observe the teacher in carrying out the use of digital literacy when learning takes place in the experimental class and 2. The test technique aims to measure or know the progress of students during learning, there are two implementations in this test technique, namely the implementation of the pre-test and post-test.

Furthermore, after data collection techniques, data analysis techniques will be carried out using a quantitative approach to data presented in the form of numbers. The analytical technique of data used in relation to the quantitative approach is the calculation of answers to problem formulation and hypothesis presentation, which are held in two stages: Data analysis is divided into first, validity and reliability tests. 2. Analysis of the results data are normality test and hypothesis test

RESULT

The results of the study consisted of the results of expert validation, the results of research in the field, and the results of inferential analysis. The following are the results of the learning device validation and research instruments used in this study, which have been validated by experts, the following are the results of validated data.

Table 1. Results of Validation of Learning Devices and Research Instruments

| Validation results | Average Validation Value | Category | Information |
|--------------------------|--------------------------|-----------|-------------------------------|
| RPP | 3,55 | B / Valid | Can be used with revisions |
| LKPD | 3,65 | B / Valid | Can be used with revisions |
| Test Sheet (Pretest) | 3,88 | B / Valid | Can be used without revisions |
| Test Sheet (posttest) | 3,88 | B / Valid | Can be used without revisions |

The validation results related to the RPP syllabus, LKPD, and Test Sheets both *pretest* and *posttest* in the table show the average feasibility validation of the four learning instruments and research instruments from the validator to get a good category, so it can be concluded that the learning device is feasible to use with little revision.

The following is the percentage of the comparison of Pre-test and Post-test scores

Pre-test and Post-test Value Results on learning outcomes

| | | |
|-----------------|------|-------|
| Amount of Value | 1072 | 1859 |
| Average Value | 53,6 | 92,95 |

Source: processed data

For the results of the analysis of observations of experimental class student learning results showed that for the *pretest* results the average presentation was 53.6% with the medium category and for the *posttest* results the average presentation was 92.95% with a very high category. Based on the results of the analysis of the observations of the learning outcomes of the control class students for *pretest* and *posttest* in the control class and the experimental class there is an influence of the application of a realistic mathematical approach because there are very significant differences.

Pre-test and Post-test Value Results on learning outcomes

| | | |
|-----------------|-------|------|
| Amount of Value | 811 | 1498 |
| Average Value | 40,55 | 74,9 |

Source: processed data

The results of student learning outcomes in the control class showed that for the *pretest* results the average presentation was 40.55% with less and for the *posttest* results the average presentation was 74.9% with sufficient categories. Based on the results of the analysis of learning outcomes for the control class for the *pretest* and *posttest* only at the stage of less and sufficient. In this case it has not shown good results.

From the table above, it can be seen that the comparison between the average pre-test value and the post-test value is higher post-test value.

Furthermore, the translation related to the normality test of data obtained from student learning outcomes and collaboration, the researcher used the *SPSS 21.00* program with the *kolmogorov-smirnov* technique at a significant level of 0.05. The selection of the *Kolmogorov-Smirnov* test because this technique can test in large or small quantities, besides that, the data in this study are interval scale or ratio.

The results of the normality test that has been processed are in table 4.13

Table 4.13

Normality Test Results

| Variant | Class | Kolmogorov-Smirnov | Sig- |
|--|------------|--------------------|-------|
| LKPD (<i>Pretest</i>) | Kontrol | 0,583 | 0,886 |
| LKPD (<i>Posttest</i>) | | 0,666 | 0,766 |
| LKPD (<i>Pretest</i>) | Eksperimen | 0,605 | 0,857 |
| LKPD(<i>Posttest</i>) | | 0,692 | 0,724 |
| Learning outcomes (<i>Pretest</i>) | Kontrol | 0,912 | 0,377 |
| Learning outcomes (<i>Posttest</i>) | | 0,671 | 0,759 |
| Learning outcomes (<i>Pretest</i>) | Eksperimen | 0,691 | 0,727 |
| Learning outcomes (<i>Posttest</i>) | | 0,788 | 0,563 |

Source: processed data

Normality test data based on table 4.13 above obtained that, the results of the significance level of the collaboration variable and creative thinking of students in the control class and experimental class were more than 5% or 0.05. So based

on the acquisition, it can be concluded that the analysis requirements test has been determined because all data that has been obtained is normally distributed.

The homogeneity test carried out in this study aims to determine the similarity of the sample section. In the homogeneity test, researchers used the SPSS 21.00 program with a *one way ANOVA test* technique at a significant level of 0.05. The homogeneity test results can be seen below.

Table 4.14
Homogeneity Test Results

| Variable | Levene Statistic | df1 | df2 | Sig. |
|---------------------------------------|--------------------|-----|-----|-------|
| LKPD (<i>Pretest</i>) | 1,489 ^a | 5 | 12 | 0,264 |
| LKPD (<i>Posttest</i>) | 2,118 ^a | 5 | 10 | 0,146 |
| Learning outcomes (<i>Pretest</i>) | 1,911 ^a | 4 | 11 | 0,179 |
| Learning outcomes (<i>Posttest</i>) | 1,931 ^a | 3 | 11 | 0,183 |

Source: processed data

Based on the acquisition of homogeneity test data in table 4.13, each variable gets more than 5%. Then concluded that the second sample homogeneous variance (HO is rejected) and requirements test analysis has been fulfilled.

Interpretation of the results of hypothesis testing data, the hypothesis of this study is "there is the influence of a realistic mathematical approach to the mathematics learning outcomes of third grade students of Artodung State Elementary School". The results of these hypotheses are tested from the results of the research data that has been conducted. This can be seen from the average score of the experiment class and control *posttest*. The results of research in A class of third grade are greater than the average score in B class of third grade. The average of A class of third grade students is 82.5 and the average of B class of third grade students is 71.7.

Based on the observations of table 4.13, it can be seen that the two classes that have been tested are the class that applies the realistic mathematical approach and the class applying conventional learning, the results of the significance level of the normality test for each of the two groups are obtained. Data on student learning outcomes (*pretest*) of 0.857 in the control class and in the experimental class of 0.866 while, at the time (*posttest*) in the control class of 0.766 and in the experimental class of 0.724. Because the two classes that have been tested have a significance value of 5 0.05, it can be concluded that the student learning outcomes data are normally distributed in each group.

Based on the observations of table 4.13, it can be seen that the two classes that have been tested are the class that applies the realistic mathematical approach and the class applying conventional learning, the results of the significance level of the normality test for each of the two groups are obtained. Data on the collaboration ability of students (*pretest*) is 0.857 in the control class and in the experimental class is 0.866 while, at the time (*posttest*) in the control class is 0.766 and in the experimental class is 0.724. Because the two classes that have been tested have a significance value of 5 0.05, it can be concluded that the student learning outcomes data are normally distributed in each group.

In table 4.16 shows that, the *mean* results of student learning outcomes at the time (*posttest*) amounted to 74,350 in the control class and experimental class at 92,950. While in table 4.16 for the results of the Independent Sample T-Test test about the influence of the realistic mathematical approach to student learning outcomes (*posttest*) the results obtained $t_{hitung} (6.747) > t_{tabel} (1.686)$ with *df*.38 at the 0.05 significance level. Because the significance level is 5 0.05 then H_0 is rejected while H_a is accepted. So, it shows that there are differences in critical thinking skills of students in the experimental class and in the control class at the time (*posttest*) because in the experimental class there is treatment that is by applying realistic mathematical approaches during learning and in the control class there is no treatment (treatment) given. Based on the results obtained, it can be concluded that the learning outcomes of students who apply realistic mathematical approaches are significantly higher than the learning outcomes of students who only apply conventional learning.

CLOSING

Based on the results of the discussion described above, it can be concluded that: There is an influence of the realistic mathematical approach to the learning outcomes of mathematics in the fractions of students in third grade Elementary School.

And suggestions from this research are Based on the conclusions that have been described above and the experience of researchers during the research, the suggestions that can be given are as follows:

1. Realistic mathematical approach in learning, can be used as a reference and alternative for teachers or educators to improve mathematics learning outcomes.
2. The researcher only examines the effect of realistic mathematical approaches on student learning outcomes. For researchers who want to research further with the same variable, it is expected that the material used is different so that the other material used can be seen from the analysis with the variables used.

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An Assessment to The Challenges Facing Urban Green Spaces a Case of City Park in Nairobi

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Abstract: Urban green spaces are a paramount element of the urban ecosystem. However urban green spaces have been facing challenges which if not timely dealt with, the urban green spaces will not be in a position to provide the urban inhabitants with the important ecosystem services they provide. Kenya like many other countries in the developing world have been experiencing rapid urbanization. Rapid urbanization comes with a variety of challenges among them included challenges on the urban green spaces. The focus of this paper is on describing the challenges that are facing Nairobi City Park, Nairobi. The study was therefore conducted in Nairobi city park. The study adopted descriptive research design where questionnaires an interview guide were used as the major instruments of data collection. Data collected during the study was analyzed using qualitative and quantitative data analysis methods. The results of the study pointed out that there are indeed challenges facing Nairobi City Park. The paper has presented the challenges in to three main categories namely environmental challenges, social challenges and management challenges.

Keywords: Rapid urbanization, Urban green spaces, Nairobi, City Park, County Government of Nairobi.

I. INTRODUCTION

Urbanization is one of the major global trends which is no longer considered recent. Urbanization is triggered by a number of factors which include rural- urban migration, economic growth, growth of infrastructure among other factors [1]. Recent studies indicate that more than half of the world population is currently living in the urban areas [2]. Although urbanization is considered a major contributor to economic growth and social transformation, urbanization is also a major source of negative implications. The negative implications of urbanization are however more felt in the developing countries than in the developed countries, a scenario which is attributed to the rapid rate of urbanization which is experienced in the developing countries [3].

1.1 Theoretical Review

Born in 1850 in the United Kingdom, Ebenezer Howard is widely recognized for his publication in 1898 “Garden Cities of Tomorrow”. Garden City Model is a theory in urban planning that calls for a harmonious coexistence between human beings and nature. Howard’s publication led to the foundation of Garden City Movement that realized several garden cities in Britain [4]. The theory has got crucial relevance to the contemporary urban planning as it gives priority to the conservation of the naturally and ecologically sensitive areas such as green spaces and parks.

Founded in 1928 and disbanded in 1959, international congress of Modern architecture was responsible for a series of events and congresses arranged across Europe by the most distinct architects of the time. One of the major achievements of the congress was the formulation of “principle of intelligent urbanism” which is a theory that is composed of ten propositions for city planning and

city design. One of the propositions in the theory is the principle number one “balance with nature” [5]. The principle gives a clear distinction between use and exploitation of resources. The focus of the principle is on extent beyond which deforestation soil erosion, aquifer deterioration, siltation and flooding reinforce one another in urban systems leading to destruction of life support systems. The principle is relevant to the contemporary urban planning since it promotes environmental assessment of ecosystems to identify the fragile zones, natural systems under threat and identifies strategies that can be adopted through conservation, density control, land use and open space planning [5] .

1.2 History of the City of Nairobi

Urbanization in Kenya has a long history. The oldest urban areas can be traced back as early as 9th century AD with the agglomeration of trading centers to urban areas. The city of Nairobi was born as a result of construction of the Kenya Uganda Railway. Nairobi became the capital of Kenya in 1907 and a city in 1950. The population of Nairobi has been increasing ever since its birth as a result of both natural populations increase and rural-urban migration. The growth of urban population has led to the need for development of infrastructure hence increased demand for natural resources. One of the major effects of urban population growth in Nairobi is the challenge to the urban green spaces [6]

1.3 Importance of urban green spaces

Equating green spaces with a monetary value is complex as it is not always possible to relate it to quantifiable economic value [7]. However, urban green spaces offer a variety of benefits which include social, economic and environmental benefits.

The social benefits of urban green spaces and the one that is mostly recognized relate with the leisure and recreation. The social benefits are in most cases measured in terms of aesthetic value, individual perception, common interest etc. [8]. Environmental psychology suggests green spaces as a source of human and mental health which comes with human contact with nature[7], [8]. Urban green spaces also offer an array of environmental benefits which include storm water management, provision of habitats for wild animals and plants, carbon sequestration hence enhancing air quality, creation of a micro-climatic condition, reduction of the effects of urban heat islands and the reduction noise pollution from traffic [9]. Urban green spaces also have benefits that relate to economic and financial gains such as a favorable image for a place, increased tourism, enhancing inward investment etc.[8].

II. STUDY AREA

Nairobi City Park is a public recreational ground located in the Parklands area in Nairobi. The park receives visitors on a daily basis and there are no entry fees. The park is located where Limuru Road and Forest road diverge. A canalized stream by the name Kabagare flows through its lower reaches. The park has a geographical extent of 60 hectares comprising of botanical gardens and portions of the rich indigenous forests that once extended over much of Nairobi. The park is managed by Nairobi City County, Department of Environment, whose employees are stationed here. These include the park superintendent, the assistant superintendent and a host of support staff who work in the nurseries. There is also Friends of City Park, which is a voluntary association concerned with conservation of the park it has rich biodiversity, which includes troops of Sykes monkeys, silvery-cheeked Hornbills and hundreds of beautiful butterflies plus very diverse plant life. The park also provides a seed bank for tree nurseries and reforestation Centers. The Park boasts a cultural legacy too, being the final resting place of Joseph Murumbi, who was Kenya’s second vice president and Pio Gama Pinto, an Asian who was assassinated in 1965 and was a pioneering human rights activist. The park also has a Jewish and world war one memorial cemeteries, The Bandstand and the maze.

III. MATERIALS AND METHODS

The study adopted descriptive research design. The design was preferred since it describes the character, opinions, preferences, subjects and perception [10]. Questionnaires and interview guides were used in the study as instruments for data collection. The questionnaires had both open ended and closed ended questionnaires which were administered randomly to a hundred respondents. Data was analyzed using Microsoft excel and Statistical package for social sciences (SPSS) and presented in form of text and figures.

IV. RESULTS AND DISCUSSION

The study sort to identify the challenges that are facing Nairobi City Park. The results presented here is however categorized in to three major categories that is the environmental challenges, social challenges and management challenges.

4.1 Environmental challenges

The study identified that Nairobi City park is facing a number of environmental challenges.

The study revealed that there are indeed environmental challenges facing City Park environmental problems with 86% of the respondents indicating that there are environmental challenges and 14% indicating that there are no environmental challenges. The study revealed that the environmental challenges are also a variety and range form pollution, encroachment for expansion and spread of the city, illegal land use, human wildlife conflict and invasion by alien plant and animal species.

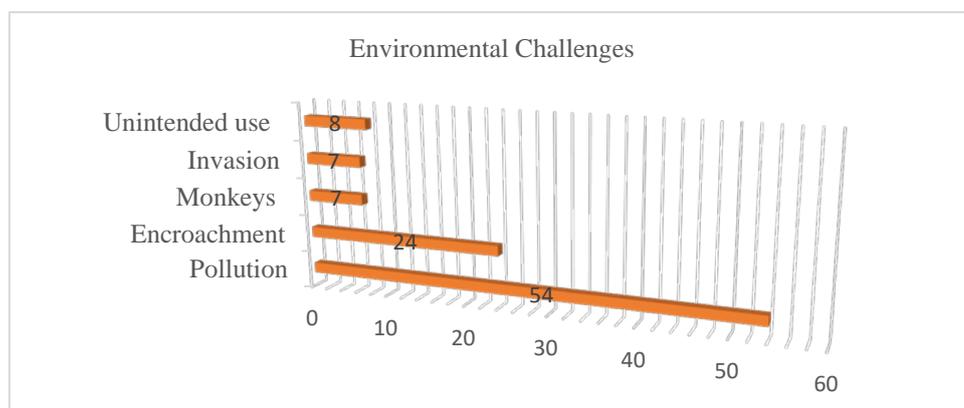


Figure 1: Environmental challenges facing Nairobi City Park
Source: Field Survey, 2019

4.1.1 Pollution

Like in most other areas within a city, city park experiences solutions pollution that ranges from air pollution, water pollution and land pollution. The major source of air pollution in Nairobi City Park is from vehicular especially from Thika Super highway and a number of vehicles that pass through the park. Water pollution is also evident in Nairobi City Park. Kabagare stream that passes through the park has been polluted as a result of discharging of raw sewage from the surrounding residential areas. The stream has also been polluted by disposal of solid waste near or in the stream. Poor solid waste disposal also leads to land pollution in Nairobi City Park especially improper disposal of non- biodegradable waste such as plastic bags, textile by products, construction debris etc.

4.1.2 Encroachment

Nairobi City Park is at a threat of existence; this is as a result of encroachment of the park as a result of need for development and growth of the city. With rapid urbanization in the City of Nairobi, there is need to create more housing units and also develop infrastructure for the city inhabitants. As a result, Nairobi City Park has been encroached for construction of houses both for residential and commercial purposes. Encroachment of the park has got effects both on flora and fauna that is mothered in the park. The effects come in form of destruction of habitats for both plants and animals, extinction of some plants and animal species as well as human wildlife conflicts. Development of infrastructure has also costed the Nairobi City Park, for example in the year 2017, a number of mature trees were brought down at the edge of the park for purposes of creating a new advertisement board. Although after the then Karura member of parliament pointed the bringing up of the bill board illegal and was brought down after wide media coverage, the trees were lost

4.1.3 Unintended use

Nairobi City Park is also facing the challenge of being used for purposes that it is not meant for. Nairobi City Park is mainly used for leisure purposes specifically viewing of birds commonly Yellow-breasted Apalis, Brown-backed Woodpecker and the Pallid Honeyguide and monkeys such as Syke's monkeys. However, as this study pointed out the park has of late been used for unintended purposes. The study determined that the park has been used as a grazing area for cattle, sheep and goat especially during the dry season. Some tree species have also been exploited by traditional medicine men who either strip off the barks of the trees continuously or uprooting the entire tree which has led to either reduction or extinction of some indigenous plant species in the park.

4.1.4 Monkeys

The study pointed out that the Sykes' monkeys has also become a challenge in the park. This is due to the rapidly increasing number of the monkeys to an extent of becoming a threat to the biodiversity. The study pointed out that the monkeys sometimes invade the birds' nests in search of eggs making it difficult for the birds to hatch. The monkeys also have the tendency of killing snakes.

4.1.5 Invasive species

The interviewees confirmed that in recent year there had been influx of invading shrubs and weeds such as Lantana camara and Datura stramonium, which are difficult to eliminate once established.

4.2 Social challenges

The study pointed out that Nairobi city park is experiencing some social problems. The results of the study pointed out a number of social challenges facing the Nairobi City Park, among the challenges include murder, rape, theft, poisoning of fish ponds and overcrowding as shown in the figure below;

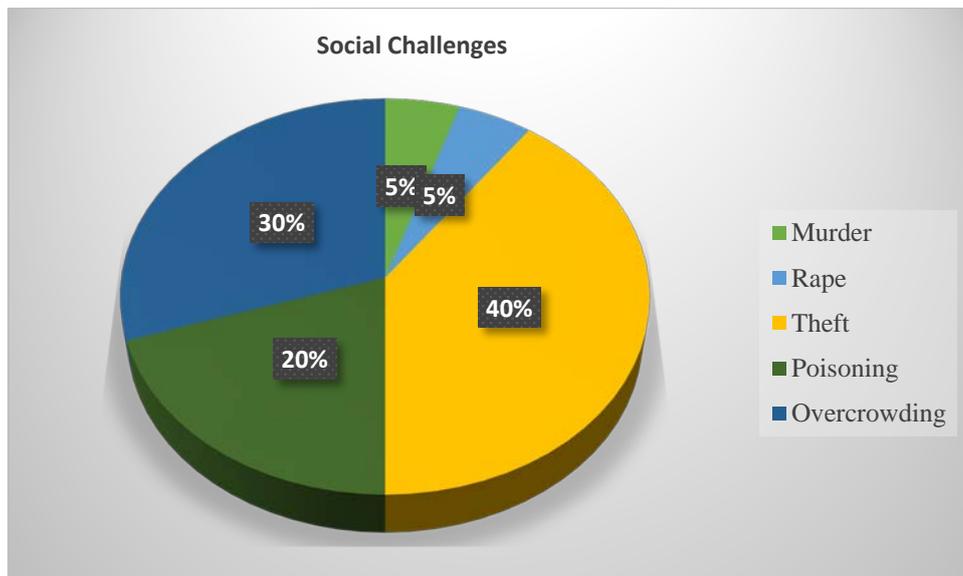


Figure 2: Social challenges facing Nairobi City Park
Source: Field Survey, 2019

The results above point out that the most manifested social challenge in Nairobi City Park is theft, with the rapid increase of population in the city of Nairobi and the composition of the population being the youth, there are high cases of unemployment and poverty which in most cases lead to cases of theft and robbery in the park. Overcrowding is another social problem facing Nairobi City Park; however, overcrowding is mostly experienced during the weekends when most people are free, being a recreation site with no charges attached, there is a tendency of attracting a very huge population. Overcrowding exacerbates issues such as pick-pocketing and indiscriminate disposal of waste. Poisoning of fish ponds is another challenge facing Nairobi City Park. Initially, the park used to have a number of fish ponds, however, cases of fish ponds poisoning were experienced leading to the death of all the fish, as at the time of data collection for this study, there were no fishponds in Nairobi City Park. Murder and rape are also social problems that are facing the Nairobi City Park; although their prevalence are low each attributed to 5% of the social challenges facing Nairobi City Park, their implications are undoubtedly high. Murder and rape in Nairobi City Park in most cases happen in the forests.

4.3 Management challenges

This study pointed out that there are indeed management issues facing the Nairobi City Park. The most common management issues that the study pointed out are shortage of man power and low/lack of expertise. City Park falls under the Parks and Open Spaces Section of the department of environment, Nairobi City County. According to the respondents, this section has only 50 employees tasked with working in the nurseries and other general work. The 50 are then divided among all the parks and open spaces run by Nairobi City County. City Park is therefore understaffed and this definitely affects its operations. Respondents asserted that the nurseries were the most affected, as there is always a lot of work to be done while the employees are few. Nairobi City Park is also facing the challenge of low/lack of expertise. Being a host to abundant plant and animal species, the park ought to have experts in botany and zoology, however, the study pointed out that most of the employees are hands-on-men and women without specialized knowledge on park and wildlife management.

V. CONCLUSION

The focus of this paper is on the challenges that are facing urban green spaces in Kenya with a specific focus to Nairobi City Park. The study identified three broad categories of challenges that is environmental, social and management challenges. However, it is worth noting that this study has not provided any solutions to the challenges identified, however, the paper has acted as an eye opener for future research in developing a strategy for sustainable management of urban green spaces in Kenya.

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Framework to Reduce the Adversary Linkage Attacks in Data Publishing: MORAS

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Abstract- Collaborative data publishing from multiple data providers in recent is a common practice. Data owners publish these micro data for research and pattern analysis deploying data mining and high end intelligent retrieval systems. albeit, few attributes may necessitate sensitive data disclosure when nexus with external viable data sources resulting sensitive data leakage. MORAS algorithm, used in this work enlightens a framework to reduce the linkage attacks by adversary and deriving the population uniqueness to zero. Hence, the privacy infringements are eliminated in data publishing avenue.

Index Terms- data mining, equivalence class, privacy leakage, linkage attacks, Re-identification risk, uniqueness,

I. INTRODUCTION

Data collection and data publishing is a most preferred activity by repository systems such as health care. The published data may subsist person-centric information. few attributes published by various data holding agencies may be classified as i)sensitive ii)non-sensitive and non-identifiable iii) identifiable and iv)partially identifiable. the earlier studies rendered by researches draw out with insights adhering identity attacks and sensitive data disclosure menace. Hence, Privacy preserving data mining is evolved to protect individual's privacy while facading the users to share their data with trust and assurance. The earlier models imbibing privacy preservation in data publishing avenue are presented. *k*-Anonymity model which emphasize on constructing the clustering groups according to their similar features[1]. this suffers with homogeneity attacks, as the similar clusters were distributed in the published database, the adversary can figure out the similar classes and re-identity the records pertaining to an individual. hence, *l*-Diversity model proposed to guarantee the distribution of equivalence groups and clusters exhibiting the diversity of sensitive attributes, at each cluster level, so that the attacker is bewildered to identify the individual's record[2].

According to rules laid by HIPAA(Health Insurance Portability and Accountability Act,1996), while publishing the microdata of statistical databases and the privacy guidelines to be adapted while adhering NCBI suggestions. *t*-closeness offers reduced granularity in each cluster classes, such that they exhibit reduced distance at sensitive attributes[3]. The following scenario describes adversary attack using data linkage as presented in Fig.1.

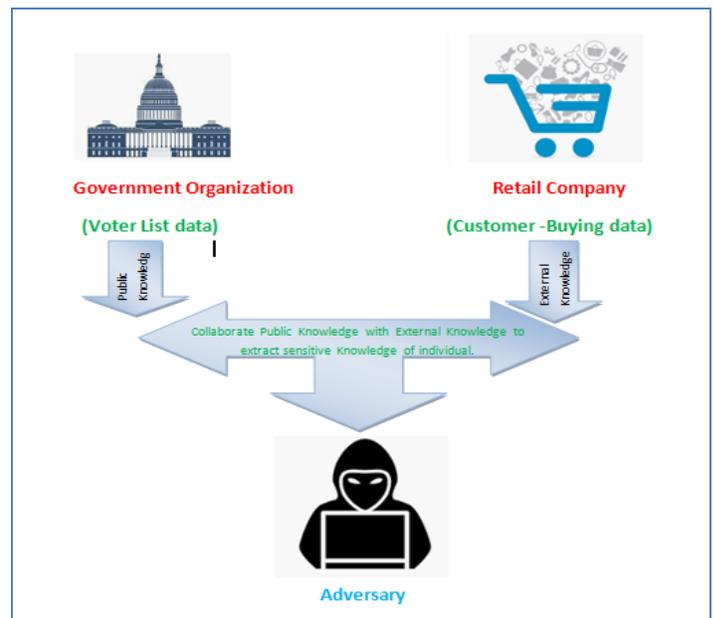


Fig.1 A Visualization of attacker model for linkage of data from public knowledge to private knowledge.

The Adversary Attack Model(AAM) described, with linking the public available data(Voters data) with external knowledge such as Customer buying habits on an e-commerce platform. If customer purchases, few sales items, which are sensitive, then the attacker can mine such sensitive knowledge using high performant information extraction techniques and then, it leads to Privacy infringement. The Proposed work, MORAS(MODEL for Reduced Attacker Success) is instrumental in enhancing the privacy preservation and prudent in thwarting privacy breaches.

The privacy is jeopardize when linkage of published data by the repositories when compared with other private knowledge. This work focus on evaluating the Re-Identification Risk(RIR), Data disclosure by quasi-identifiers and finally a model for reduced adversary attack with respect to Prosecutor Risk Model(PRM).

II. RELATED WORK

A. Key definitions

Quasi-identifiers : A set of attributes, $\{a_0-a_n\}$ of a database *D*, which help to identify an individual from a released database(*D*).

Sensitive data : the data, which is an attribute $A \in D$, which an individual want non-disclosure to public domain.

Prosecutor Risk Model (PRM): the intruder extract the sensitive knowledge from released database, D using aprior knowledge about an individual from the given population P .

Uniqueness : the equivalence classes, $E_q \in$ each Equivalence class is clustered such that the dankar population constant is set zero.

This work carried on de-facto dataset for privacy evaluation named US Adult dataset, provided from UCI machine learning repository, which is highly cited by research community. It's best known as Census dataset, which exhibits following properties. Table 1, presents sampling size of 32561 having $QI = \{age, gender, occupation\}$ acting as QI for given data, D and $\{race\}$ is a sensitive attribute. Table 2, shows the population size considered for two regions, namely USA and India having sampling fraction 0.0001 and 0.00003 respectively. the distinction and separation of quasi-identifiers were presented in the Table.3

Table 1. Adult dataset properties

| Attributes type | Quasi-identifiers | Domain size | Cardinality |
|-----------------|-------------------------|-------------|-------------|
| Multivariate | {age,gender,occupation} | 32561 | 15 |

B. Evaluating the Privacy Disclosure- Risk (PDR) based on quasi-identifiers.

Table 2. Dataset Model

| Region | Sampling fraction | Population size | Suppression Limit |
|--------|-------------------|-----------------|-------------------|
| USA | 0.0001 | 317238626 | 0% |
| India | 0.00003 | 1210569573 | 0% |

.Table 3. Distinction and Separation of QI

| Quasi-identifier | Distinction(%) | Separation(%) |
|--------------------------------|----------------|---------------|
| age | 0.2241 | 97.86 |
| gender | 0.0061 | 44.27 |
| occupation | 0.04 | 90.28 |
| {age,gender,occupation} | 4.89% | 99.85 |

among the given quasi-identifiers, attribute *age* shows maximal distinction(.2241) and *occupation* having 0.04% and when $\{age,gender,occupation\}$ then, distinction of records is 4.89%.

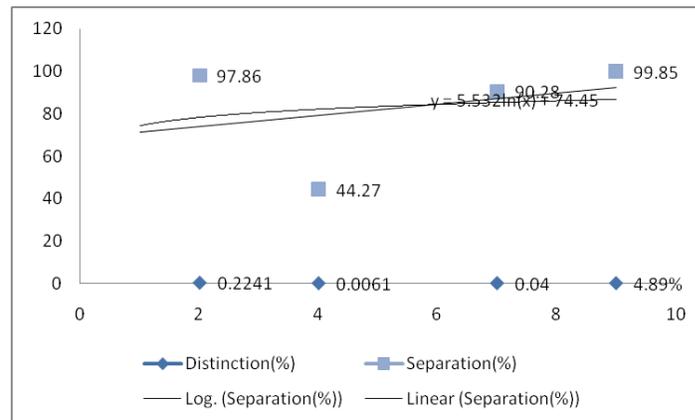


Fig.2 Graph showing the Distinction & Separation for attributes {age},{gender},{occupation} and {age,gender,occupation}.

A. Framework

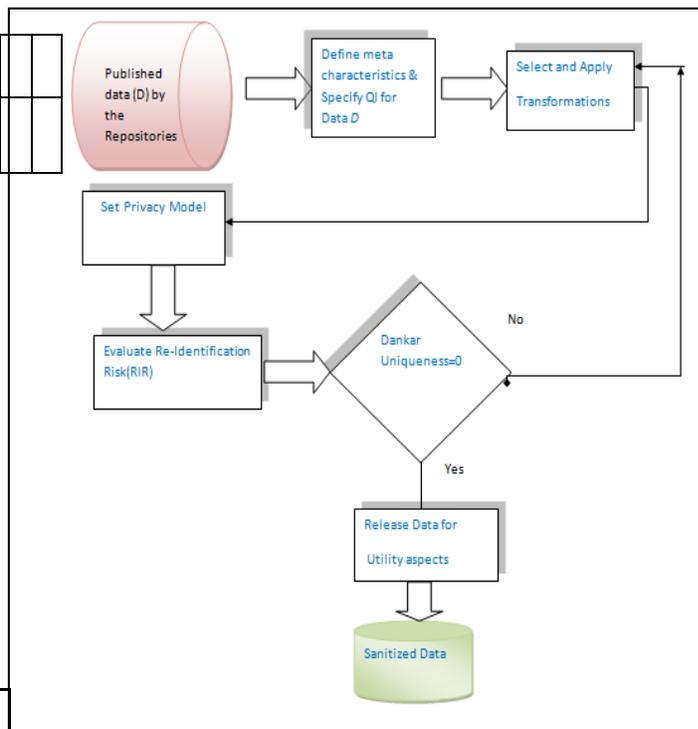


Fig.3 Framework deployed for the proposed work to be work on US-Adult data.

The transformations applied is shown with lattice representation as shown in Fig.4. The contingency between 'gender' and 'occupation' were analyzed for dataset showing maximal risk associated with 'managerial' category with 'male' gender as shown in Fig.5 demarked with an ellipse.

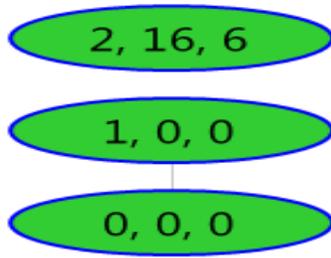


Fig.4 Lattice with transformations performed

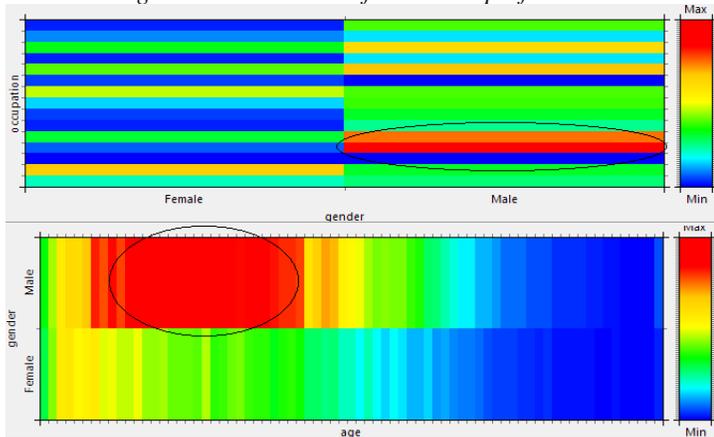


Fig. 5 Visualizing the Contingency of attributes 'occupation' and 'gender'

B. Proposed Algorithm

```

Algorithm MORAS(Input Original Database-D)
// accepts original database which is to be sanitized.
Begin
step 1: Define Quasi-Identifiers  $\forall$  attributes  $A_i$  in
database -D
step2 : Apply Transformations  $\exists$  QI are geneneralized
while ( $i \leq$  domain size)
    begin
        set k value
        //the k value is set for k-anonymity
    step3 : Perform construction of equivalence class
    step4: evaluate re-identity risk (RIR) and
    Uniqueness(UN)
    end
    if  $UN \leq 0$  then
step5: publish database D
    else
repeat step 3:
End// release sanitized data-D
    
```

C. Evaluating Re-Identification Risk(RIR)

The RIR for the dataset for the regions mentioned USA and India were evaluated using equivalence classes constructed with mentioned transformations.

*if Database D having Domain_{size} DS
 then \exists QI transformations T applied \in Database D
 then equivalence classes (EQ) constructed using
 clustering model(N) \forall QI*

$$\text{Attacker Success Estimate(ASE)} = \frac{Eq}{Ds} \text{ ----- eq.(1)}$$

where Eq = No. of. Equivalence class
 and Ds = No. of. Records

ASE(Attacker Success Estimate) for USA population is evaluated using Eq.(1) and presented in Table 4 when local transformation scheme applied using 100 iterations.

| Region | Parameters |
|---------------------|------------|
| USA | 4.01 |
| Maximal class size | 151 |
| Minimal Class Size | 1 |
| Equivalence Classes | 1306 |
| Total Records | 32561 |
| ASE(%) | 4.01 |

Table 4 showing various parameters after transformations

III.RESULTS DISCUSSION

The experiment carried on US-Adult data ,which comprises 32561 rows with 15 attributes exhibiting multivariate features on 64-bit Intel i3-3220 ,3.30GHz Processor. The RIR for given dataset using MORAS algorithm analyzed, which results in minimal data disclosure to highest prosecutor risk=30%. the intruder can extract sensitive data of individuals from published database maximal up to 3.39%.

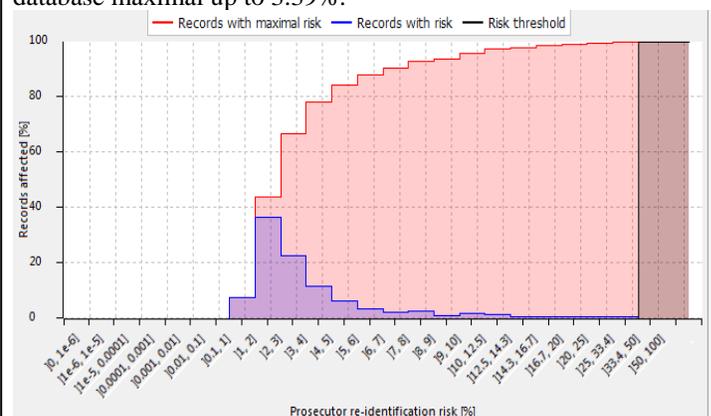


Fig.6 Visualization of Re-Identification Risks(RIR).

the population Uniqueness was evaluated using Dankar approach. this shows , the Uniqueness is derived to zero as represented in Fig.7.

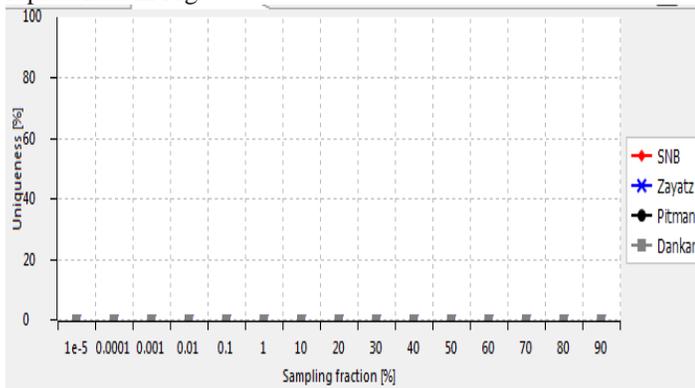


Fig.7 Population Uniqueness=0 using MORAS algorithm

IV. CONCLUSION

Data repositories publish collected data of individuals for diverse utilities. the public knowledge released to outer domain is innocuous, but due to external linkage from viable sources leads to sensitive data breach. To, thwart such linkage attacks by adversary, MORAS(Model for Reduced Attacker Success) is instrumental in reduction of Re-Identification Risks(RIR) by constructing equivalence classes with higher population spread at each bin. The Uniqueness of records is also reduced to zero, such that the attacker is minimal to data disclosure using intelligent extraction techniques. The individuals are open to share their data with trust and prudence , so that

The proposed work enhances data utility by balancing data suppression=0 and minimal attack. Further, the work can be extended to use, MORAS for voluminous data in Statistical data Disclosure Control(SDC) applications.

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Groundwater Quality analysis in and Around Chidambaram Taluk, Tamil Nadu

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Abstract- The estimation of water quality is very important for human being knowing its suitability for quality analysis in and around Chidambaram Taluk. Water samples were collected from 10 different areas of Chidambaram Taluk and analyzed various characteristics of water samples. The results showed that many of the water quality parameters from residential areas above the permissible limits of BIS and WHO.

Index Terms- Water pollution, BIS, Water quality, Groundwater.

I. INTRODUCTION

Groundwater is very important source of drinking water for both human being and animal in the world. It is also very essential source of water for the drinking, agricultural and the industrial sector. Being a significant part of the hydrological cycle, water resources depends on the rainfall and recharge methods. Groundwater quality is based on the physical, chemical and biological characteristics of groundwater. The suitability of groundwater for various uses majorly depends on quality of groundwater. Hence protecting the quality of groundwater is a major concern Packialakshmi et al., 2011. Water quality assessment is the major important tool for share the information on the qualities of water to the public. It acts as the indicator of the quality of water. The purpose of assessment water quality is to turn multifaceted water quality data into simple information that is essential for the public. Many other researchers have conducted a study on groundwater quality by estimating the water quality index to substantiate the variation of groundwater quality Kumar et al., 2013.

The availability of a water supply depends upon the both quality and quantity is vital to human existence. The supply for water has increased over the year by year and this has led to water scarcity in many other part of the world. The situation is aggravated by the problem of contamination or water pollution. India is facing towards a freshwater crisis mainly due to improper miss management of water resources and environmental degradation. This leads to deficiency of access to safe drinking water supply to millions of people. This drinking water crisis is already evident in many parts of India, varying in scale and intensity depending mainly on the time of the year Sundara Kumar et al., 2010.

If the groundwater is contaminated, its quality cannot be return to its original quality, till stopping the pollutants from the sources. So more attention required to regularly monitor the groundwater quality and to device ways and means to protect it

Khalid Hameed Lateef 2011. Water quality index(WQI) is the important tool to give the information on the water quality to the concerned citizens and policy makers. It is an important parameter for the analysis and management of groundwater. WQI is defined as a rating reflecting the composite influence of different quality of water parameters Ramakrishnaiah et al., 2009.

II. MATERIAL AND METHODS

All the water samples were collected from 2.5 litre clean and dry plastic canes without any air bubble. Then the water samples were analysed in the water analysis laboratory within four hours after sampling without mixing any preservatives. These Water samples were collected in the month of April 2015 to month of April 2016. The water samples temperature were noted in the sampling point itself. The samples were transfer to the laboratory to determine the major characteristics. The physical and chemical characteristics were analysed such as pH, turbidity, calcium, magnesium, iron, fluoride, TDS, Total Hardness, chloride, sodium, potassium, total coliform, using standard methods ISI, 1983; Sing et al., 2008; Dhembare et al., 1998. Based on the analysed data correlation coefficient was calculated by statistical method. Water samples were collected and analyzed as per procedures outlined in IS-2488/IS-3025/AWWA/ APHA. Sterilized containers were used for collection of water sample for bacteriological analysis, stored in ice-box and transported to the lab for the analysis. The temperature is measured using the thermometer and the pH is measured using the pH meter. The total dissolved solids are measured by Gravimetric method. Turbidity is measured using an instrument known as nephelometer Hussain and Hussain 2004; Shah et al., 2005; APHA 1989. Atomic Absorption Spectrophotometry provides accurate quantitative analyses for metals in waters. Total suspended solids are measured using Gooch Crucible and Total Hardness is measured using Titrimetric (EDTA) method Shyamala et al., 2008; Packialakshmi et al., 2010; Kumar, 1997; Purandara et al., 2003. Sodium, potassium by flame photometer and aluminium, manganese by atomic absorption spectrophotometer method Agbaire et al., 2009; Palanisamy et al., 2007.

III. RESULTS AND DISCUSSION

Determination of chemical and physical characteristics of water is very important for the suitability of water for drinking, household uses and industrial. Standards have been laid down by

various agencies such as a World health organization, U.S. Environmental protection agency, Bureau of Indian standard and ICMR for drinking water quality for many other uses. The results of the physico-chemical analysis of water samples are shown in tables 1 and 2. The mean temperature of water samples ranged from 24 to 37°C. The highest temperature was recorded in the month of June and the lowest temperature was recorded in the month of February. All the water samples were colourless, odourless, tasteless and clear.

Turbidity is the haziness or cloudiness of a fluid caused by individual particles (suspended solids) that are generally invisible to the naked eyes (Mazhar et al., 2013). The turbidity of all water samples ranged from 0.7 to 2.8 NTU (Tables.2). The higher values are observed at station 1 and lowest turbidity was observed at station 3. The analysed values are above the recommended limits (BIS: 10500-1991). Clear water is more appealing to drink; one treatment method is a filtration system. A total dissolved solid is a measure of total concentration of all constituents dissolved in water and has a bearing on its taste color and odour. The TDS values varied from 114 to 388 mg/L Tables.2. High levels of TDS is not suitable for bathing and washing (Senthilnathan and Parvathavarthini, 2011). It is generally inferior to palatability and may induce an unfavourable physiological reaction in the transient consumer (Dhembare et al., 1998); Sangeetha et al., (2000); Mariappan et al., (2000) observed greater values of TDS than that of ISI standard, the reason may be due to entry of pollutants.

Table 1: Name of areas were samples taken.

| Station no. | Location | Source |
|-------------|--------------|-----------|
| 1 | Sethiyathope | Open Well |
| 2 | Manjakollai | Bore Well |
| 3 | Bhuvanagiri | Bore Well |
| 4 | Poonthotham | Bore Well |
| 5 | Vakkur | Bore Well |
| 6 | Chidhambaram | Bore Well |
| 7 | Orathur | Bore Well |
| 8 | Mirallur | Bore Well |
| 9 | Oodiyur | Bore Well |
| 10 | Vazhakollai | Open Well |

Table 2: Groundwater quality parameters of the study area.

| S I . N o | Part icul ars | Un it | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-----------------------|---------------------|----------|-----|-----|--------------|------|-------|------|------|------|-------|------|
| | | | 1 | EC | µS / cm @ 25 | 7300 | 10500 | 8758 | 6380 | 9620 | 11900 | 8950 |
| 2 | pH | m g/l it | 7.5 | 7.3 | 7.3 | 7.5 | 8.1 | 7.4 | 7.3 | 7.3 | 7.3 | 8.4 |

| | | | | | | | | | | | | |
|----|-----------------------------------|-------------|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|
| 3 | Tur bidi ty | N T U | 0.7 | 2.3 | 2.8 | 2.6 | 1.5 | 2.5 | 1.7 | 0.9 | 1.8 | 1.6 |
| 4 | Ca | “ | 315 | 374 | 414 | 457 | 367 | 459 | 343 | 473 | 447 | 338 |
| 5 | Mg | “ | 26 | 23 | 31 | 25 | 23 | 27 | 32 | 26 | 29 | 30 |
| 6 | Na | “ | 13 | 15 | 15 | 14 | 17 | 16 | 17 | 16 | 17 | 12 |
| 7 | K | “ | 25 | 93 | 57 | 62 | 54 | 66 | 59 | 14 | 18 | 95 |
| 8 | HC O ₃ | “ | 248 | 756 | 978 | 1101 | 850 | 159 | 140 | 170 | 175 | 960 |
| 9 | CO ₃ | “ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | SO ₄ | “ | 128 | 127 | 77 | 106 | 147 | 170 | 90 | 86 | 134 | 127 |
| 11 | Cl | “ | 28 | 115 | 118 | 385 | 155 | 252 | 122 | 69 | 96 | 128 |
| 12 | NO ₃ | “ | 53 | 54 | 46 | 49 | 52 | 72 | 69 | 56 | 59 | 68 |
| 13 | F | “ | 04 | 07 | 06 | 05 | 04 | 06 | 08 | 05 | 09 | 06 |
| 14 | TD S | “ | 114 | 208 | 189 | 276 | 178 | 388 | 281 | 339 | 289 | 188 |
| 15 | TH as Ca CO ₃ | “ | 180 | 135 | 122 | 166 | 127 | 170 | 164 | 159 | 190 | 150 |
| 16 | TA as Ca CO ₃ | “ | 198 | 127 | 115 | 179 | 132 | 200 | 144 | 110 | 143 | 139 |

IV. CONCLUSIONS

Groundwater is essential need for growth of all country. If water resources is to remain available as good quality water for upcoming generations, it is very essential to control from the possible contamination. This freshwater and pure water crisis is already evident in many other part of India, particularly in Tamil

nadu, varying in scale and intensity, depending mainly on the climate condition of the year. In Tamil Nadu, water supply scarcity plays an important role. However, water quality monitoring is an important tool to find contamination of groundwater and to provide an advanced warning of the approaching contaminated groundwater to important sources of water supply. This is of great importance, because the problem concerns securing a safe portable water supply for the present and future generation people.

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Implementation challenges and Research Gaps of Electronic Medical Records (EMR) in Public Sector Hospitals of Sri Lanka

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Abstract: Electronic Medical Record (EMR) is the lifelong electronic Health Passbook which contains patient's health information in a computerized system. This research paper reviews the implementation challenges of Electronic Medical Records (EMR) of Sri Lankan public sector hospitals. The main focus of this paper is to investigate the research gaps in national EMR implementation for systematic empirical study in order to substantiate future doctoral studies. This paper highlights the current status and research gaps of EMR implementation in Sri Lankan public sector hospitals in relation to progress, benefits and challenges. Absence of empirical evidence of systematic investigation on EMR project progress and national plan for implementation concludes with recommendations for future researches.

Keywords: *e-Government, eHealth, Digital Health, Public Sector Hospital, EMR, barriers for EMR implementation, Sri Lanka*

1. Introduction

Good health is not only important for individuals, but also for governments because it plays a central role in achieving sustainable economic development and growth as well as effective use of resources. World Health Organization (WHO, 2018) defined e-Health or digital health as “use of information and communications technology (ICT) to improve health” and highlighted its benefits “reduce healthcare costs to families, improve equitable access to quality services, efficiently link health systems with social protection programmes, and increase accountability and sustainability of health service delivery” EMR is a real time electronic record of an individual patient's health information: patient demographics, past medical history, vital signs, examination and progress notes, medications, allergies, immunizations, laboratory test results, radiology reports, and living wills (Rampatige, Abusayeed, & Galappaththi, 2010, p 54). Compared to hand-written paper-based health records maintained at each clinic/hospital, EMR provide significant benefits to patients, clinical staff, management and policy makers for effective clinical management and hospital management.

1.1 Purpose of the Study

This study aims to study overall EMR implementations in Sri Lankan public sector hospitals and identify the progress so far, benefits of implementation and challenges. It intends to identify the research gaps and propose recommendations with direction for future research.

1.2 Methodology

This paper uses deductive approach to arrive conclusions by interpreting the meanings of findings from literature and interviews. Journal articles and publications were reviewed from online libraries and databases. Preliminary interviews were conducted with medical professionals who are involved and not involved in EMR implementations and ICTA digital health project managers.

2. Literature Survey

Health is central to human happiness and well-being thus it makes an important contribution to economic progress, productive and healthy population. There are many players to support health care in a country such as government organizations, non-government organizations, private sector health organizations, donor organizations, civil society groups and communities (WHO, 2018a).

The health care system of a country can be grouped to two distinct sectors: public sector – government health care system and private sector health care system. In Sri Lanka, public sector health care system facilities are provided free of charge while private sector systems are on payment based.

The cost of health services is increasing thus health care organizations and citizens have to make health financing arrangements to ensure that people are not denied access to essential health services because they cannot afford it. As per the World Bank statistics the global health expenditure (% of GDP) in 2016 as 10.02 while United States having very high 17.07 and Sri Lanka's score is at the lowest end: 3.89 (World Bank Group, 2019). Thus finding innovative methods to provide better health care facilities with minimum cost has become very important for hospitals and governments. Digital Health helps to address the health problems and challenges faced by patients and helps reduce inefficiencies and costs in healthcare delivery, whilst also improving access, increasing quality, and making medicine more personalized and precise (Kelly, 2017). The most endorsed digital health technologies are Electronic Medical Records (EMR), computerized provider order entry (CPOE), eChanneling, ePrescribing and computerized decision support systems (CDSS) due to their financial and clinical benefits (Scott, Pillans, Barras, & Morris, 2018).

2.1 Electronic Medical Records (EMR)

EMR sometimes referred to Electronic Health Record (EHR) is a real time electronic record of an individual patient's health information: patient demographics, past medical history, vital signs, examination and progress notes, medications, allergies, immunizations, laboratory test results, radiology reports, and living wills (Rampatige et al., 2010). During past three decades, a number of different forms of EMRs have been developed and implemented in developed and developing countries while other countries are currently in the process of planning and implementing EMR systems (WHO, 2006). Effective EMR implementations help achieving a comprehensive set of information providing continuity of patient care, at the right time, right place and right cost. This will not only facilitate to provide timely healthcare, but also prevent duplication of investigations, medications, delay in care, risk and reduce cost (Mogli, 2012). Many patients receive services from separate facilities (clinics and hospitals) and care providers thus the value of individual patient data for improved patient care is efficient and effective if the electronic record system could compile these data and make them accessible to other health care professionals (World Health Organization, 2012).

2.2 EMR in Sri Lanka

Introduction to digital health initiative in Sri Lanka has started in 1997 and many organizations: Ministry of Health, Nutrition & Indigenous Medicine, the Specialty Board in Biomedical Informatics, Redcross, Post Graduate Institute of Medicine (PGIM), the Health Informatics Society of Sri Lanka has contributed to its evolution (Health Informatics Society of Sri Lanka, 1998). The multi-disease surveillance software (MDS) has developed locally for the Ministry of Healthcare and Nutrition in collaboration with the support from World Health Organization which was initially developed for healthcare in the US and implemented in a small hospital (Chenkaldy Rural Hospital) in February 2007 then the first large hospital (Batticaloa Teaching Hospital) in April 2007 (Pole, 2010). The national EMR system in Sri Lanka is Hospital Health Information Management System (HHIMS) which started in 2010 and had successful pilot implementations in different hospitals: Dompe District hospital, Dambadeniya Base Hospital, Avissawella base hospital and Mahaoya base hospital. The Open-source version of HHIMS version 1 was implemented for the Regional Director of Health Services, Kegalle through the partnership with Information Communication Technology Agency (ICTA) in 2010 (HISSL, 2018), (Rathnayaka, 2019). Ministry of Health, Nutrition & Indigenous Medicine planned to implement this system in 47 hospitals in 2016, 100 hospitals in 2017, and 150 hospitals in 2018 (Ministry of Health, 2017).

2.2.1 Current Progress

The current EMR implementations in public sector (non-profit organizations) has provided significant cost benefits (Amarasiri & Dorabawila, 2018b), (Hewapathirana & Rathnayake, 2014). The four basic cost reductions were found: costs for stationeries, patient queue waiting time, supporting staff number and indirect costs such as drug balancing. The majority of economic benefits of EMR have been evaluated through Cost Benefit Analysis (CBA) techniques (Soo, Baik, & Lyul, 2013), (Karl, Tom, Alexander, & Veli N, 2006). A Sri Lankan research study also indicated that Health care professionals, supporting staff and patients had a positive perception on EMR systems (Amarasiri & Dorabawila, 2018b).

An evaluation report of ICTA shows that 52% of users find that there is hassle free quality health care services while another 35% of clients and 67% of users find that better quality in treating patient (Management Frontiers (Pvt) Ltd, 2015). The usability and acceptance of EMR has been recorded satisfactory (Pole, 2010), (Rathnayake & Hewapathirana, 2009), (Jeyakodi & Herath, 2016), .

The current EMR solution only covers the Out Door Patient Department (OPD) and its related sections although there is provision in the system to implement it other departments such as wards, blood bank, etc. It was planned to implement the EMR system in 300 hospitals during 2016 to 2018 however, only 50 hospitals (15%) have been implemented in mid-2019 (Rathnayaka, 2019). Ministry of Health plans to issue e-Health cards for all Sri Lankans by 2020 (DailyFT, 2018), however there is no national plan for its realization. The current status of EMR implementation is stagnated.

2.3 Implementation barriers

Implementation of EMR has been very challenging and many barriers have been identified in developed and developing countries: Holistic approach, Aversion to change, legal complication, privacy concerns, Security issues, technical barriers, inter-operability, Leadership, Coordination among stakeholders, resistance to use, incentives and knowledge of IT. (Eden, Burton-Jones, Scott, Staib, & Sullivan, 2018),(Alkhalidi, Sahama, Huxley, & Gajanayake, 2014),(Zayyad & Toycan, 2018) (Kaye, Kokia, Shalev, Idar, & Chinitz, 2010), (Mandirola, et al., 2015), (Kaduruwane, 2012)

Further, Williams & Suzanne, 2014 highlighted that converting from a paper-based to an EMR system is complex and difficult because it represents a paradigm shift for the work of physicians and other staff. The transition requires a systematic activity and must be managed from many aspects 'clinically, administratively, culturally, and organizationally. The transition must include not only the process changes inherent in the use of a new tool, but also the technical and procedural training, and the resultant changes to physician and staff roles within the office. Subsequently, it requires a strong management commitment and motivation. Secondly, involvement of all stakeholders, care providers and other users of the system right from the beginning is necessary for survival and sustenance of the project. Involving the stakeholders will help them to have a clear understanding of why the organization is making the change.

One research findings indicated that there are many independent e-Health systems implemented in Sri Lanka without proper central coordination (Wanniarachchi, Wanasinghe, Gamage, & Gunsekera, 2014). The main barrier of e-Health implementations is unavailability of national Health Implementation policy to drive the e-Health projects. Lack of research on eHealth related projects, inadequate central coordination, current compartmentalization among key stake holders have been identified as other barriers (Rathnayaka, 2019).

2.4 Gaps identified in EMR implementations

Gap 1 –Limited scientific research on EMR

The scientific research on EMR is limited in developing countries (Bedeley, 2014). Very few research articles were found in Sri Lankan EMR Implementations. Most of them evaluate the user acceptance using Technology Adaptation Model (TAM) (Edirisinghe, 2017), (Fernando, 2018) or Unified Theory of Acceptance and use of Technology (UTAUT) Model (Jeyakodi & Herath, 2016). The economic value of EMRs have been quantified by different researches and confirmed that EMR helps to avoid duplicate tests, reduce adverse drug events and achieve other benefits resulted in \$1.3 billion in benefits between 2006 – 2012 (Canda Health Infoway, 2015). However, there is limited economic evaluation studies available in developing countries and suggests the greater need for economic evaluation of eHealth interventions in developing countries (Bogale, Leon, & Louwrence, 2018). Importance of policies in implementing EMR and Health Managers' Trust also have been studied (Hewapathirana & Rathnayake, 2014; Indika Jagoda, Samiddhi Samarakoon, 2014; Rathnayake & Hewapathirana, 2009). There have been few researches on EMR success stories of EMR implementation (Syed Rehan, 2018), (Rathnayake & Hewapathirana, 2009), (Jeyakodi & Herath, 2016), (Amarasiri & Dorabawila, 2018a).

Gap 2 – National policy to implement EMR in all departments/hospitals and national Integrated EMR

Ministry of Health (2017) identified issues in implementing digital health projects "A *one-system-for-all model may not be acceptable to all providers; flexibility may be required as core data required for primary care consultations is identified, Need to identify the connections in terms of data sharing, Integration of existing systems in the private sector*". Currently the outdoor patient records are computerized in few hospitals and there is not connectivity among them thus the planned benefits of one health card concept is not yet possible to achieve. Margunn Aanestad (2011) indicated the building of nation-wide information infrastructures in healthcare through modular implementation strategies is important. Another research has highlighted the importance of national policies for successful implementation of country-wide digital health system (Jagoda, Samarakoon, & Rathnayaka). The Sri Lanka's digital health policy is still at a draft stage.

Gap 3 – Data Ownership, Data security and Privacy

There are over 3 million patient records already available in different hospitals. Ministry of Health has identified the need of proper maintenance of this large data set ensuing data security and privacy (Ministry of Health Sri Lanka, 2016). However, the routine Information Systems audit and empirical researches on this security area are not evident to assure the data protection.

Gap 4 – Data analytics and decision making

The true value for healthcare stems from providing the best level of care for patients based on well-analyzed data and predictions. The evaluation report has recommended to include data mining tools and business intelligent tools enabling decision support system (DSS) for the health sector at the provincial and national levels (Management Frontiers Limited, 2015). Thus the study on how this patient data could be used for better health care need to be studied.

Conclusion

EMR is a real time electronic record of patient's health information which can reduce healthcare costs to families, improve equitable access to quality services, and efficiently link health systems with social protection programmes, and increase accountability and sustainability of health service delivery. During past three decades, a number of different forms of EMRs have been implemented in developed and developing countries while other countries are currently in the process of planning and implementing EMR systems. Sri Lankan public health sector has made significant efforts in implementing a national EMR systems however, it is now stagnated without a national plan. Researchers and implementers have identified several barriers such as coordination, leadership, interoperability, Privacy, Security, national policy, lack of empirical research, etc. Therefore it is important to conduct a systematic empirical research to find-out these barriers and develop a national policy/framework which will be instrumental for policy makers to expedite this national implementation of EMR in Sri Lanka.

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Design and Implementation of Handheld Museum Guide

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Abstract- Many applications have been available in the market for guiding tourists in museums for helping them reaching their destinations efficiently. But these applications suffer from many shortcomings including limited functionality and accuracy of features. To alleviate these problems, we propose a design and implementation of TIG handheld museum tour guide device. TIG has been designed to provide the museum tourists with accurate and reliable information along with the ability to Interactive with free move. In addition to providing general information, TIG is capable of making visitor surveys with friendly GUI. Also, this device has been designed to access huge database. Evaluation of the device shows that TIG provides more accurate information with better efficiency than the existing solutions.

Index Terms- Handheld Device, Museum Tour Guide, friendly GUI.

I. INTRODUCTION

When we come into a museum, there are usually some kinds of guide systems, such as traditional multilingual tour expositor, special sections for expertise explanations, touch-screen computers for inquiries and tape or CD guide machine. All of them seem to bear different kinds of problems. Traditional multilingual tour guide and special sections for expertise explanations require high expense on training and ages. Touch-screen computers for inquiries provide the interaction with the user, but they cannot be carried around. As to tape or CD, which seems to be cheaper and easier to catch, it lacks the function of interaction. Visitors interested in the exhibit can press the indexed number of the exhibit and listen with the earphone, but they may not be able to enjoy color pictures functional and suitable to be applied for multimedia applications. With what have been stated, we choose handheld devices in museum guide system.

RFID is used to navigate and get the index number of exhibit. Every exhibit owns a RFID tag and RFID reader obtains the information in RFID tag such as index number of exhibit. System deployed on handheld devices gets detailed information from database through wireless network. Visitors can listen to the audio explanation, watch video, look the color picture of the exhibited items and read the text from the handheld devices without following the pace and route of the expositor. They will have enough time memorizing information explained and enjoy their tour. They will also be able to save their favorite information onto

devices, so that they can search for the information about the exhibit without going to the place.

Our guide system will make full use of the exhibits information, including pictures, 3D models, audios, videos, flash, text explanation, coming from our Digital Museum system. There are still issues to consider. How can we use the existing resources and existing services and how to provide the services to other systems which need them? How can we fully utilize the limited multimedia data to make the visitors enjoy themselves? How to design good experiences?

In this paper, we will present a framework and discuss the key technologies of museum guide system based on RFID & handheld device. The rest of the paper is organized as follows. Section 2 reviews the related works. Section 3 describes the hardware and software design of the handheld museum guide system. The system operation will introduce in Section 4. Section 5 shows the implementation of the device. Section 6 concludes this paper and gives the future work.

II. RELATED WORKS

Self-service guides are a common way of providing information about artworks exhibited in museums. Handheld devices are becoming popular companions that support our daily life. Due to increased storage and improved speed, handheld devices can provide multiple functions, such as tour guides, search instruments, and entertainment tools. handheld devices become an inseparable part of the "digital life" for many people around the world. This is owing to the fact that handheld devices have small screens [1], so they can be used at any time and any places. Furthermore, handheld devices permit the delivery of a range of multimedia material, such as audio, graphics, and video. In spite of such benefits, handheld devices are not expensive when compared with other types of computers [2]. Modern advances in handheld applications and wearable devices that offer new ways of designing museum guides that are more engaging and interactive than traditional self-service guides such as written descriptions or audio guides as in [3], [4].

Researchers design many systems for guiding such as iGuider (Intelligent-Guider), which is based on user-centered design principles and in view of usability and user experience perspective. iGuider uses the ARM11 processor and embedded systems, integrates Geographic Information System (GIS),

multichannel interaction technologies and RFID to provide multimedia attraction information for tourists as in [5]. Researchers design the tour guide system to be a humane and intelligent portable instrument guide [6][7]. As to the position technology about which exhibit you are looking for, [8] uses the infrared transmission technology to automatically get the position of the visitor. A Museum Guide System which is based on handheld devices (e.g. PDAs, short for Personal Digital Assistants) is presented in [9]. In which Radio-frequency identification (RFID) is used to navigate and get the index number of exhibit. Compared to traditional guide systems, such as tape or CD guide machine.

A radio frequency identification reader (RFID reader) is a device used to gather information from an RFID tag, which is used to track individual objects. RFID shown in figure 3.



Figure 3: Radio Frequency Identification Reader

III. SYSTEM DESIGN

A. Block Diagram

As shown in figure 1, the proposed hardware design of the handheld device mainly consists of Raspberry Pi 3 controller, Radio Frequency Identification Reader (RFID Reader), touch screen, and Microphone and speaker.

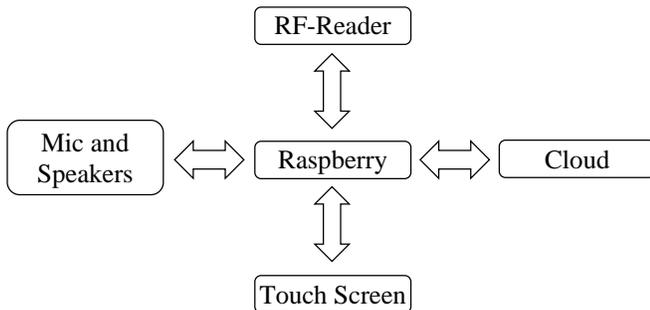


Figure 1: Block Diagram of Tour Guide Handheld Device

B. Hardware Design

- Controller (Raspberry Pi 3 Model B)

The Raspberry Pi 3 Model B shown in figure 2 is the third generation Raspberry Pi. This powerful credit-card sized single board computer wireless LAN & Bluetooth connectivity making it the ideal solution for powerful connected designs.



Figure 2: Raspberry Pi 3 Model B

- Radio Frequency Identification Reader (RFID Reader)

- Raspberry pi screen

We use Raspberry Pi 5 inch HDMI LCD USB TFT (800 x 480) display with touch screen that can provide high resolution picture and large viewing screen for the Raspberry Pi.

C. Software

- Raspbian OS

Raspbian comes out on top as being the most user-friendly, best-looking, has the best range of default software's and optimized for the Raspberry Pi hardware.

- Software Code

I. Python

Python is a widely used general-purpose, high level programming language. It was mainly developed for emphasis on code readability, and its syntax allows programmers to express concepts in fewer lines of code.

II. Tkinter

Tkinter is Python's de-facto standard GUI (Graphical User Interface) package. It is a thin object-oriented layer on top of python layer. Tkinter is not the only GUI programming toolkit for Python. It is however the most commonly used one.

III. SPI protocol

Implementation of SPI driver by python The Serial Peripheral Interface bus (SPI) is a synchronous serial communication interface specification used for short distance communication, primarily in embedded systems. SPI devices communicate in full duplex mode using master-slave architecture with a single master.

- Text to Speech (Alexa)

Alexa Voice Service (AVS) is Amazon's suite of services built around its voice-controlled AI assistant for the home and other

environments. AVS enables voice interaction with various systems in the environment and online. Alexa also supports an online service that automates Web-based tasks so that when user-specified events occur, follow-up tasks are triggered and handled.

D. Overview of the Operation of the System

The Raspberry Pi is the controller of the device; it runs the operating system and displays it on the screen. The RF-Reader is used to localize the device in the map and find the status around it. The Headphones are used to hear the audio scripts, and the mic is used when the user want to ask questions. The Raspberry Pi is connected to IBM cloud at which all the data are collected and analyzed. These data can be accessed through the cloud dashboard.

IV. DESIGNING GUI FOR HANDHELD DEVICE

The system GUI consists of four main screens, The Home Screen, the Map Screen, the statue screen and the Survey screen.

In the Home screen shown in Figure 4, there are three Buttons. The Help Button: In which the user can find a simple manual for how to use the system. The Map Button: This will show the map of the museum and the status in it. The About Button: It contains information about the device version and developers contacts.

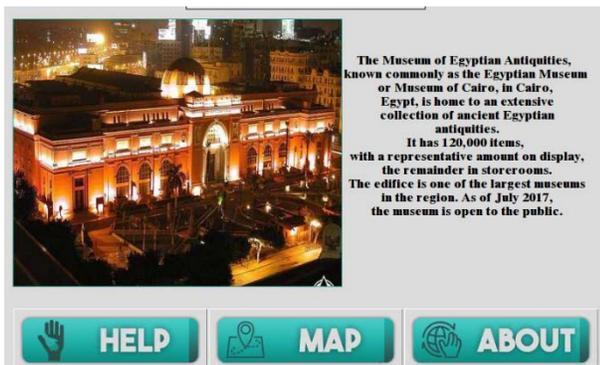


Figure 4: Home Screen

Figure 5 shows the Map screen in which the tourist has three choices to use to design his tour. He can follow a tour based on the nearest status to his location where all the status nearby will be shown on the map and their location so he can choose one of them. Or based on the Trending Status where the most visited and the most popular status will be shown on the map. Finally, He can display all status in the museum in case he wants to find specific statue.

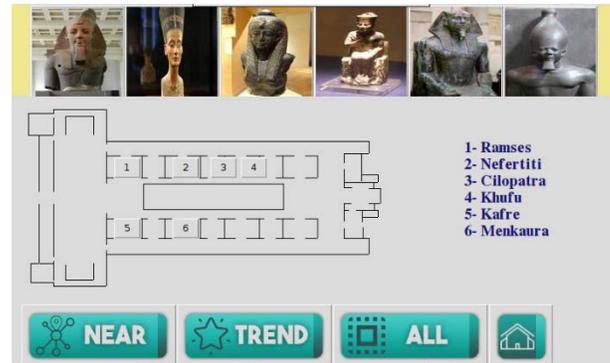


Figure 5: Map Screen

Once the tourist will choose a statue, the Statue screen will open and some information about the statue will be shown on the screen as well as the information will be heard through the headphones. The tourist can pause/play, stop and start the script again. As well, he can show more information about that statue, ask question about that statue or go back to find another statue. The statue screen is shown in Figure 6.



Figure 6: Statue Screen

After some time, the survey screen pops up to the tourist that asks him some questions about his tour in the museum, his visit to the country, some personal questions and to rate the device.

Beside the data from the survey, the device also collect data about what status do the tourist visit and how long he consumes at each of them. All these data are shown on a dashboard which can be used to improve the tourist visit to the museum by changing the most visited status positions so they can be reached easier, rearrange the status at which the tourist consume long time in order to reduce the crowding and update the status information based on the asked questions.

Finding statistics about the tourists as what nationalities visit the country, what are target gender and age. This information can be used in marketing.

V. SYSTEM FLOWCHART

The user communicates with the handheld device through touch screen. At the beginning of the tour there is a welcome message after that a screen that contain the help icon which is used to get familiar with the device also there is a map icon used to know the map of museum that can make the tourist made the navigate accurate with himself. When there is status nearby the RFID read detect the status tag and the record of the history of the status start with pictures after the record end there are tour interactive button at which the tourist can ask question by using Alexa and the device will answer it by the information that stored pervious in its data base (Alexa database). If the question is general Alexa will search over Wikipedia and answer the question. Then start to navigate into another status and so on. All the data collected from the RF tags and surveys made in the GUI send to IBM Blue mix cloud to make a dashboard illustrate the number of tourist came to museum and the gender percentage and the nationality needed to market. And used also for dynamic navigation at which the readied tags will send that how many devices nearby the status to alert the other devices to tell the tourist which status is busy and which is not. Figure 7 shows the system flowchart

VI. RESULTS

The experiment investigated the use of handheld device as platforms for self-service museum guides. Five main topics were considered for evaluation: engagement, guidance, interaction & intuitiveness, gamification, and the overall satisfaction. For the engagement, responses from participants of the experiment showed that the handheld tour guide was more engaging than other existing tools, and participants were able to experience the exhibit, rather than just visit it. The participants saw the handheld device more applicable, accessible, and finished, but admitted that the smart phones could have potential in the near future. The handheld device was evaluated as better by participants in the experiment in terms of guidance and interaction & intuitiveness. This has been due to the suitable size of field of view as was also mentioned by the exhibition coordinator. Furthermore, the touchpad of the handheld device seemed more challenging and bigger than interaction through touch on the other self-service museum guides. Further research is needed to develop better interaction, for example, by use of natural hand gestures. Gamification added to the guide did not provide a significantly different experience, but engaged participants in the exhibit. Several participants were very excited to try it out and it showed to be a good way of involving them into the exhibits. Rating on the overall satisfaction with the handheld device did not show any significant notes, and participants would use handheld device if they were available in the museum.

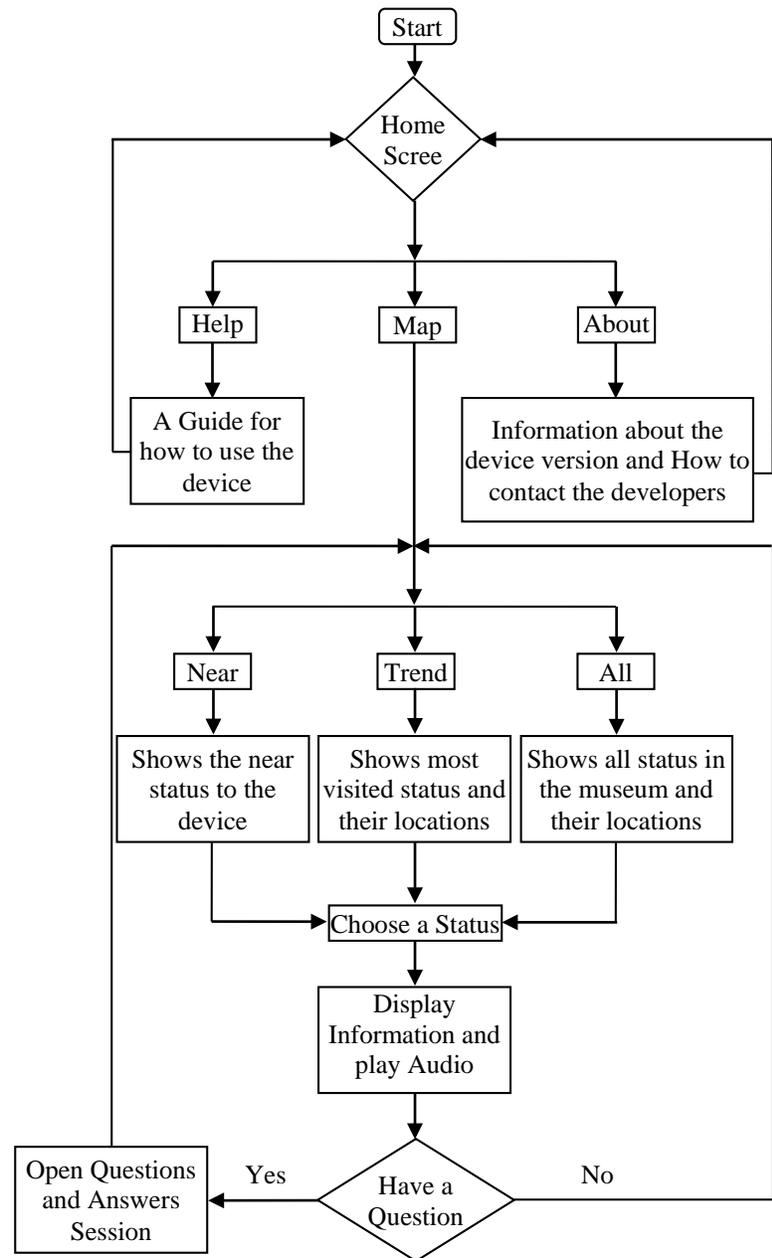


Figure 7: System Flowchart

VII. CONCLUSION

In this paper, we have presented a design and implementation of handheld device for Museum Guide. Figure 8 shows the museum guide device. Many key technologies have been discussed such as localization, Tkinter and Alexa. In spite of the works we have

done, some problems have not been solved completely. For example, RFID reader range and power consumption.

VIII. RECOMMENDATIONS

Future studies should replace the Raspberry Pi with a micro controller chip and replace the screen with another one that consume less power in order to increase the power efficiency.



Figure 8: The Museum Guide Device

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A Case Study on the Correlation Between Systemic Lupus Erythematosus and Tuberculosis

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Abstract- The incidence of Mycobacterium tuberculosis infections among Systemic Lupus Erythematosus (SLE) patients is commonly observed due to the immunocompromised state of SLE patients [1]. Recent studies show that a history of tuberculous infections play a key role in the induction and exacerbation of SLE in genetically susceptible hosts thus acting as an immunomodulatory agent [2]. We report a case of a female patient with history of tuberculosis with an incidental diagnosis of SLE. The symptoms of SLE worsened after completing a six month course of Anti Tubercular Therapy (ATT) with standard drugs on par with RNTCP DOTS guidelines.

Index Terms- Systemic Lupus Erythematosus; Tuberculosis; Koch's abdomen; Pleural effusion

I. INTRODUCTION

Tuberculosis is an infectious disease caused by acid fast bacilli, Mycobacterium tuberculosis and is typically transmitted via airborne droplet nuclei. The incidence of TB is a grave concern for the world today as approximately one quarter of the population is currently infected with latent TB [3]. Whilst affecting worldwide, tuberculosis tends to have a greater prevalence in developing countries due to community health problems and economic constraints [3]. SLE is an autoimmune disease having multiple organ system involvement. The pathophysiology of SLE is production of autoantibodies by the body's immune system against self-antigens. Renal failure, cardiovascular failure and infections due to immunodeficiency are major causes for mortality among cases of SLE [4]. Most common infections are caused by Gram positive and Gram negative organisms along with Mycobacterium tuberculosis infections among many other opportunistic infections [5].

There is ample evidence suggesting that cases of SLE are highly susceptible to tuberculous infections, mostly due to the hyperactivity of the immune system and high doses of immunosuppressive therapy, both aetiologies leading to an immunocompromised state[2]. Resistance to M tb mediated by cellular immunity is dysfunctional in patients with SLE [2].

II. CASE REPORT

A 26 year old female patient from Eastern India (Cuttack, West Bengal) presented with menstrual irregularities in April, 2019. On enquiring about her medical history, she was diagnosed

with Systemic Lupus Erythematosus simultaneously with abdominal tuberculosis in late 2016. She had completed a course of ATT for 6 months and has been taking corticosteroids for SLE since diagnosis. The patient is also a known case of hyperthyroidism since the age of 16 and is on medication for the same.

The patient gives history of an abortion 1.5 months after marriage at the age of 20. She has been anxious to conceive ever since the abortion. 4 years after the abortion, she developed symptoms of cough with expectoration, evening rise in temperature, night sweats and occasional abdominal pain. She also had presented with bilateral pitting pedal oedema, bilateral pleural effusion and mild ascites. Her ultrasound scans of the abdomen and pelvis were congruent with findings of Koch's abdomen (Thickened omentum with mesenteric and peripancreatic lymphadenopathy) . Chest X rays had findings of pleural effusion (Left lower lobe infiltrates along with bilaterally blunted costo-diaphragmatic angles). She gave history of her mother being diagnosed with pulmonary tuberculosis about 15 years ago. Other test results included raised erythrocyte sedimentation rates, strongly positive anti-nuclear antibodies, low serum albumin levels (2.2g/dl) and low albumin: globulin ratio (0.51). Tests for SLE were done out of suspicion due to her multi organ involvement despite the patient not presenting with any evident symptoms of SLE. She was immediately started on ATT, prednisolone 10mg BD and hydroxychloroquine 200mg BD; the latter two drugs being therapeutic for SLE, though she was asymptomatic for SLE. The ultrasound findings of Koch's abdomen were recurring on repeat scans for about 4-6 months after which her ultrasound scans were normal along with subsiding symptoms of tuberculosis. Repeat chest X ray also showed no evidence of pleural effusion or pulmonary infection. Yet, the patient's ESR oscillated between 60mm/hr and 115mm/hr strongly indicative of an ongoing inflammatory process.

In early April, 2019, she presented to the department of Obstetrics and Gynaecology with history amenorrhoea of 3 months and spotting with abdominal pain since 1 week. Serial beta Human Chorionic Gonadotropin values were monitored and pregnancy was ruled out, supported by no evidence of a foetus on ultrasound scans. On admission, she presented with abdominal pain, orthopnoea, bilateral pitting pedal oedema, breathlessness at rest, chest pain, joint pain(mostly small joints- fingers), pallor, crepitations in her lower lung fields, history of gradual weight loss over 2 years and passage of worms in stools. On running some tests, serum Amylase and Lipase were low indicative of pancreatitis. The patient was strongly positive for anti-nuclear

antibodies and anti dsDNA antibodies. Anti-Smith antibodies were negative. Liver function tests showed low total protein (5.2g/dl), low serum albumin levels (2g/dl) and low albumin: globulin ratio (0.6). Ultrasound scans of abdomen and pelvis showed bulky pancreas, peri- pancreatic lymphadenopathy and moderate ascites which puts abdominal TB as one of the aetiologies. Chest X rays showed evidence of bilateral pleural effusion. She was continued on treatment with parenteral prednisolone (40mg intravenous OD) and 200mg hydroxychloroquine. There was no evidence of Lupus nephritis nor was there evidence of involvement of the cardiovascular system.

III. DISCUSSION

Infections are a major cause of morbidity and mortality among patients with SLE [6], mostly due to their immunocompromised state. A study from northern India showed that 2.6% of 309 lupus patients had multiple infections. Approximately 25% had infections and tuberculosis was the most common infection in their study [7]. In this case, the patient was first diagnosed with abdominal tuberculosis and SLE was diagnosed incidentally. The patient later developed symptoms of SLE which gradually worsened over the years though she was already on medication for SLE. There are studies that show that tuberculous infections precipitate the onset of SLE in genetically predisposed individuals [8], [9], [10], [11], especially in endemic areas. There are other studies that show that tuberculous infections are responsible for a flare of SLE symptoms [12]. In this patient, we suspect that tuberculosis precipitated the onset of SLE and also it caused an acute flare in the symptoms of SLE. Over a period of 6 years, we suspect that the patient's medications for SLE have brought upon an immunocompromised state in the patient. This immunocompromised state could have caused a reactivation of tuberculous organisms and may be the reason for the recurrence of abdominal TB which could also be causing an acute exacerbation of symptoms of SLE in this patient. Findings of pancreatitis in the patient is suspected to be a result of usage of steroids in the patient or as a complication of gastrointestinal tuberculosis. Ironically, steroids are the most effective treatment for pancreatitis. Findings of bilateral pitting pedal oedema could be caused due to protein losing enteropathy, also a common complication of gastrointestinal tuberculosis. Reappearance of mild ascites and bilateral pleural effusion could be linked to SLE and to protein losing enteropathy. Nephrotic syndrome and liver failure can be ruled out as causes for ascites, pleural effusion and pedal oedema due to absence of proteinuria and normal liver enzymes on LFT.

Few studies suggest that the incidence of tuberculous infection in SLE patients on steroids (prednisolone) increased by 23% for each gram of prednisolone given [2]. Given that prednisolone is the most commonly used drug in SLE, a delicate balance exists between treating a case of SLE and subsequently not letting the treatment induce or reactivate a tuberculous infection.

ABBREVIATIONS

SLE: Systemic Lupus Erythematosus
TB: Tuberculosis
RNTCP DOTS: Revised National Tuberculosis Control Program Directly Observed Treatment, Short Course
BD: Twice Daily
M Tb: Mycobacterium tuberculosis
ATT: Anti Tubercular Therapy

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Analysis of the Factors Affecting Outcome of Therapeutic Penetrating Keratoplasty

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Abstract- This prospective study aims to determine the Factors affecting outcome of Therapeutic Penetrating Keratoplasty and its role in the management of corneal diseases. Penetrating keratoplasty is the final therapeutic option in the management of refractory corneal disease after conventional medical therapy fails to prevent corneal perforation.⁽¹⁾

Out of the 42 cases that underwent Penetrating keratoplasty in Karwar Institute of Medical Sciences and Hospital, Karwar from February 2018 to January 2019, 62% of cases were males and 38% were females. Male to Female ratio was 1.63:1. 95% of the cases were anatomically successful while 48% cases showed visual improvement. And it was found that the patients with pseudomonas infection had high failure rates and patients with smaller graft size had better outcomes.

Index Terms- FC- Finger counting, Graft clarity, Microbial Keratitis, PL- Perception of light, Therapeutic penetrating keratoplasty,

I. INTRODUCTION

Microbial keratitis is infection of the cornea that can be caused by a range of non-viral pathogens like bacteria, protozoa and fungi². Depending on the size and location of the ulcer, vision may be impaired.

The primary purpose of therapeutic penetrating keratoplasty is to restore the structural integrity of the eye and¹ to resolve infectious or inflammatory keratitis that is refractory to conventional medical therapy, and often both these indications are present.²

With the improvement of surgical techniques in penetrating keratoplasty in recent years, therapeutic PKP has

become an increasingly successful method for managing corneal perforation and refractory corneal inflammation.^{3,4}

This study was an analysis done at Karwar institute of medical sciences and hospital-Karwar to determine the factors that affect the success or failure of therapeutic keratoplasty.

II. RESEARCH ELABORATIONS

Methods :

Our study is a prospective analysis of 42 cases who have undergone therapeutic keratoplasty at Karwar institute of medical sciences and hospital- Karwar from February 2018 to January 2019. The age of the patients varied between 11 - 70yrs and included both males and females. The study was approved by local ethics committee and written informed consent was obtained from all subjects prior to participation.

The patients suffering from infective keratitis were selected and treated medically. For the cases which did not improve by medical treatment, surgical treatment using therapeutic penetrating keratoplasty was done and the patients were followed up and assessed at the end of one month and one year and the outcome was analysed considering the following factors.

- Graft size and post operative Graft clarity.
- Aetiology and clarity of the graft.
- Post operative visual acuity.

Observations :

Following observations were made after the clinical evaluation of the cases.

Table 1: Age and Sex distribution of cases:

| AGE IN YEARS | MALE | | FEMALE | | TOTAL | |
|--------------|------|-----|--------|-----|-------|-----|
| | NO. | % | NO. | % | NO. | % |
| 0-10 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| 11-20 | 1 | 3.8 | 0 | 0.0 | 1 | 2.3 |
| 21-30 | 2 | 7.7 | 1 | 6.2 | 3 | 7.1 |

| | | | | | | |
|--------------|-----------|--------------|-----------|--------------|-----------|--------------|
| 31-40 | 5 | 19.2 | 5 | 31.3 | 10 | 23.8 |
| 41-50 | 10 | 38.4 | 6 | 37.5 | 16 | 38.1 |
| 51-60 | 6 | 23.0 | 3 | 18.8 | 9 | 21.4 |
| 61-70 | 2 | 7.7 | 1 | 6.2 | 3 | 7.1 |
| TOTAL | 26 | 100.0 | 16 | 100.0 | 42 | 100.0 |

In the present series, out of 42 patients who had undergone therapeutic keratoplasty, 26 were males and 16 were females.

The most common age group affected was a group between 31-60 years (83%).

Age and Gender Distribution of Patients

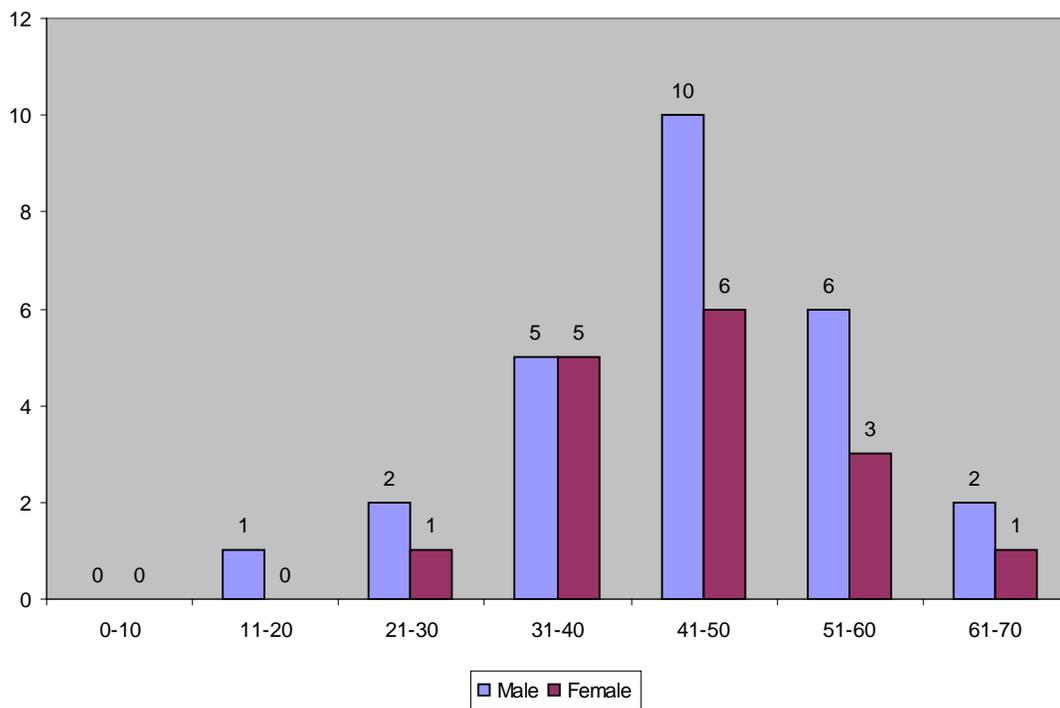
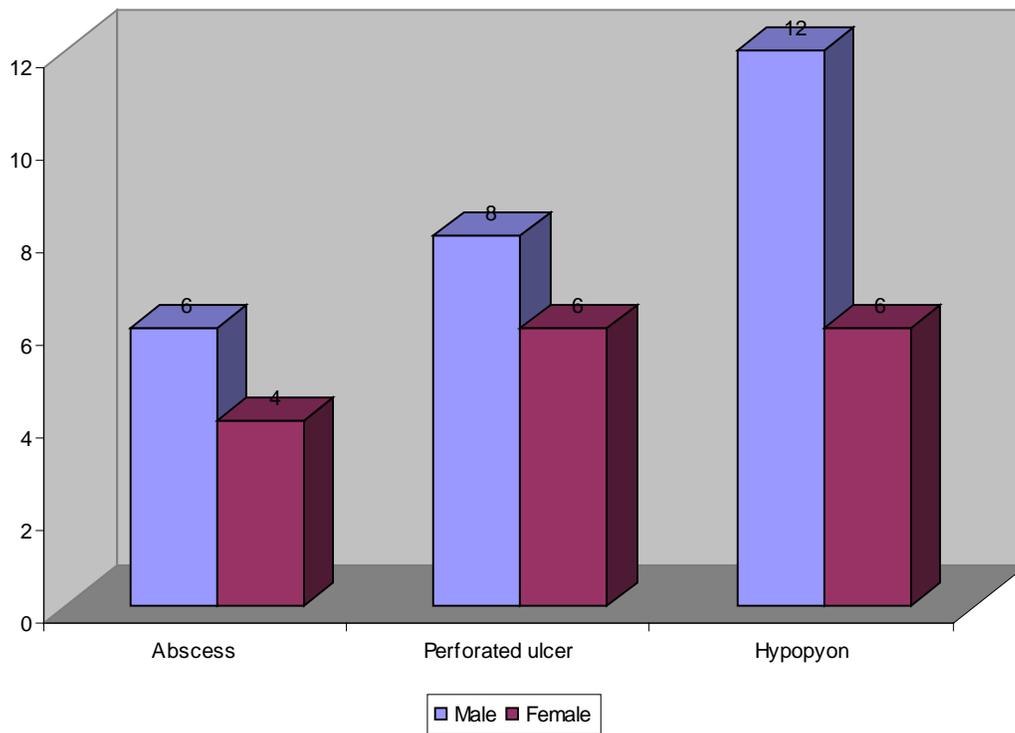


Table 2: Indications for Therapeutic Penetrating Keratoplasty:

| CAUSE | MALE | FEMALE | TOTAL |
|------------------------------------|-------------|---------------|--------------|
| Corneal Abscess | 6 | 4 | 10 |
| Perforated ulcer | 8 | 6 | 14 |
| Corneal Ulcer with Hypopyon | 12 | 6 | 18 |
| Total | 26 | 16 | 42 |

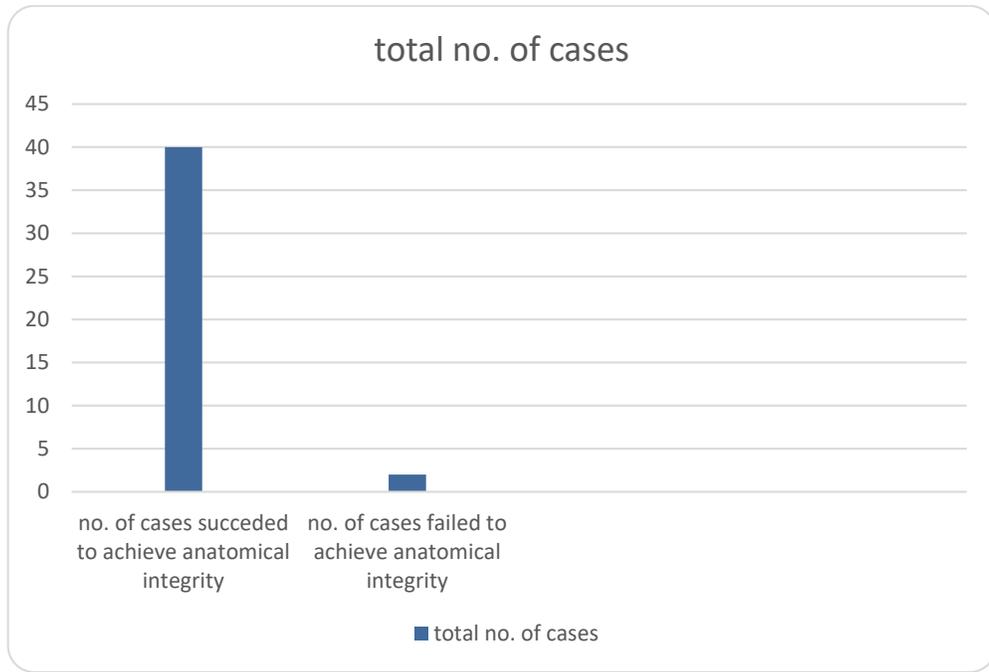
Causes of Keratitis



Most common presentation was hypopyon ulcer not responding to medical treatment (43%).

Table 3 : Anatomical outcome of the Surgery :

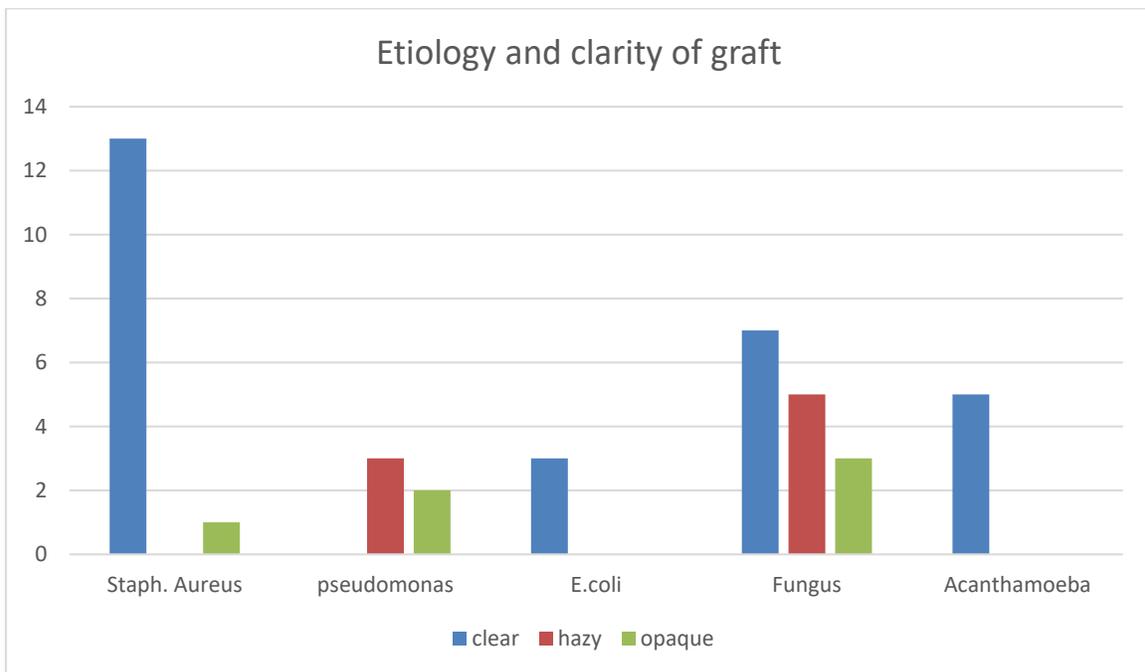
| Total No. of cases | No. Of cases succeeded to achieve anatomically integrity | No. Of cases failed to achieve anatomically integrity |
|--------------------|--|---|
| 42 | 40 | 2 |



95.3% of the cases succeeded in achieving anatomical integrity.

Table 4: Etiology and clarity of graft:

| Infection | CLEAR | HAZY | OPAQUE |
|---------------|-------|------|--------|
| Staph. Aureus | 13 | 0 | 1 |
| Pseudomonas | 0 | 3 | 2 |
| E. coli | 3 | - | - |
| Fungus | 7 | 5 | 3 |
| Acanthamoeba | 5 | - | - |

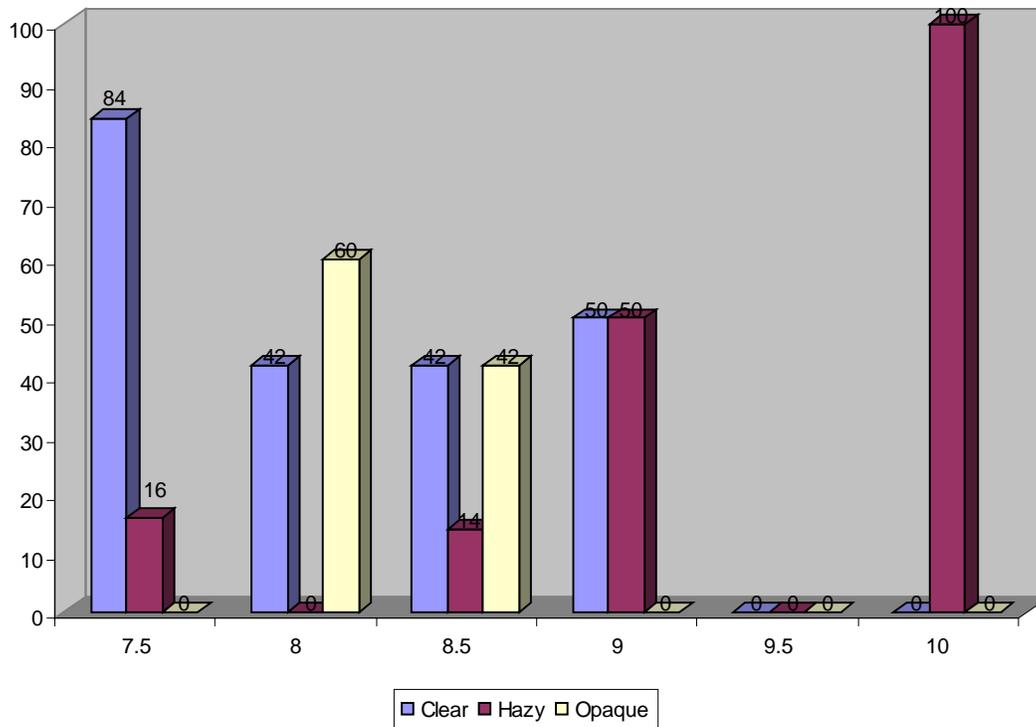


Graft failure rate was high with pseudomonas infection. Out of 5 patients infected with pseudomonas infection, 2 developed phthisis bulbi.

Table 5: Graft Size and Post Operative Graft Clarity

| GRAFT SIZE | CLEAR | HAZY | OPAQUE | TOTAL |
|------------|---------|---------|--------|-------|
| 7.5 | 21(84%) | 4(16%) | 0 | 25 |
| 8 | 2(42%) | 0 | 3(60%) | 5 |
| 8.5 | 3(42%) | 1(14%) | 3(42%) | 7 |
| 9 | 2(50%) | 2(50%) | 0 | 4 |
| 9.5 | 0 | 0 | 0 | 0 |
| 10 | 0 | 1(100%) | 0 | 1 |

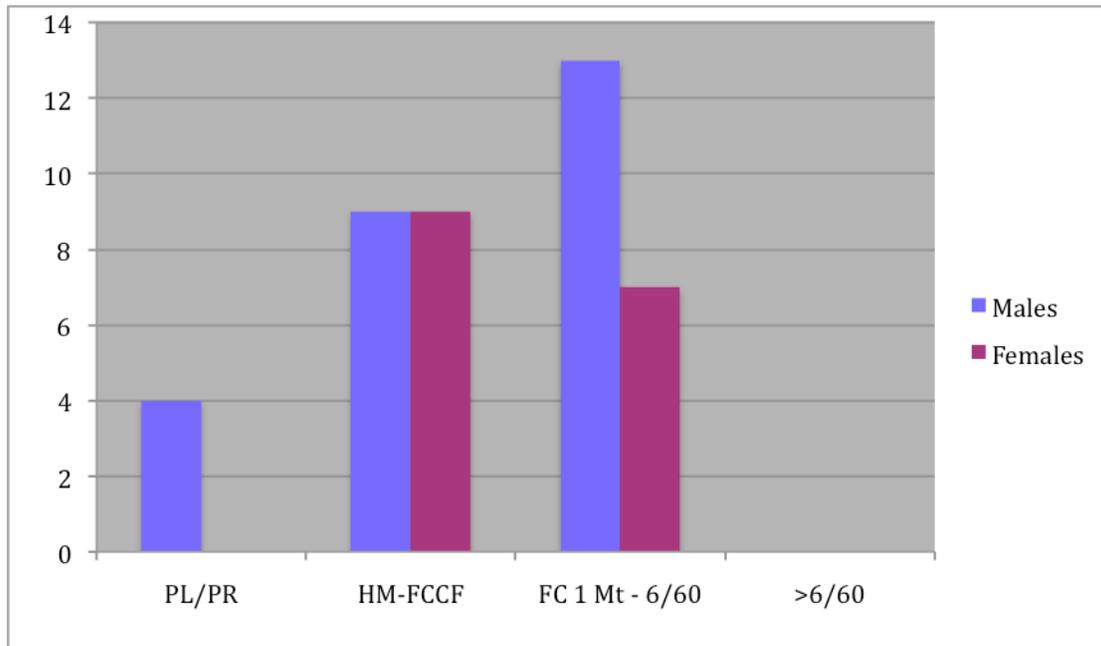
Outcome of Therapeutic Keratoplasty



60% patients undergoing transplantation had graft size of 7.5 mm. In this Graft size, 84% patients have clear graft and 16% have hazy graft.

Table 6: Post Operative Visual Acuity:

| Post Op Vision | Male | Female | Total |
|----------------|------|--------|-------|
| PL, PR | 4 | - | 4 |
| HM – FCCF | 9 | 9 | 18 |
| FC 1m- 6/60 | 13 | 7 | 20 |
| >6/60 | 0 | 0 | 0 |
| Total | 26 | 16 | 42 |



Restoring anatomical integrity was the main aim of therapeutic keratoplasty. Graft clarity and vision improvement were secondary considerations. Postoperative vision in patients undergoing therapeutic keratoplasty is more than seen preoperatively. 48% patients have vision of FC 1m-6/60.

III. RESULTS

In the present study, 42 cases were subjected for penetrating therapeutic keratoplasty. This study was undertaken to study the results of penetrating keratoplasty with respect to their anatomical and visual improvement. In the present study 62% of cases were males and 38% were females. Male to Female ratio was 1.63:1. Among these 42 PKPs, 22(52%) PKPs were diagnosed as bacterial keratitis, 15(36%) suffered from fungal keratitis, and 5 (12%) suffered from acanthamoebic keratitis. The age group between 31-60 years seemed to be affected more, i.e. (83%) compared to the older people.

Therapeutic keratoplasty is considered successful when anatomical integrity of eyeball is maintained⁷. In present study 95% eyes were saved anatomically.

Success of the therapeutic graft depends upon several factors:

1. Interval between death and enucleation and the interval between the enucleation and operation.
2. Selection of cases.
3. Virulence of organism
4. Graft size
5. Local and systemic immunity of the host
6. Tissue necrosis
7. Best time to operate
8. Operative technique and postoperative complications.

In this study, postoperative failure of graft was neither related to donor corneo-scleral button quality nor related to the interval between enucleation and keratoplasty surgery, since All buttons used were good to fair quality and there was no time lapse between availability of corneo-scleral donor button and keratoplasty surgery.

Also it was found that out of all the cases having Staphylococcus infection and undergoing therapeutic keratoplasty 99% had clear graft. Out of cases who preoperatively had fungal infection, 46% had clear graft. In cases infected with Pseudomonas, all had failed grafts. Which may be due to difference in the virulence of the organism.

Further we have found that The larger the graft size, the more the chances of graft failure, because of the increased chances of immunological graft rejection, vascularisation, peripheral anterior synechiae as well as secondary glaucoma.

In the cases with graft size 7.5 mm, 84% cases had clear graft while cases with larger size graft had more chances of graft failure. With 9.0 mm graft 50% ,while with 10.0mm 100% graft failure occurred.

IV. CONCLUSION

In present study, anatomical success was achieved in 95% cases, with visual improvement in 48% cases. Therapeutic PKP is valuable in the management of microbial keratitis, abscess and corneal perforation that does not respond to antimicrobial therapy. Bacterial keratitis was the leading indication for therapeutic PKP at our hospital but fungal keratitis had the worst postoperative results. However, therapeutic PKP eradicates more than 75% of bacterial and acanthamoebic keratitis. According to our study, therapeutic PKP has a satisfactory place in the management of medically unresponsive infectious keratitis. Judicious patient selection before surgery, careful planning of surgical techniques and appropriate follow-up care may all enhance the chances of a successful outcome.

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Spatial Analysis on Stunting Events Based on Community Led Total Sanitation and Poor families in Cianjur District

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Abstract- Stunting is a condition of failure to thrive in children under five (infants under five years old), a result of chronic malnutrition so that the child experiences a size that is too short of her age in general (National Team for the Acceleration of Poverty Reduction (2017). In the first 1000 days, from conception to age 2 years a window of critical opportunity, where timely intervention can have a measurable impact on the prevention of stunting in children. The stunting problem illustrates the existence of chronic nutritional problems, influenced by the condition of the mother, the condition of the fetus, and infancy including illnesses suffered during that period. By using secondary data which is then processed using geographic information system(GIS) software, the percentage of stunting, community- based total sanitation stop chapter can be seen so that it can be known priority areas in Cianjur district.

Index Terms- stunting, poor family, community led total sanitation, GIS

I. INTRODUCTION

stunting is one form of malnutrition problem that causes linear growth delay [1]. Short stunting increases the risk of child mortality, adversely affects cognitive and motor development decreases school performance, increases the risk of excess nutrition and non-communicable diseases, and reduces future productivity[2]. Stunting children are also at risk of experiencing a decrease in Intelligence Quotient (IQ) of 10-15 points[1].

Stunting is a condition of failure to thrive in children under five (infants under five years old), a result of chronic malnutrition so that the child experiences a size that is too short of his age in general [3]. In the first 1000 days, from conception to age 2 years a window of critical opportunity, where timely intervention can have a measurable impact on the prevention of stunting in children. The stunting problem illustrates the existence of chronic nutritional problems, influenced by the condition of the mother, the condition of the fetus, and infancy, including diseases suffered during this period [4].

According to WHO, the prevalence of stunting is a serious health problem in the community. When compared with other neighboring countries, Indonesia has the highest prevalence of stunting compared to Myanmar (35%), Vietnam (23%), Malaysia (17%), Thailand (16%) and Singapore (4%). The 2014 Global Nutrition Report shows that Indonesia is included in 17 of 117 countries, which have three nutritional problems, namely stunting, wasting and overweight in infants [4].

National stunting prevalence in 2013 was (37.2%), an increase compared to 2010 (35.6%) and 2007 (36.8%). Short prevalence of (37.2%) consisting of (18.0%) was very short and (19.2%) short. In 2013 the very short prevalence showed a decline, from (18.8%) in 2007 and (18.5%) in 2010. Short prevalence increased from (18.0%) in 2007 to (19.2%) in the year 2013 [5]

One of the factors that influence stunting is the condition of sanitation and environmental hygiene in pregnant women and children under the age of two years because they are vulnerable to various infections and diseases (MCA-Indonesia & Ministry of the Republic of Indonesia, 2015a). Access to clean water and poor sanitation facilities can increase the incidence of infectious diseases which can make energy for growth diverted to the body's resistance to infection, difficult to absorb nutrition by the body and hampered growth[4]. Increased adolescent nutrition and access to family planning will increasingly contribute to stunting reduction, such as the promotion of handwashing, access to clean water and sanitation [6].

Cutting the chain of bad sanitation and preventing stunting, pregnant women and children must live in a clean environment, do not defecate carelessly, and wash their hands with soap. Sanitation and hygiene interventions with a coverage of 99% reported an impact on reducing diarrhea by 30%, which then reduced the prevalence of stunting by 2.4% [7]

Previous research was also conducted in Indonesia, where it was found that household sanitation and drinking water treatment were strong predictors of stunting in the population of children aged 0-23 months in Indonesia. This finding adds to the increasing national and global evidence regarding the link between Household Water, Sanitation and Hygiene and linear growth in early life and shows that program policies and actions to overcome stunting must pay greater attention to Household Water, Sanitation and Hygiene interventions in Indonesia[2]

Health development in Indonesia, especially hygiene and sanitation is still a huge challenge. Integrated intervention is needed through a sanitation approach, which is a government program, namely Community Led Total Sanitation. The implementation of the Community Led Total Sanitation with five pillars will facilitate efforts to improve access to better community sanitation and change and maintain the sustainability of a clean and healthy culture. The five pillars are related to stopping open defecation, washing hands with soap, managing drinking water, and household food, securing household waste and securing household liquid waste. The implementation of Community Led Total Sanitation in the long term can reduce morbidity and mortality caused by poor sanitation, and can encourage the realization of a healthy, independent and just society

Another factor that causes stunting is poverty. Children who experience short are vulnerable and come from poor families. This factor is caused by inadequate feeding and childcare practices during infancy, low access to health services, or poor environmental sanitation. Some studies show that poverty is related to a factor of malnutrition, which in turn will affect children's development. Poverty causes reduced opportunities and the ability of parents to stimulate growth and development in children [8]. Previous research conducted in the City of Botswana showed that children who were significantly affected by wasting, stunting, and underweight were children living in slums[9].

Data from the Ministry of National Development Planning shows that Cianjur District is included in the focus of the integrated stunting prevention intervention in 2019 [3], and Cianjur Regency is also included in 100 districts and cities that have a prevalence, priority stunting and poverty health interventions[7]. The population in 2016 in Cianjur Regency was 2,249,000 people. The number of stunting toddlers in 2013 was 95,023 with the prevalence of stunting in 2013 amounting to 41.76%. The number of poor people in Cianjur Regency in 2016 was 261,000 with a poverty rate in 2016 of 11.62% [7].

The Health Profile of Cianjur Regency in 2017 shows that only 46.1% of villages have implemented community-based total sanitation out of a total of 360 villages / sub-districts in 32 sub-districts. Cianjur Regency is one of the priority areas for implementing community-based total sanitation as an intervention program for the Directorate of Environmental Health, Ministry of Health for handling stunting. In order to support efforts to implement total community-based sanitation and stunting treatment in Cianjur Regency, West Java, adequate information is needed regarding the implementation of total community-based sanitation and the incidence of stunting. Location / spatial based information can describe the actual conditions in the field and can be easily understood. Information on the distribution of implementation of total community-based sanitation and information on the distribution of location / spatial-based stunting events in the region will greatly support the implementation of effective and efficient programs.

II. METHODS

This study uses data from the Cianjur District Health Office of West Java Province 2017 and maps shapefile data from <http://gadm.org/maps>. This study used a descriptive study design by classifying the spatial analysis of the factors of stunting and poor families as well as the implementation of community-based total sanitation based on frequency distribution and administrative areas as well as scoring and weighing the main priority areas for stunting treatment programs based on poor families and implementing community-based total sanitation in Cianjur Regency.

This research was carried out in the area of Cianjur Regency, West Java Province. Data collection and analysis is planned for 3 weeks in December 2018. This study is a further analysis of the profile data of the Cianjur District Health Office in 2017 therefore the population and sample in this study are population and samples used in the profile of the Cianjur District Health Office in 2017. The target population profile of the District Health Office of Cianjur is the entire Regency population Cianjur and the study population was toddlers suffering from stunting in Cianjur Regency.

Spatial analysis is used to examine the patterns of spreading problems in spatial aspects or interactions between human variables and their environment. The type of spatial analysis used in this study is database query and overlay. Queries are used to regain the attributes of community-based total stunting and sanitation data where data that has been processed in the previous stage is classified, then given scores and weights so that they can be grouped into regions or areas that have a potential or a large risk of disease occurrence. The overlay is used to combine stunting data, community-based total sanitation, and poor families based on the region in Cianjur district which is displayed in layers on a thematic map.

III. RESULT

A. Cianjur regency, West Java, Indonesia

Map of the administrative region of Cianjur Regency consists of 32 Districts. The location of Cianjur Regency is geographically located between 6° 48' - 7° 12' South Latitude and 106° 24' - 107° 36' East Longitude, in the central part of West Java Province, with a distance of about 65 km from Bandung and 120 km from Jakarta.

Cianjur Regency with a total area of 3,501,470 Km² In addition to the geographical location that benefits the natural conditions of the Cianjur Regency area it also varies greatly. The expanse of the Cianjur Regency area from the north to the south is highland to the lowlands. Cianjur Regency is located at the foot of Mount Gede which stretches to the coastline of the Indonesian Ocean with a height of about 7 - 2,962 meters above sea level.



Figure 1. Cianjur regency, West Java, Indonesia

B. Poverty Relations with Stunting

Some perspectives in defining the concept of poverty, first, from the point of view of measurement, poverty is divided into two namely absolute and relative poverty. Second, from the point of view of causes, poverty can be grouped into natural and structural poverty. One of the important conditions for a poverty alleviation policy to be achieved is that there must be clarity about the criteria for who or which group of people falls into the category of poverty and becomes the target of the program.

Poverty is relatively a state of comparison between income groups in society, namely between groups that may not be poor because they have higher income levels than the poverty line, and relatively richer community groups. By using income measures, this situation is referred to as inequality in terms of income distribution [10].

In general, the population classified as poor is a "residual group", namely a group of people who have not been touched by a variety of specifically concentrated government policies, such as the Farmers and Fishermen Income Improvement Program. This group includes being difficult to touch because of the low quality of resources so that it does not utilize the facilities, including production factors. They also lack the ability, low level of education, very minimal training, including utilizing assistance for basic human needs, and legal protection or legislation that is not in their favor.

Some other criteria regarding poor occupation are related to the implementation of the Sub District Development Program according to the version of the National Family Planning Coordinating Board that to determine the poor population at least fulfills the following 6 criteria, namely self-owned and not self-owned, access to clean water and sanitation, income / converted to expenditure, asset ownership, frequency of meals (more than 2 times a day) and nutritional quality of food and in a year can buy at least 1 set of new clothing.

Of the six variables, if you get a score of 3 or more, the family is categorized as poor. Therefore, the commitment and consistency of the government in increasing economic growth in equitable ways without excluding the poor will increase social cohesion with politics

still limited access to quality early learning services (only 1 in 3 children aged 3-6 years has not been enrolled in Early Childhood Education / Early Childhood Education services).

3. Still, the lack of household/family access to nutritious food. This is because the price of nutritious food in Indonesia is still relatively expensive. According to several sources[5], food commodities in Jakarta are 94% more expensive than in New Delhi, India. Prices of fruits and vegetables in Indonesia are more expensive than in Singapore. Limited access to nutritious food in Indonesia has also been noted to have contributed to 1 in 3 pregnant women who have anemia.
4. Lack of access to clean water and sanitation. data obtained in the field shows that 1 in 5 households in Indonesia still defecates in open spaces, and 1 in 3 households do not yet have access to clean drinking water[12]

Lack of nutrition, especially stunting is an agenda that never ends and is a serious concern of the Government of Indonesia. The prevalence of stunting in children under the age of five (5) years is relatively high and does not show a significant decline over the past 10 years. National stunting prevalence among children under the age of five is 36.2%, 35.6%, and 37.2% respectively in 2007, 2010 and 2013 [5]

Stunting problems are influenced by various interrelated factors. Directly, stunting is influenced by the quality and quantity of inadequate and chronic nutrition, especially since the fetus until the age of 2 years, and a sick child. While indirectly affected by food security at home, handling health and nutrition and sanitation and hygiene behavior, as well as access to quality health and nutrition services. The state of sanitation and hygiene, especially the habit of defecating and washing hands with soap, has been proven conclusively to influence stunting.

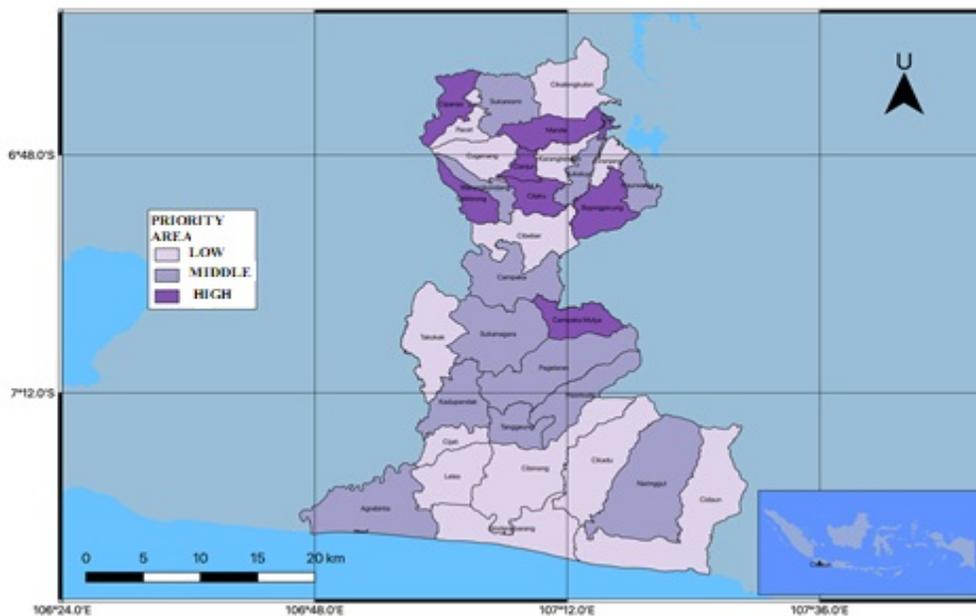


Figure 3 Management Program based on Poor Families and Implementation of CLTS in Cianjur Regency, West Java Province, Indonesia
Based on Figure 3, it can be seen that the areas that are the priority of the Stunting management program are based on poor families and Community Led Total Sanitation, namely Cipanas District, Mandeh, Cianjur, Gekbrong, Cilaku, Bojongpicung, and Campaka Mulya. The problem of malnutrition in children is the impact of complex food insecurity. Children who experience short (stunted), in food insecure environments and come from poor families.

IV. DISCUSSION

Community Led Total Sanitation, in this program is intended to improve sanitation conditions in order to reduce the prevalence of stunting in Indonesia through changes in sanitation behavior and community hygiene. Changes in sanitation and hygiene behavior are carried out through community empowerment to improve access to sanitation.

Lack of nutrition, especially stunting is an agenda that never ends and is a serious concern of the Government of Indonesia. The prevalence of stunting in children under five (5) years is relatively high and does not show a significant decline over the past 10 years. National stunting prevalence among children under five years of age was 36.2%, 35.6% and 37.2% respectively in 2007, 2010 and 2013[5].

Stunting problems are influenced by a variety of interrelated factors. Directly, stunting is influenced by the quality and quantity of inadequate and chronic nutrition, especially since the fetus until the age of 2 years, and / or a sick child. While indirectly affected by food security at home, handling health and nutrition and sanitation and hygiene behavior, as well as access to quality health and nutrition services. The state of sanitation and hygiene, especially the habit of defecating and washing hands with soap, has been proven conclusively to influence stunting.

2013 Basic Health Research (Riskesdas) data showed the prevalence of family stunting with adequate sanitation conditions (using healthy latrines) of 23.9%, while for families with poor sanitation conditions (not using latrines or using unhealthy latrines) at 35.5%. In terms of water treatment behavior in households, the prevalence of family stunting using processed drinking water is 27.3% while families using non-processed drinking water are 38.0% [13]

The condition of poor sanitation also affects the nutrition of children which ultimately also affects the incidence of stunting. Based on previous research conducted by Adiyanti, it was found that there was a significant relationship between the types of latrines used, protected water sources, and easily available water sources. Inappropriate types of latrines indicate that children tend to suffer from stunting 1.3 times higher than those who have proper latrines. Unprotected water sources are also 1.3 times higher than those protected [14]. Not only that, poor family factors can also influence the incidence of stunting.

V. CONCLUSION

Stunting summarizes various originating variables including the problem of poverty and community-based sanitation, then by presenting analysis in spatial form can help decision makers to understand easily the problem of stunting in Cianjur district. Stunting's analysis of spatial data in this study seems to vary based on poor family variables. It is known that the highest area is in Gekbrong sub-district (59.27%). The highest case variable is severe stunting in Sukaluyu Subdistrict (11.95%). (stunting) is highest in Haurwangi District (20.08%), low access sanitation variables are in Campaka Mulya District (26.17%), Variable access to Stop BABS is still low in Cijati District (30%), Top priority for Stunting handling programs based on poor families and Community Led Total Sanitation, namely in Cipanas District, Mande, Cianjur, Gekbrong, Cilaku, Bojongpicung, and Campaka Mulya.

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A Computational Model of High Jump Height

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Abstract

Elite high jump athletes use fosbury flop to compete their jump. This technique comprises three phases, namely, approach phase, takeoff phase and flight phase. The performance of the athlete is depended on these three phases, and the takeoff phase plays a salient role in the athlete performance. As the takeoff phase makes a tremendous contribution to change the high jump height in comparison to approach and flight phases, we aim to propose a dynamical model to describe the takeoff phase using biomechanical characteristics.

In prior works, the takeoff phase is considered in the two-dimensional space. In this study, the takeoff phase is modeled in the three-dimensional space. Such an approach has not been considered in the literature. As the position of the peak of the jump relative to the bar is determined by the takeoff distance, it is important to know the takeoff distances that give the maximum performance for athletes. However, existing methods have not provided a variable to work out the takeoff distance. *Our propose model provides necessary details to compute takeoff distances for players.*

Using our model, we observe that the takeoff distance is altered for the same athlete with change of *takeoff plane* while other parameters are fixed. In particular, an athlete is considered: body mass is 75 kg , coefficient of air resistant is 0.75 kg/m , takeoff velocity is 5.4 m/s , and takeoff angle (azimuthal angle) is 54° . The takeoff distance is altered between 1.26 m and 1.03 m while the takeoff plane is changed from 30° to 45° . For elite athletes, the takeoff distance may be changed between $0.94 - 1.50\text{ m}$. Consequently, the performance of athletes can be changed by 12.96 cm . Moreover, our model turns out that the takeoff distance is depended on the takeoff velocity, takeoff angles and coefficient of air resistant.

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Keywords: phase, takeoff distance, takeoff plane, jump, height.

1 Introduction

Thousands billion dollars were spent on the sports industry around the world [1]. This statistic concludes the competition in the sports industry and the importance of sports. Several researches

have been carried out to study the performance through the motion of the athlete [2, 3, 4, 5]. In particular, mathematicians start to model dynamics of sporting events. Exploring the dynamics of sporting events lead to enhance athlete's performance and reduce the risk of injury [1].

Track and field comprises several events such as sprints, middle-distance, long-distance, hurdles, relays, jumps and throws. Among these events, the high jump has been one of the most intensely studied events in track and field [1, 6, 7, 8]. However, the knowledge of it is still imperfect, and there is room for doubts and disagreements. In the literature, regression model and gray prediction model were used to predict the high jump performance. However, as growth rate of the high jump achievements is gradually decline, the predicted results have significantly deviated from the actual situation [9]. The approach phase, the takeoff phase and the flight phase are components of the high jump. An individual model for each of these phases and combination of these models were studied in [1]. However, Cooke [1] completely ignored the air resistance and takeoff angle, in particular, polar angle is ignored. As many of the characteristics of the flight phase are determined by the takeoff phase [7], flight of the athlete is described using takeoff phase together with biomechanical characteristics.

The most important biomechanical parameters are pointed out in [8, 10, 11, 12, 13]. Results of high jumps are determined by rational biomechanical characteristics, namely: speed of running, speed of repulsion, takeoff angle of a sportsman's body mass center, position of a sportsman's body masses center in the phases of repulsion and bar over passing [8]. A mathematical model were proposed by Adashevskiy [8] to analyze the influences of biomechanical characteristics on the high jump height. The takeoff distance, that is, the distance between the takeoff position and the plane of the bar and stands, is important to achieve athlete's best performance because the value of this distance determines maximum height of the jump relative to the bar. However, there is no way to discuss the takeoff distance using mathematical model of Adashevskiy [8]. Moreover, existing works concluded that high jumpers need to be able to judge whether the takeoff point is too close or too far from the bar [14].

Unlike prior work, we propose a mathematical model using biomechanical parameters to describe the three-dimensional motion of the athlete in the air. Using this model , we predetermine the takeoff distances for players. In addition, the actual motion of the athlete is described.

2 Prior Work

Fosbury flop; modern high jump technique, with curved approach is the most common method used by current elite athlete. The high jump consists three individual stages. In the first stage, the athlete runs along a linear trajectory. In the second stage, the athlete runs along a curve instead of running along a straight line. The third stage of the high jump is the actual jump. An individual model for each of these stages and combination of these models were investigated in [1]. The actual jump is modeled as a projectile motion and the equation of the athlete's trajectory is [1]:

$$y = y_0 + v_i t + \frac{gt^2}{2}, \tag{1}$$

where y_0 is the initial distance of the athlete's center of mass from the ground, v_i is the initial velocity, g is the standard gravity, t is time. In this work, angles at repulsion and air resistance are completely ignored. According to authors knowledge, the motion of the athlete can be described using newton's second law. In this case, we assume athlete as a particle. The motion of the athlete then can be written as

$$\ddot{y} = -g. \tag{2}$$

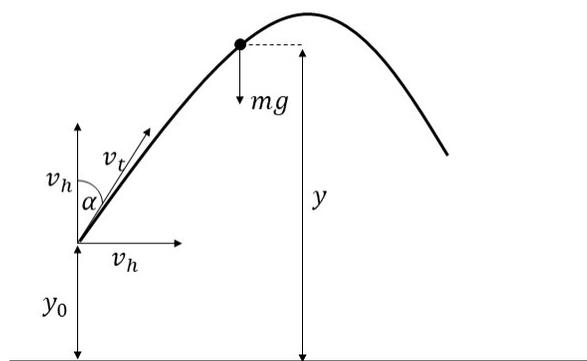


Figure 1: The motion of athlete is modeled as a projectile motion [1]. The athlete's trajectory is shown.

By integrating twice, we obtain

$$y = y_0 + v_t \cos \alpha - \frac{gt^2}{2}, \tag{3}$$

where v_t is takeoff velocity (initial velocity), α is the takeoff angle, and y_0 is the initial distance of the athlete's center of mass from the ground.

However, takeoff speed and angle of sportsman's masses center at repulsion are the main biomechanical characteristics of high jumps [8]. Adashevskiy et al. [8] proposed a mathematical model to determine the influences of biomechanical characters on the height of jump: speed and corner of flight of center of mass during pushing away, positions of center of mass body of sportsman in the phases of pushing away and transition through a slat, forces of resistance of air environment, influences of moment of inertia of body. The motion of the athlete was expressed as follows [8]:

$$m\ddot{x} = -kv^2 \cos \alpha; \quad m\ddot{y} = -mg - kv^2 \sin \alpha; \quad J\ddot{\phi} = -k\dot{\phi}^2, \tag{4}$$

where α is angle between current projections of body masses center speed and speed vector, and

$$\cos \alpha = \frac{\dot{x}}{v}; \quad \sin \alpha = \frac{\dot{y}}{v}; \quad v = \sqrt{\dot{x}^2 + \dot{y}^2}. \quad (5)$$

Here J – moment of inertia, $\ddot{\phi}$ – corresponds to angle acceleration of the body. The takeoff distance is crucial because it determines the position of the peak of the jump relative to the bar [6]. However, as Adashevskiy et al. [8] consider athlete’s body moves in a one of anatomical plane, there is a limitation for finding the takeoff distances.

In contrast to all of the above mention methods, we develop a mathematical model to describe the flight of the athlete in the air. Propose model describes the three-dimensional motion of the athlete in the air. Our model turns out that the salient of the takeoff distance and takeoff plane.

3 Our Contribution

A dynamic model of the high jump height is developed. The model describes the three-dimensional motion of the athlete in the air. In this paper, we assume that the athlete is a particle, that is, the center of gravity is the particle. The force of gravity and air resistance are accounted in the model.

$$\ddot{x} = F_1(m, v, \theta, \phi, k) \quad (6)$$

$$\ddot{y} = F_2(m, v, \theta, \phi, k) \quad (7)$$

$$\ddot{z} = F_3(m, v, \theta, \phi, k) \quad (8)$$

where m is body mass, v is absolute speed of body, θ, ϕ are takeoff angles of sportsman’s masses center at repulsion, that is, polar angle θ , and azimuthal angle ϕ , and k is the air resistant coefficient. Estimation of air resistant forces for objects is explained in [8].

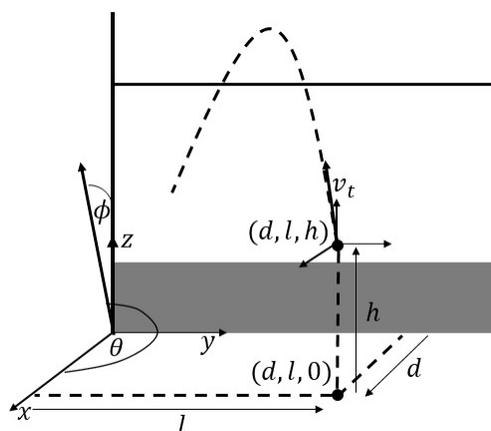


Figure 2: The motion of the athlete in three-dimensional space is shown. The velocity v_t is the takeoff velocity, and θ, ϕ are takeoff angles, that is, polar and azimuthal angles. The polar angle describes the *takeoff plane*.

The following system of second-order differential equations describes the motion of the athlete:

$$\begin{aligned} m\ddot{x} &= -kv^2 \cos \theta \sin \phi \\ m\ddot{y} &= -kv^2 \sin \theta \sin \phi \\ m\ddot{z} &= -mg - kv^2 \cos \phi, \end{aligned} \tag{9}$$

where $v = \sqrt{\dot{x}^2 + \dot{y}^2 + \dot{z}^2}$, $\cos \theta = \frac{\dot{x}}{v}$, $\sin \theta = \frac{\dot{y}}{v}$, $\cos \phi = \frac{\dot{z}}{v}$. It follows

$$\begin{aligned} \ddot{x} &= -\frac{k}{m} \dot{x} \sqrt{\dot{x}^2 + \dot{y}^2} \\ m\ddot{y} &= -\frac{k}{m} \dot{y} \sqrt{\dot{x}^2 + \dot{y}^2} \\ m\ddot{z} &= -g - \frac{k}{m} \dot{z} \sqrt{\dot{x}^2 + \dot{y}^2 + \dot{z}^2}, \end{aligned}$$

Using a change of variables, we obtain the following system of first-order differential equations:

$$\begin{aligned} \dot{X} &= -\frac{k}{m} X \sqrt{X^2 + Y^2} \\ \dot{Y} &= -\frac{k}{m} Y \sqrt{X^2 + Y^2} \\ \dot{Z} &= -g - \frac{k}{m} Z \sqrt{X^2 + Y^2 + Z^2}, \end{aligned}$$

It can be written in the matrix form as follows:

$$\begin{bmatrix} \dot{x} \\ \dot{X} \\ \dot{y} \\ \dot{Y} \\ \dot{z} \\ \dot{Z} \end{bmatrix} = \begin{bmatrix} X \\ -\frac{k}{m} X \sqrt{X^2 + Y^2} \\ Y \\ -\frac{k}{m} Y \sqrt{X^2 + Y^2} \\ Z \\ -g - \frac{k}{m} Z \sqrt{X^2 + Y^2 + Z^2} \end{bmatrix}. \tag{10}$$

The takeoff position of athlete is $(d, l, 0)$, and h is the initial distance of the athlete's center of mass from the ground. The initial position of the the athlete's center of mass then is (d, l, h) . The takeoff velocity of athlete is v_t . The initial conditions then are given as

$$x(0) = d, y(0) = l, z(0) = h,$$

and

$$\dot{x}(0) = v_t \cos(\theta) \sin(\phi), \dot{y}(0) = v_t \sin(\theta) \sin(\phi), \dot{z}(0) = v_t \cos(\phi).$$

4 Results and Discussion

The effect of air resistant on the high jump height is examined using Cooke [1], Adashevskiy et al. [8] and our approaches. To do so, we did a gedanken experiment. In this case, we consider a particular high jump athlete with body mass 75 kg and height of center of mass 0.92 m . We assume athlete's takeoff velocity and takeoff angles are 5.8 m/s and 54° , respectively. The standard gravity is considered as 9.8 kg/s^2 . Table 1 shows high jump height with different k values (air resistant).

Table 1: Estimated high jump heights for a particular athlete using Cooke approach, Adashevskiy approach and our approach are shown. Athlete's weight and height of center of mass are 75 kg and 0.92 m , respectively. Moreover, we consider takeoff velocity 5.8 m/s and takeoff angle 54° . The standard gravity is 9.8 kg/s^2 .

| k Values | Cooke Approach (m) | Adashevskiy Approach | Our Approach (m) |
|------------|------------------------|----------------------|----------------------|
| 0.15 | 2.0432 | 2.0392 | 2.0391 |
| 0.30 | 2.0432 | 2.0355 | 2.0355 |
| 0.45 | 2.0432 | 2.0319 | 2.0319 |
| 0.60 | 2.0432 | 2.0283 | 2.0283 |
| 0.75 | 2.0432 | 2.0248 | 2.0247 |
| 0.90 | 2.0432 | 2.0212 | 2.0211 |

As we expected, our approach and Adashevskiy approach are coincided (the numerical error between our approach and Adashevskiy approach is 10^{-4} m). According to the Table 1, we may observe that Cooke [1] approach is overestimating the maximum jump height, and the jump heights are not changing with different k values since Cooke approach is ignoring the air resistant k .

Figure 3 shows the motions of the athlete in the two-dimensional space with different takeoff velocities while other parameters are fixed. The athlete's trajectories are obtained using our approach. Note that, the takeoff distances are altered with takeoff velocities. Moreover, the takeoff distance is varied with the takeoff plane. However, Adashevskiy approach does not provide a variable and a parameter to compute the takeoff distance. Using our propose method, one can compute the takeoff distance that corresponds to the takeoff velocity and the takeoff plane. To illustrate, we consider a particular athlete: mass of the athlete is 75 kg , the takeoff velocity is 5.4 ms^{-1} , the take-off angle (azimuthal) is 54° , and the air resistant is 0.75 . The takeoff distances with the different takeoff planes are illustrated in Table 2. Figure 4 illustrates the motion of the same athlete in the three-dimensional space.

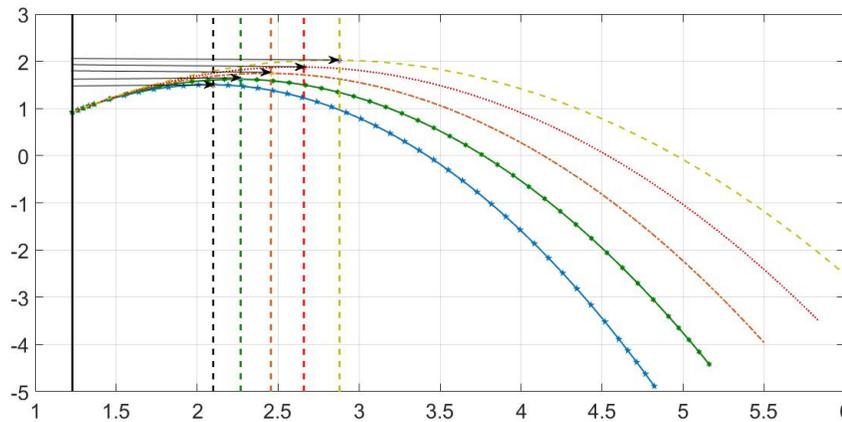


Figure 3: The motions of the athlete for different takeoff velocities are shown. Our approach is used to obtain the motions of the athlete.

Table 2: Change of the takeoff distance with the takeoff plane is shown.

| Takeoff Plane | Takeoff Distance (m) |
|---------------|----------------------|
| 30 | 1.2583 |
| 35 | 1.1912 |
| 40 | 1.1139 |
| 45 | 1.0282 |

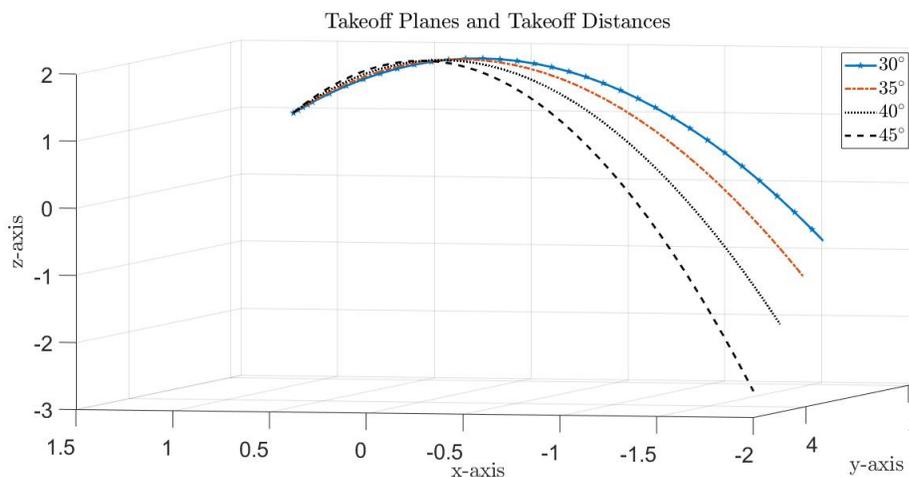


Figure 4: Three-dimensional motions of the athlete with the different takeoff planes are shown.

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Enterprise Risk Management – International Standards and Frameworks

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Abstract- Under the massive expansions of the world economies in the recent years, business organizations have realized the significance of integrating risk management into their strategies as the nature of business risks upcoming are terrifyingly increasing due to high competition, continuous technological advancements and changing behavior of customers. International organizations who are interested on risk management have published and revised many standards and frameworks to help practitioners to select the best and appropriate risk management framework comparing the strengths and weaknesses of their entities. This paper presents definitions of the risk, risk management and enterprise risk management terms and the summaries of seven internationally recognized risk management frameworks that are popularly used by corporates and in the academic literature.

Key Words- CAS, COBIT 5 for risk, COBIT 2018, COSO ERM updates, Enterprise Risk Management, ISO 31 000, Risk, Risk Management, S&P, TRM.

I. INTRODUCTION

This paper focuses on reviewing the definitions of risk, risk management and the enterprise risk management given by various scholars and researchers using the deductive research approach. A comprehensive literature survey has been conducted in order to find out the definitions as well as international standards and frameworks that are published and used by the present day decision makers in the risk management arena.

The core of the modern economy is the proper understanding of the nature of risks, the art and the science of making correct choices as every choice, from day-to-day operational decisions to the fundamental trade-off decisions made in the board room in order to pursuit the objectives of the firm are involved with a variety of risk types (COSO, 2017). Rubino state that risk and uncertainty bring not only the negative outcomes but also the positive outcomes to an organization. Therefore, firms cannot survive and create value to their stake holders unless they take the risk as a part of their business (2018).

Risk management is hardly a new concept though the principles and application if risk management have arisen since possibly in the 17th century in Europe (Sum, 2017). The origin of the risk management and the practice of risk management started in ancient days where the existence of human beings. In the business context, during the period of 1950s, the insurance industry initiated the use of risk management as many businesses tried to reduce possible hazards through insurance in the US. Later, in 1960s, the concept of contingency planning emerged as an essential tool in risk management as insurance was not sufficient to safeguard the assets of a firm, to control the business operations and to protect the complete loss from risky acts. (Sithipovanichgul, 2016; Li et al, 2014; Farrell & Gallagher, 2014; Vollmer, 2015). The concept of Traditional Risk Management (TRM) then became popular as a silo base approach in risk management where organizations view each risk type individually and act on them as a stand-alone object. Alawattegama state that TRM is a less effective system for managing risk as each risk is addressed case by case to identify and assess the impact onto organizations with the major concern of mitigation of the risk establishing risk limits but, not to utilize the risk for value creation. Due to many limitations of TRM, the concept of Enterprise Risk Management (ERM) emerged later as a holistic and integrative approach in risk management which will unify all the risk types and integrate them into the overall objectives of the organization. ERM gained the attraction of the modern corporate world as an effective risk management practice which will create and protect the firm value and the stability of the firm in the long run (2018). ERM added a paradigm shift to the risk management arena allowing firms to assess their risk attitude, identify and prioritize risk and identify the risk as acceptable, mitigated or completely avoided. The major focus of ERM is the development of a strategy for the firm enabling the adoption of ERM best practices with the support of all the relevant stake holders (COSO, 2017; Sithipolvanichgul, 2014).

All organizations need to set strategies and review them periodically in order to grab the ever-changing opportunities in the market place for value creation of their firms while managing the challenges expected to occur in pursuit of that value. Therefore, a need has arisen for the implementation of best possible ERM framework for every organization for optimizing strategy and performance for untangling the art and science of making well informed decisions (COSO, 2017).

1.1 Benefits of effective implementation of ERM

According to the World Economic Forum (WEF), in the rapidly changing dynamic environment, the future businesses are expected to be full of volatility, uncertainty, complexity and ambiguity. Every business firm regardless the size or the type of business therefore will have to exhibit traits that drive an effective response to changes (IRM, 2018b).

COSO (2017) framework stresses the following benefits of effective implementation of ERM into a firm.

- **Increasing the range of new business opportunities:** management is able to identify new opportunities and related challenges through the ERM framework considering both positive and negative aspects of risk.
- **Identifying and managing entity-wide risk:** every part of the business exposes myriad risks that will affect the entire organization. Risk may originate in one department may have inverse effect onto the other divisions. ERM supports the management to identify the sources of risks and the diverse impacts that are created by them in order to sustain and improve the performances of the firm
- **Increasing positive outcomes and advantages while reducing negative surprises:** Effective implementation of ERM facilitates the entities to improve their abilities of identifying risk and establishing appropriate solutions, getting ready for facing shocks and surprises that will make unbearable losses.
- **Reducing performance variability:** performance variability occurs when the firm does not achieve the expected targets or outcomes and also when the scheduled targets exceeded. Both scenarios make the firm unrest due to unmanageable situations. ERM supports firms to anticipate the targets accurately in both the scenarios which will enable the firm to put forward proper actions required to minimize the disruptions of not achieving expected targets while utilizing the achieved over-targets through proper contingency action plans on managing overall need of resources, prioritizing resource deployment and enhancing resource allocation effectively.
- **Enhancing enterprise resilience:** the ability of an entity on accurately anticipating the future changes and ability of planning how firms are responding to these changes may decide the medium and long-term viability of that entity. Effective ERM provides the platform for the entity basically for the survival and also the guidelines for thriving the business into success.

In addition to the above benefits, the implementation of an ERM framework is the best tool for an entity as ERM facilitates the management for the selection of the most suitable strategy to their entity analyzing the risk factors aligning with resources with the mission and the vision of the entity in running the business successfully means the selection of correct choices and accepting trade-offs (COSO, 2017).

II. LITERATURE REVIEW

The purpose of this paper is to present the findings from the review of literature on the topic of enterprise risk management - international standards and frameworks. The literature survey was carried out mainly using electronic versions of journal articles and research publications. The definitions of risk, risk management and the enterprise risk management and the international standards and frameworks that are associated with the enterprise risk management are presented in this paper.

2.1 Definitions of Risk, Risk Management and Enterprise Risk Management (ERM)

ERM is an integrated risk management process which will cover the overall possible risk types that businesses are vulnerable to face and is applied to mitigate risks (Karak, Serdar & Senol, 2015). Beals (2015) state that ERM promotes the awareness of the risk factors in the top management and helps them in making decisions. Beals further insists that an effective decision making process increases the performances of the firm while reducing the cost of capital.

ERM has emerged as a holistic risk management approach replacing the TRM silo approach in the last decade realizing the importance of having a proper risk management system in organizations as no more firms can tolerate financial losses causing from unexpected events, disruptions to normal operations, damage to reputation and loss of market presence (IRM, 2018b). Implementation of a proper ERM system enables the firms to improve the decision making process related to strategy formulation where different strategic options are fully analyzed to reach the best strategy and enables the firm to make the risk adjusted tactics. ERM further helps to identify the possible events that will disrupt the operations of the entity and facilitates to reduce the likelihood of these events limiting the loss of occurrence. Compliance area can be enhanced by the implementation of ERM best practices recognizing the statutory and customer obligations well in advance and providing solutions avoiding the possibility of risks associated with those compliance issues (COSO, 2004).

Sithipolvanichgul (2016) expresses that the poor practices of Traditional Risk Management (TRM) were the causes for the recent global business crises and emphasized the need for the implementation of ERM mainly because entities can deal with all internal, external, strategic, operational, compliance and reputational risk types through ERM approach. Pooser cited in Sithipolvanichgul (2016) endorsed the idea that the ERM took the greater attention of the business community since the early 2000s and was doubled after the major financial crises (2008-2009) that destroyed the long-term value of big business giants like Enron. As a result, ERM has been largely given the focus by academic researchers and business practitioners in the recent past as the risk management is a critical business function and an essential tool for the survival of the organization.

Despite the popularity of the ERM as an effective approach in risk management, only a little empirical evidence is available to prove that ERM adds a significant impact to the existing value of the firm. Many research studies conducted to prove the significant impact of ERM implementation on the performances of the firm ended with contradictory outcomes where most of them concluded that no significant, positive relationship between ERM implementation and the firm performance (Alawattagama, 2017 & 2018; Karaka, & Senol, 2015; Barac, 2015).

2.2 International ERM Standards and Frameworks

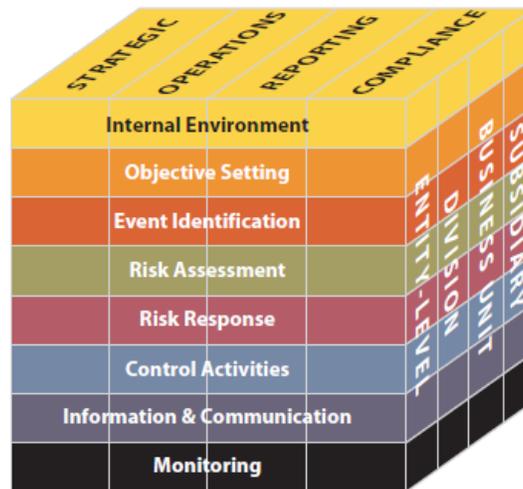
Many definitions and international standards that are associated with ERM have been revealed in this literature review. Rubino (2018) state in his article comparing the ERM standards that though several ERM frameworks are published and revised over time, these standards still have some limitations. Organizations however, if seek to adopt ERM practices into their entities in order to enhance the shareholder’s value then will have to choose an appropriate ERM framework beside the limitations. The choice of the suitable framework is based on the experience and knowledge of top management that have gained from internal and external control processes which has made ERM very idiosyncratic (Pundervolt, 2017; Vollmer, 2015).

Principles and guidelines for the correct selection and the effective implementation of the suitable ERM framework are given by various frameworks such as: 1) COSO ERM – Integrated Framework (2004), 2) COSO ERM Integrating with strategy and performance Framework (2017), 3) Casualty Actuarial Society Framework (CAS, 2003), 4) International Standard for Risk Management (ISO 31000, 2009), 5) ISO International Standard for Risk Management (31 000: 2018), 6) COBIT 2019 :Framework of the Information Systems Audit and Control Association for customizing and right-sizing enterprise governance of information technology and 6) Standards and Poor’s Enterprise Risk Management: analysis into *Corporate Credit*.

1) Enterprise Risk Management - Integrated Framework by COSO (2004)

The Committee of Sponsoring Organization (COSO) of the Treadway Commission of USA developed this framework updating their two previous versions of *Internal Control-Integrated Frameworks* 1994 and 2001. This framework has eight interrelated components, four categories of objectives and four levels in the enterprise. This framework was developed with the purpose of helping entities to protect the stakeholder value and enhance it with the underlying philosophy of value maximization through risk adjusted strategy and objective formulation (COSO, 2004).

Figure 1.1: Enterprise Risk Management – Integrated Framework developed by COSO (2004)



Source: COSO (2004)

This depiction displays the ability of the firm to focus on ERM implementation as a whole or by categories, components or by units. The effectiveness of the ERM implementation can be judged by assessing the existence and the functionality of the eight components in each department which will give the assurance to the board that the strategic, operational, reporting and compliance objectives of the firm are achieved. These eight components however will not exist identically in every entity due to the size and type of the organizations but may have applications that are more or less complicated and structured (COSO, 2004).

Since the publication, this framework has been successfully implemented by organizations that are in different sizes, different industries and in different countries to identify risk factors, manage those identified risks and to achieve the objectives of the firm (COSO, 2017). Sithipolvanichgul (2016) state that COSO – 2004 framework is the mostly accepted ERM framework by enterprises especially in the accounting literature. Though, this framework was implemented by many firms yet some argued the limitations and the potential for further development to the model. Practitioners suggested to examining some aspects of the framework with more depth and clarity to provide greater insight into the links between strategy, risk and performance (COSO, 2017). Gjerdrum et al as cited in Sithipolvanichgul (2016) state that the COSO 2004 framework is a complex, multi-layered and a complicated model that many organizations found it difficult to understand. Responding to all the arguments and suggestions, Committee of Sponsoring Organizations updated the COSO 2004 framework in 2017.

2) ERM - Integrating with Strategy and Performance Framework by COSO (2017)

This updated version of COSO 2004 framework pays the major emphasis on how ERM informs the strategy and its performance and provides the framework for the board and the senior management of entities in all sizes. It demonstrates how the ERM implementation can accelerate the growth and boom the performance of the firm and contains principles that can be applied in formulation of strategies. This publication consists of two parts as 1) the offering of the perspective on current and evolving concepts and 2) the applications of

enterprise risk management. This framework makes sense for the management, the board of directors or any other governing boards, supervisory boards, board of trustees, other general partners and the owners about the use of enterprise risk management in selecting and refining the suitable strategy for a firm examining the alternative strategies.

The risk oversight role of the board in reviewing, challenging and concurring with management is clearly explained in COSO 2017 framework on establishing suitable strategies and the risk appetite for a firm, aligning the strategies with business objectives, mission and the vision of the firm, making decisions including mergers, acquisitions, funding and dividend-distribution decisions. COSO 2017 further supports in responding to significant fluctuations in firm performances, responding to deviation from core values, approving management incentives and remuneration and maintaining in investor and stakeholder relations.

COSO 2017 framework has five interrelated components covering a set of principles naming 1) governance and culture, 2) strategy and objective setting, 3) performance, 4) review and revision and 5) information, communication, and reporting. There are twenty principles covered by these five components as shown in the figure 1.3 below.

Figure 1.2: Twenty principles under five components of the COSO (2017) framework



Source: COSO (2017)

3) *Casualty Actuarial Society Framework (CAS, 2003)*

CAS formed an ERM Committee and summarized the ERM process in 2003, taking the Australian/ New Zealand risk management standards (AS/NZS 4360) as the guide lines. The objectives of the CAS framework are similar to the objectives of the COSO (2004) framework and ISO 31 000 frameworks as the major focus of all these frameworks is the maximization of the firm value achieving the set objectives. CAS framework recommends the establishment of an independent risk management structure for implementing the ERM practices into an organization (Sithipolvanichgul, 2016).

4) *ISO 31 000: 2009 – The International Risk Management Standards*

International Organization for Standards (ISO) is an independent, non-governmental organization established with the purpose of bringing up the experts together to share knowledge and develop international standards to encourage innovations and to provide solutions to global problems, now has a membership of more than 160 national standard bodies (ISO 31000, 2009). ISO 31 000: 2009 version of the standards was developed by the technical committee of ISO on risk management to provide the guidelines and principles for the decision makers revising the Australian/New Zealand risk management standards (AS/NZS 4360) (Javaid & Iqbal, 2017).

ISO 31 000 provides guidelines but not requirements and therefore, it is not intended for certification yet applicable for all the organizations regardless the size, type or activities and locations to manage risk of all types. This framework was developed by a range of stake holders and recommended not only for risk professionals but also for anyone who involves with risk management strategy formulation. The overall goal of this framework is to develop a risk management culture where all the stake holders of the entity are fully aware of the critical importance of monitoring and managing risk. ISO 31 000 provides direction to identify both positive opportunities and negative consequences involved with risk and provides the foundation for making effective, accurate and timely decisions in the resource allocation process. It is an open, principle based system which will enable the organizations to apply these principles and standards matching with the context of the firm. The major strength of ISO 31 000 risk management approach is the ability to identify the risk owners, which is a must for the accountability, proper communication and for implementing training programmes throughout the organization (ISO 31 000:2009).

Gjerdrum as cited in Sithipolvanichgul (2016) state that ISO 31 000 framework provides a concept where risk management is at the center and is linked to the objectives of the organization which will be useful in planning, managing and governance of the corporate. Further, Gjerdrum recommends that it is not necessary for switching to ISO system if an entity has already implemented COSO

framework due to many commonalities in between these two approaches. Aven as cited in Sithipolvanichgul (2016) argues that the definition given by ISO 31 000 for the risk term misinterprets the exact meaning of the risk and mislead the organization to make illogical judgements as there are no any mathematical basis in ISO 31 000 standards and have limited use of probability, data and models. ISO standards are reviewed in every five years to ensure that the principles and guidelines are relevant and update to meet the needs of the market. The revised version of ISO 31 000 was published in 2018 considering the evolutionary changes in the market place and in order to match with the new challenges faced by present day organizations.

5) ISO 31 000: 2018 – A Risk Practitioners Guide

Institute of Risk Management (IRM) published the revised version of ISO 31000 under the name of “A Risk Practitioners Guide to ISO 31 000: 2018” reviewing the present day challenges faced by entities in allocating resources for ERM providing guidelines for professional standards related to risk management of all industries, all disciplines and all public, private, for profit or non-for-profit across the world (IRM, 2018b).

ISO 31 000:2018 provides more strategic direction compared to its previous version and emphasize more on involvement of senior management on risk management and integration of risk management into the firms’ decision making process. Also, this new framework recommends the development of policy documents clarifying the role of parties involved with risk management such as CRO, Auditors and compliance officer. The new framework highlights the importance of embedding the risk management into the organizational structure, processes, objectives, strategy and daily operations of an entity. ISO 31 000: 2018 framework has streamlined the content of the previous ISO version due to many complains from practitioners and academics about the complexity of the content and the difficulty of understanding the technical terminologies of the earlier version. ISO 31 000:2018 framework has more useful information and provides clear guidelines for entities for the implementation of risk management practices easily. However, it does not provide step-by-step checklist for entities on ERM implementation process and risk management professionals are thereby challenged as they will have to adopt their own approach in implementing the ERM into their organizations (IRM, 2018b).

6) COBIT 5: Complete Business Framework for the Governance of enterprise IT

In this modern era, Information Technology (IT) plays a major role in operations, management and the growth of entities. IT especially shape the existing strategies and open-up new business avenues for organizations while creating and exposing enterprises into new set of threats such as cybercrimes, errors and various vulnerabilities in business processes and technology awareness of people. IT affairs were not much attended by the senior management previously though, today’s entities are much more relied on information systems (IS) and as a result it has changed the dimension of the risks coming from information technology increasing the attention of risk professionals (Javaid & Iqbal, 2017).

Control Objectives for Information and related Technology (COBIT), is an internationally recognized IT management framework which contains a set of best practices for IT management developed by Information Systems Audit & Control Association (ISACA) to help IT professionals and enterprise leaders to fulfill their IT Governance responsibilities while creating the value to the business. COBIT helps businesses to develop, organize and implement strategies around information management and governance. COBIT 5 version of the framework was released in 2013 including more information related to risk management and information governance to its’ previous versions of COBIT 3 (2000), COBIT 4 (2005) and COBIT 4.1 (2007) (White, 2019).

7) Standards & Poor’s and Enterprise Risk Management

Standards and Poor’s (S&P) has added ERM component into their credit rating analysis process since 2005, especially focusing the business sectors of Energy, Financial services and Insurance and introduced the same for non-financial sector in 2008. As a result, all financial and non-financial sectors should now focus on risk management culture and the strategic risk management philosophy of their entities in order to achieve a good S&P rating. Companies with good S&P rating have high capacity and greater access to external capital at lower borrowing cost due to the high confidence of the lenders (Sithipolvanichgul, 2016).

The precedence to the real value of ERM given by S&P’s classifications create a culture of risk resilience with the ability to adapt to changes. The limitation of S&P’s ERM rating is that, it is judgmental the assessment of the effectiveness of the ERM implementation. There is no any indication in the S&P’s of any specific ERM framework and the implementation of the same to achieve objectives of the entity but, it mentions the components of effective risk management to be considered when assessing the risk management process of the enterprise (Hampton as cited by Sithipolvanichgul, 2016).

III. DISCUSSION

The terms “risk”, “risk management” and “enterprise risk management” have been given various definitions by international standard organizations, academics, researchers and practitioners and there is no universally accepted single definition for these terms. This has made a major confusion and an ambiguity among the practitioners and risk management professionals not having proper, consistent and uniformity in definitions. Therefore, it has risen the need for the development of proper, compatible and comparable international standards for enterprise risk management where any firm regardless the size, the type of business or the industry can commonly apply.

Many enterprise risk management frameworks have been developed by international standards organizations in the last two decades to combat the risk spectrum but, most of these standards focus on large scale businesses where well established systems and processes are in place plus risk management experts are on duty. Most of these international standards are specific for some special business types and provide generic guidelines for the strategic level but not for the operational level (Javaid & Iqbal, 2017).

Hampton states that COSO and ISO ERM standards are the most suitable frameworks to follow and implement ERM though, it is essential for companies to consider the indicators of effective risk management given in S&P's framework. Mikes and Kaplan, Nielson et al., Tahir and Razali indicate that COSO is the most appropriate framework for ERM implementation and therefore have been used by many researchers and practitioners whilst S&P's ERM component is widely used by insurance companies. CAS ERM framework is only used by a few academics in their research studies (as cited in Sithipolvanichgul, 2016).

It is tedious for an enterprise to select the most appropriate risk management framework for the self-organization yet it is the first step of the ERM implementation process. The selection, customization and the application of the matching standards and framework for an entity is a time consuming process with the commitment of an ample amount of resources which is difficult for small organizations to bear. In-depth knowledge is essential about the standards and frameworks as well as the good understanding of the strengths and weaknesses of the entities to consider adhering to any particular standard which requires the service of expert human resource again at high cost. Thus, the implementation/application of international risk management standards are still at a sour level in many organizations because of the poor level of understanding of the top management on the importance of effective implementation of enterprise risk management standards (Rubino, 2018).

IV. CONCLUSION

This paper discussed the terms of risk, risk management and enterprise risk management given by various authors, the benefits of implementing an effective ERM system for an organization, the difference between the traditional risk management and the enterprise risk management and the international standards and frameworks available for organizations to choose the most appropriate framework for their work setting.

The process of selecting and implementing the most appropriate risk management framework for an enterprise is a complex and a time taking activity which varies from company to company. There are many factors influencing this whole process such as the organizational governance culture, the risk philosophy of the entity and the size of the organization.

There is a number of frameworks which is developed by international standards organizations in order to fulfil the need of having consistent and compatible guidelines for organizations to implement effective ERM systems. It is however, many of these frameworks have had some criticism from practitioners and from academics in terms of complexity and impracticality. Therefore, most of the international standard organizations tend to revise the framework periodically to overcome the limitations of the earlier versions and to include new strategies to combat new challenges upcoming in the market place. As a result, Committee of Sponsoring Organizations (COSO) has now developed two versions of their framework with the latest in 2017. International Standard Organization (ISO) has published the latest version of ISO 31000: 2018 adding new set of instructions and guidelines for organizations. Information Systems Audit & Control Association (ISACA) revised the COBIT 5 version in 2019 as a framework for customizing and right-sizing enterprise governance of IT considering the new trends, technologies and security needs into the framework. COBIT 2019 framework helps aligning business goals through linking IT with other functions of the business organization. Mikes and Kaplan, Agrawal and Ansell as cited by Rubino (2019), despite the updates of the frameworks covering the current risk factors, still there is a need for better frameworks in order to implement an effective and accurate risk management process as the existing frameworks are little integrated with the corporate control systems, including strategic planning and management control.

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Design Calculation of Pelton Turbine for 220 kW

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Abstract- In Myanmar, there are various natural resources such as water, air, wind and solar. Among of them, water resource is the most abundant as there are many rivers and streams with rich electrical energy. Moreover, the cost of hydro-electric power is relatively cheaper compared with other resources. In hydraulic turbine is one of the most important parts to generate electricity. This paper intends to design the runner and nozzle with needle for Pelton turbine that will generate 220 kW output power from head of 213 m and flow rate of 0.135 m³/s. For these head and capacity of turbine, rotational speed is 1000 rpm, specific speed is 18.4, pitch circle diameter is 0.56 m, jet diameter is 0.053 m and nozzle outlet diameter is 0.064 m. The number of bucket based on jet ratio, 11 is 21. Detail design of runner, nozzle with needle of that turbine is described in this paper.

Index Terms- Pelton turbine, output power, head, bucket, nozzle

I. INTRODUCTION

IN Myanmar, the main sources of energy for generating electricity are hydropower because of her hilly regions with rivers and water-falls. Hydropower is an eco-friendly clean power generation method that has been widely used throughout the world. In Myanmar, where 75% of the populations live in rural area, has a low level of village access to electricity. Myanmar has abundant hydro energy sources and the Geography, Topography of the country is favorable for hydropower supply system. A hydropower generation system for remote area in Myanmar is mainly classified into run-of-river type and reservoir type.

Several inherent advantages have been mentioned for hydropower generation including,

- (1) Simplicity of its technology, which is available and only requires adaptation to specific conditions in order to reduce costs.
- (2) Viability as a means of providing electricity, particularly in rural and isolated areas, without any need for imported fuel supply.
- (3) Contribution to the promotion of industrial, socio-economic and cultural development of the rural environment.
- (4) The long lifetime of the structure and machinery, requirements in the locality.
- (5) Adaptability of scale designed for specific user requirements in the locality.
- (6) Compatibility with the use of water for other purposes such as irrigation and drinking water supply, thereby improving investment.
- (7) A supplement to the regional or national grid.

According to above mentioned particulars, there are three types of hydropower plants, such as micro, mini and small hydropower. The power that can be obtained from a stream of water depends on the amount of water flowing and the height from which it flows down the pipe to the turbine. The main types of turbine used in hydropower plants are impulse and reaction turbines.

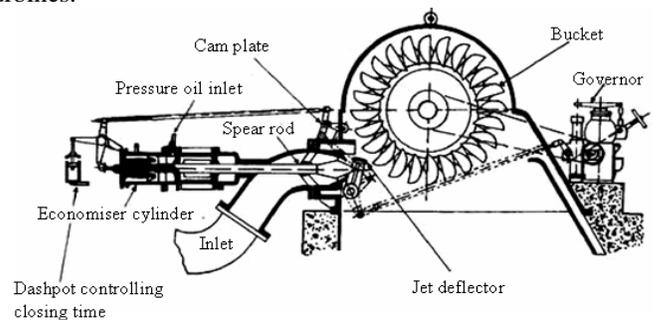


Fig. 1 Main Components of Pelton Turbine [1]

The Pelton turbine is an impulse turbine used for high head and low flow. These turbines are simple to manufacture, are relatively cheap and have good efficiency and reliability. Water is taken to the turbine from the reservoir through penstocks. The penstock is a large pipe fitted with a nozzle at the end. Water comes out of the nozzle in the form of a jet. The whole of hydraulic energy is converted into kinetic energy at the nozzle. The pressure all over the wheel is constant and equal to atmosphere, so that energy transfer occurs due to purely impulse action. A Pelton turbine has one or more nozzles discharging jets of water which strike a series of buckets mounted on the periphery of a circular disc. The runner consists of a circular disc with a number of buckets evenly spaced round its periphery. The buckets have a shape of a double semi-ellipsoidal cup. Each bucket is divided into two-symmetrical parts by a sharp edged ridge known as a splitter. The jet of water impinges on the splitter, which divides the jet into two equal portions, each of which after flowing round the smooth inner surface of the bucket leaves it at its outer edge.

II. REQUIRED PARAMETERS FOR PELTON TURBINE DESIGN

Myanmar Electric Power Enterprise has identified an exploitable potential of 39,624MW on 267 sites. Existing hydropower plants constitute 360 MW (30% of the generating capacity), and hence only 1% of the exploitable potential has been developed.

In this paper, design specification are as follow.

Expected output power, P = 220 kW
Effective head, H = 213 m

Overall efficiency, η = 78%
 Density of water, ρ = 1000 kg/m³
 Acceleration due to gravity, g = 9.81 m/s²

220kW turbine is intended to mini-hydropower plant and flow rate of this turbine, Q will be obtained by power equation.

$$P = \eta \rho g Q H \quad (1)$$

By Equation (1), the required flow rate for expected output power is 0.135 m³/s.

A. Specification of Suitable Turbine Type

The suitable type of turbine can be classified depending on net head and flow rate as shown in Fig. 2. Since head and flow rate ranges, 213 m and 0.135 m³/s are within the range of Pelton turbine type, Pelton turbine type is selected.

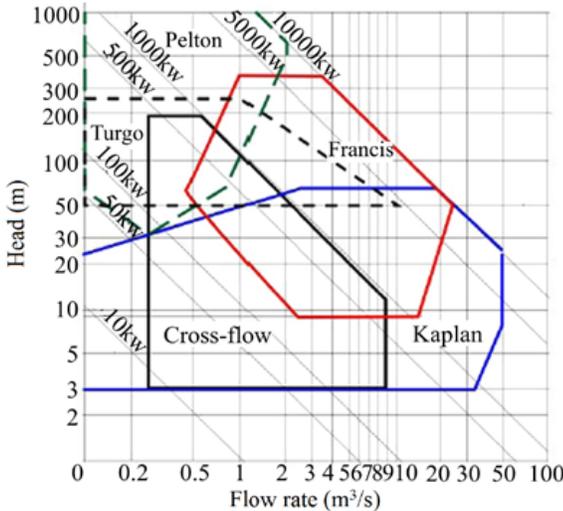


Fig. 2 Turbine Type Based on Head and Flow Rate [2]

B. Determination of Specific Speed and Rotational Speed

Specific speed plays in an important role for selecting the type of turbine. And also the performance of turbine can be predicted by knowing the specific speed of the turbine. The specific speed of a turbine is the speed of geometrically similar turbine that would develop one horse power (metric) when working under a head of one meter. Once the specific speed is known, the fundamental dimensions of the turbine can be easily estimated. The value of specific speed for Pelton turbines with single jet fluctuate between 8.5 and 30. The selected turbine type is single jet Pelton turbine type and the value of specific speed for this type can be calculated by using the following equation.

$$N_s = 85.49 / H^{0.245} \quad (2)$$

The rotational speed of a turbine is directly linked to its specific speed, flow and net head. The rotational speed of turbine is directly or through a speed increaser to the turbine, should reach the synchronous speed. The rotational speed of

turbine is $N = \frac{N_s H^{5/4}}{\sqrt{P}} \quad (3)$

In the hydro scheme, standard generator is installed when it is possible, either directly coupling or through a speed increaser should reach the synchronous speed. The number of pole for synchronous speed generator is always even number and it is expressed by

$$P_o = \frac{120 f}{N} \quad (4)$$

Where, f is frequency (50 Hz) and the calculated number of pole is 6. Based on number of pole as shown in Table I, the generator synchronization speed is 1000 rpm and for direct coupling system, rotational speed of turbine is also 1000 rpm.

Table I. Generator Synchronization Speed [2]

| Number of poles (P_o) | Frequency | | Number of poles (P_o) | Frequency | |
|---------------------------|-----------|------|---------------------------|-----------|------|
| | 50Hz | 60Hz | | 50Hz | 60Hz |
| 2 | 3000 | 3600 | 16 | 375 | 450 |
| 4 | 1500 | 1800 | 18 | 333 | 400 |
| 6 | 1000 | 1200 | 20 | 300 | 360 |
| 8 | 750 | 900 | 22 | 272 | 327 |
| 10 | 600 | 720 | 24 | 250 | 300 |
| 12 | 500 | 600 | 26 | 231 | 277 |
| 14 | 428 | 540 | 28 | 214 | 257 |

C. Prediction of Shaft Diameter

The turbine shaft will transmit the rotary motion of the runner to the generator. In most cases, the shaft has a circular cross-section and it subject to either pure torsion or a combination of torsion and bending. The diameter of a shaft to transmit a given power can be determined from the following formula.

$$d_s = \sqrt[3]{\frac{1.77 \times 10^6 \times P}{N}} \quad (5)$$

Since it is difficult to predict the bending moment at this time, the estimated shaft diameter will be slightly increased.

D. Inlet and Outlet Velocities of Pelton Wheel

In Pelton turbine, water flows over the runner and leaves the runner at its outlet point. To estimate the required parameters for bucket design, nozzle design, work output and efficiency of Pelton turbine, reference is made to the inlet and outlet velocities of pelton wheel. Inlet and outlet velocities triangles of Pelton wheel are shown in Fig. 3.

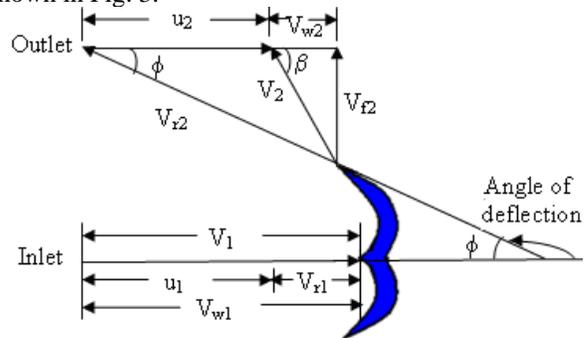


Fig. 3 Inlet and Outlet Velocity Triangles of Pelton Wheel [1] Where,

- V_1 = absolute velocity of water at inlet (m/s)
- V_{r1} = jet velocity relative to bucket at inlet (m/s)
- V_{w1} = velocity of whirl at inlet (m/s)
- u_1 = tangential velocity of wheel at inlet (m/s)
- V_2 = absolute velocity of water at outlet (m/s)
- V_{r2} = jet velocity relative to bucket at outlet (m/s)
- V_{w2} = velocity of whirl at outlet (m/s)
- u_2 = tangential velocity of wheel at outlet (m/s)
- V_{f2} = velocity of flow at outlet (m/s)

β = angle made by the absolute velocity with the direction of vane motion

ϕ = angle made by the relative velocity with the direction of vane motion

The jet emerging from the nozzle hits the splitter symmetrically and is equally distributed into the two halves of hemispherical bucket. The inlet angle of the jet is therefore between 1° to 3°, but it is always assumed to be zero in all calculations. Then the relative velocity of the jet leaving the bucket would be opposite in direction to the relative velocity of the entering jet. This cannot be achieved in practice since the jet leaving the bucket would then strike the back of the succeeding bucket to cause splashing and interference so that overall turbine efficiency would fall to low values. In practice, the angular deflection of the jet in the bucket is limited to about 165° and the angle, ϕ is adopted 15° to keep the jet clear of the succeeding bucket.

The ideal velocity of jet usually is known as spouting velocity, $V_1 = \sqrt{2gH}$. However, the actual velocity of the jet is slightly less, due to friction loss in the nozzle. Thus,

$$V_1 = C_v \sqrt{2gH} \quad (6)$$

The coefficient of velocity, C_v account for friction losses in the nozzle and has a value ranging from 0.97 to 0.99 [4]. In this paper, the mean value 0.985 is used for it.

The tangential velocities at inlet and outlet of runner will be same at the mean pitch. Therefore, $u = u_1 = u_2$. For the maximum efficiency, the tangential velocity of wheel at pitch circle, u is equal to $0.5V_1$ [4]. However, in actual practice the maximum efficiency occur when the value of u is about $0.46V_1$. In this relation, this coefficient of V_1 is also known as speed ratio, k_u .

From inlet and outlet velocity triangles, relative velocity of water at inlet is

$$V_{r1} = V_1 - u \quad (7)$$

The relative velocity of water at outlet, V_{r2} is KV_{r1} and blade friction co-efficient, K is slightly less than unity. Ideally when bucket surfaces are perfectly smooth and energy losses due to impact at splitter is neglected, $K=1$.

III. DESIGN OF BUCKET

A. Pitch Circle Diameter and Jet Diameter

Mean diameter or pitch circle diameter of the Pelton turbine refers to the diameter of the wheel measured upon the centers of the buckets.

$$u = \frac{\pi DN}{60} \quad (8)$$

Where, D = pitch circle diameter of pelton wheel (m)

And then, the diameter of jet is an important parameter in the design of Pelton wheel and it is determined at the maximum charge by using continuity equation.

$$Q = aV_1 = \frac{\pi d_0^2}{4} \times Z_0 \times C_v \sqrt{2gH}$$

Thus,

$$d_0 = 0.545 \sqrt{\frac{Q}{Z_0 \sqrt{H}}} \quad (9)$$

Where, d_0 = jet diameter (mm) and
 Z_0 = number of nozzle

B. Jet Ratio and Number of Bucket

The ratio of pitch circle diameter of Pelton wheel to the jet diameter is known as jet ratio represented by m and it is a size parameter for the turbine. For maximum hydraulic efficiency, the jet ratio lies between 11 and 15 [4]. A smaller value of m results in either too close a spacing of the buckets or too few buckets for the whole jet to be used. A larger value of m results in a more bulky installation.

$$m = \frac{D}{d_0} \quad (10)$$

The number of buckets for a Pelton wheel should be such that the jet is always completely intercepted by the buckets so that volumetric efficiency of the turbine very closes to unity. The number of buckets is usually more than 15. Certain empirical formulae have been developed for determining the number of buckets. One such formula which is widely used has been given by Taygun according to which the number of buckets, Z is approximately given by

$$Z = 0.5m + 15 \quad (11)$$

Table II. Approximate Number of Buckets for a Pelton Turbine [3]

| Jet ratio | 6 | 8 | 10 | 15 | 20 | 25 |
|---------------|-------|-------|-------|-------|-------|-------|
| No: of bucket | 17-21 | 18-22 | 19-24 | 22-27 | 24-30 | 26-33 |

C. Dimensions of Bucket Design Curvature

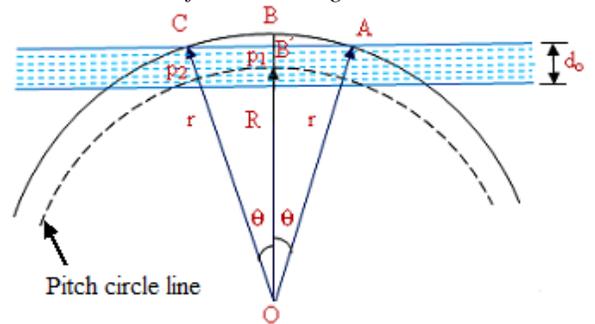


Fig.4 Curvature of Bucket [1]

Where,

R = radius of pitch circle

d_0 = diameter of the water jet

p_1p_2 = bucket pitch

r = radius of the outer circle

A, B, C = positions of three adjacent buckets
 θ = angle subtended by adjacent buckets at the centre of the wheel

$$Z = \frac{360}{\theta} \quad (12)$$

In $\Delta AOB'$,

$$\cos \theta = \frac{R + 0.5d_0}{r} \quad (13)$$

The bucket pitch on the pitch circle can be obtained by the following equation.

at the position of the needle according to Fig. 7 is given by the relation.

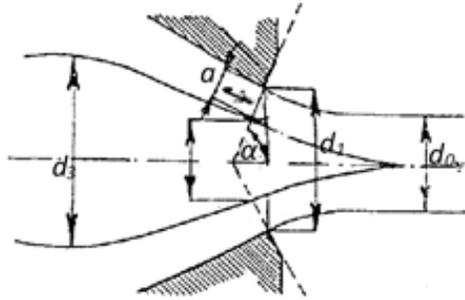


Fig. 7 Cross Section of Nozzle at the Position of the Needle [6]

From Fig. 7, required equation for nozzle outlet diameter, d_1 is

$$d_1 = \sqrt{\frac{Q \sin \alpha}{2.66 \mu C_v \sqrt{H}}} \quad (16)$$

The nozzle outlet diameter, d_1 must be within the range $(1.2 \sim 1.25)d_0$. The efflux coefficient, μ is between 0.8 and 0.88 [6]. Assume, $\mu = 0.84$ and $\alpha = 80^\circ$.

B. Dimensions of Nozzle and Needle

Nozzle dimension is depending upon the nozzle outlet diameter. The profile of nozzle and needle design

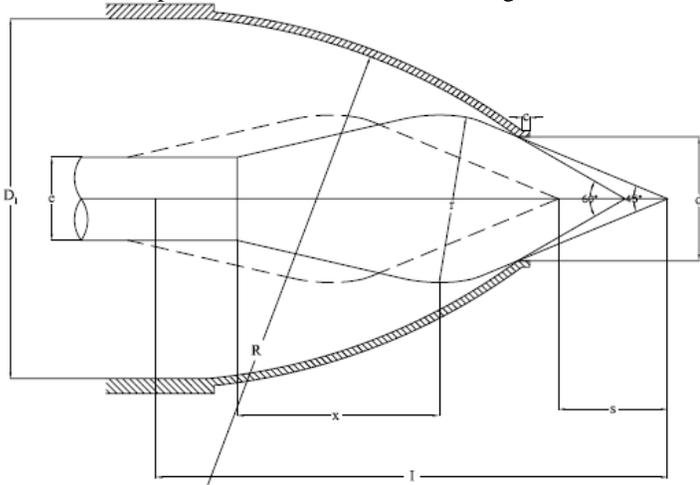


Fig. 8 Profile of Nozzle and Needle [6]

Table IV. Nozzle Dimensions

| Item | Values | Results (m) |
|-------|------------|-------------|
| s | $0.88 d_1$ | 0.056 |
| r | $1.35 d_1$ | 0.086 |
| x | $1.63 d_1$ | 0.104 |
| R | $5.02 d_1$ | 0.321 |
| D_1 | $2.9 d_1$ | 0.186 |
| e | $0.67 d_1$ | 0.043 |
| c | $0.06 d_1$ | 0.004 |
| I | $4.12 d_1$ | 0.264 |

V. RESULTS OF DESIGNED TURBINE

The calculated results in Table V are parameters of runner design for 220 kW output power based on net head, 213 m.

Moreover, main dimensions for bucket curvature based on referenced design Fig. 6 are shown in Table VI.

Table V. Required Parameters for Runner Design

| No | Description | Symbol | Value |
|----|--------------------------------------|----------|------------------------------|
| 1 | Flow rate of water at jet | Q | $0.135 \text{ m}^3/\text{s}$ |
| 2 | Specific speed | N_s | 18.4 |
| 3 | Speed of wheel | N | 1000 rpm |
| 4 | Absolute velocity at inlet | V_1 | 66.676 m/s |
| 5 | Tangential velocity at outlet | u | 29.29 m/s |
| 6 | Pitch diameter of the wheel | D | 0.56 m |
| 7 | Jet diameter | d_0 | 0.053 m |
| 8 | Nozzle outlet diameter | d_1 | 0.064 m |
| 9 | Jet ratio | m | 11 |
| 10 | Number of buckets | Z | 21 |
| 11 | Angle substandard by adjacent bucket | θ | 17.14 deg |
| 12 | Relative velocity of water at inlet | V_{r1} | 34.39 m/s |
| 13 | Relative velocity of water at outlet | V_{r2} | 34.386 m/s |
| 14 | Whirl velocity of water at inlet | V_{w1} | 63.676 m/s |
| 15 | Whirl velocity of water at outlet | V_{w2} | 3.924 m/s |
| 16 | Velocity of flow at outlet | V_{f2} | 8.90 m/s |
| 17 | Angle at exit runner | β | 66 degree |
| 18 | Absolute velocity at outlet | V_2 | 9.65 m/s |
| 19 | shaft diameter | d_s | 75 mm |

Table VI. Main Dimensions for Bucket Curvature

| Item | Minimum Value | Maximum Value | Average Result Value |
|------------------|---------------|---------------|----------------------|
| Bucket length, L | 120.8 mm | 174.9 mm | 144 mm |
| Bucket width, B | 148.4 mm | 212 mm | 175 mm |
| Notch depth, S | 23.3 mm | 33.1 mm | 28 mm |
| Notch width, M | 59.4 mm | 84.8 mm | 63 mm |
| Bucket depth, E | 42.4 mm | 63.6 mm | 63 mm |
| Bucket height, A | 92.8 mm | 132.5 mm | 112 mm |

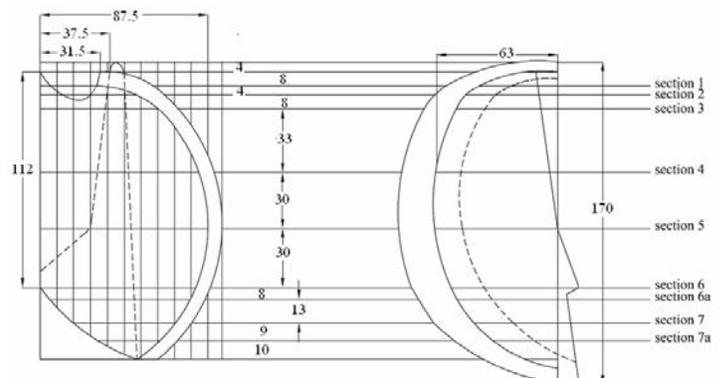


Fig.9 Front View and Side View of Bucket

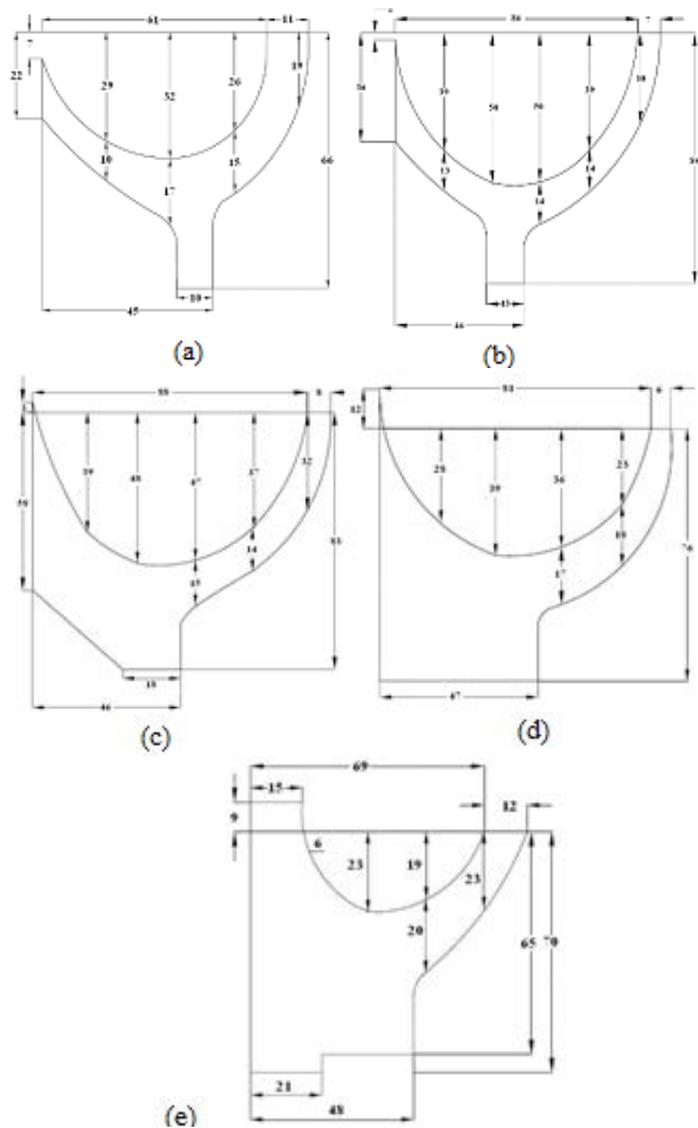


Fig.10 Five Section of Bucket Curvature: (a) Section Two, (b) Section Four, (c) Section Five, (d) Section Six and (e) Section Seven

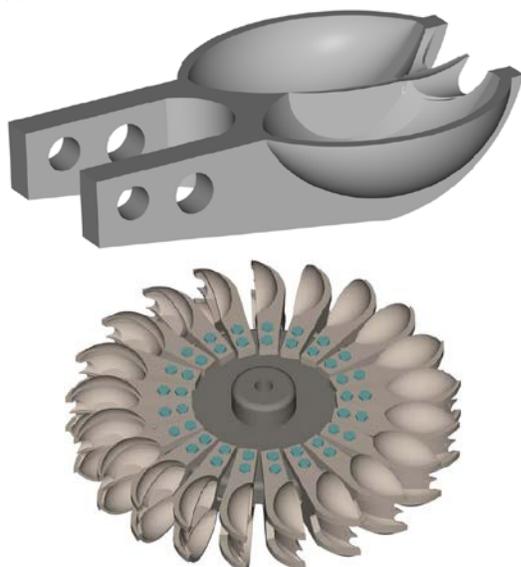


Fig.11 Bucket and Runner for Designed Pelton Turbine

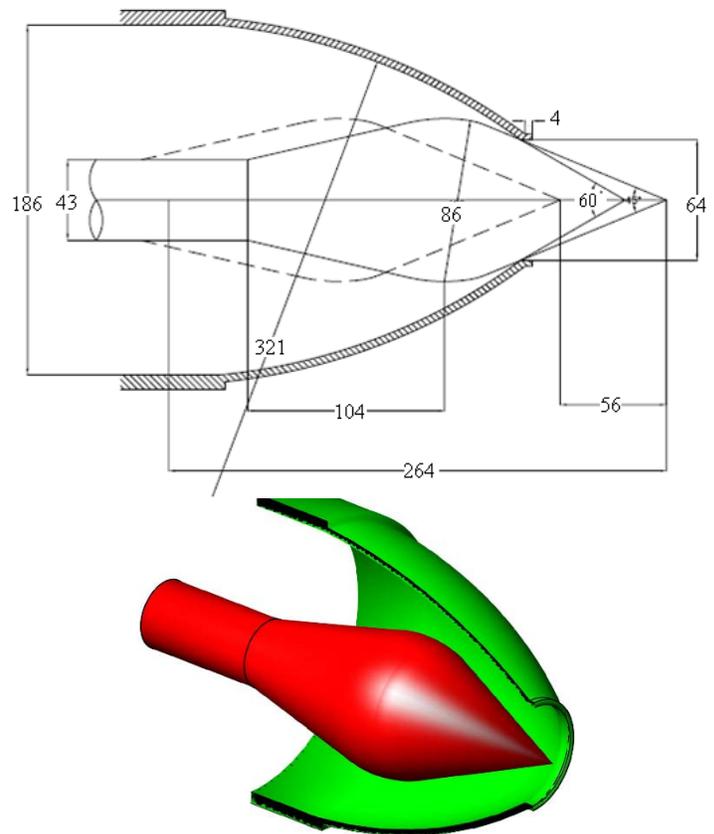


Fig.12 Nozzle with Needle for Designed Pelton Turbine

VI. CONCLUSION

In hydropower plant, turbine is one of the most important parts to generate electricity. The output power of turbine depends on the head and flow rate. The designed turbine can develop a power of 220 kW on the designed head 213 m and the designed flow rate 0.138 m³/s. The rotational speed and specific speed of turbine is 1000 rpm and 18.4 respectively. In this paper, detail design of bucket and nozzle with needle for single jet Pelton turbine is presented. Bucket dimensions must between maximum and minimum value with respect to jet diameter. The jet diameter is 0.053 m. Notch width of the bucket must be larger than the diameter of jet. If the notch width is smaller than the diameter of jet, some of the incoming water would not strike the next bucket. Besides, all of the hydraulic energy cannot be obtained in this condition and many losses can be occurred. It is important that the jet is always completely intercepted by the buckets so that the volumetric efficiency of the turbine very closes to unity. The angle made by the relative velocity with the direction of motion of vane at outlet, is less than 90 degree and the velocity of whirl is negative. In Pelton turbine, nozzle is also one of the main parts because the available fluid energy is converted into kinetic energy by the nozzle. In this study, single jet nozzle is being used because many nozzle turbine interfered by the big bend of channels to bring the collector. In nozzle design, the calculated result of nozzle outlet diameter must be within the range between 1.2d₀ and 1.25d₀. The detail dimensions of nozzle and needle shape is mainly depending on the nozzle outlet diameter that is 0.064 m. In this study, detail drawing of runner and nozzle with needle are expressed.

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Restoration of Ancient History of Sri Lanka with the help of *Sīhalavattthupparāṇa*

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Abstract- The sources contribute to write history (Perera S. Lakshman, 2001:46). *Sīhalavattthupparāṇa* is one of the oldest surviving sources, has gained its life due to the untiring efforts of Rev. Polvattē Buddhadatta. Initially, a Burmese copy of the *Sīhalavattthupparāṇa* has found from Burma and later on its Pāli copy, as well has been found in the Mahākappinna Mudalindārāmaya in Vālithara in Sri Lanka. Following the due clarification, Rev. Polvattē Buddhadatta is credited to have published this particular book. It can be speculated that this book has been written during the reign of king Vattagāmiṇiābaya (104-67 B.C.E). This can be illustrated as one of the oldest books available right at the moment and further, the way in which the Pāli language is used in this particular book proves the above fact. This book recalls us where Pāli, as a language was not highly used for the purpose of writing. Further, the book seems to have a lot of grammatical errors.

Though Sirima Wikramasinghe in the book of the Anurādhapura era mentions that *Dīpavaṃsa*, written before the 5th century A.C., was the first attempt, to write the Sri Lankan history by way of traditional historical reports (2014:2). It should be noted that *Sīhalavattthupparāṇa* is much older than the *Dīpavaṃsa*.

Index Terms- history, chronicles, compile, stipulate

I. METHODOLOGY

The Pali and the Sinhalese translation of *Sīhalavattthupparāṇa* compiled by Rev. Polvattē Buddhadatta were studied. I was able to compare historical facts which is in *Sīhalavattthupparāṇa* with the chronicles of *Mahāvamsa* and *Dīpavaṃsa*. The evidence of the different texts permits us to conclude with some certainty of that there really existed.

II. MAIN TEXT

There are around 82 stories illustrated over there, while the name of the author has also been mentioned in the book. The book itself clearly demonstrates the fact that āchārya Dhammanandi, of the Pattikotti Vihāra in the Kaṇṭakarasolapattana, compiled this particular book. This particular vihāraya is introduced as Saṇḍakonti in the book itself. It is understood that the relevant place does not exist in Sri Lanka and could be thought as a place, situated in the Southern India. The Kaṇṭakarasola pattana could perhaps be a harbour in the Chōla country of the South India

(Ellāvāla Hema, 1962:4). Professor Hema Ellavala has written an article named “Whether *Sīhalavattthupparāṇa* is older than *Dīpavaṃsa*?”, to the fourth volume of the history magazine of the Vidyodaya university in the year 1962.

Furthermore, Professor Hema Ellavala has illustrated that there had been a vihāra, called Sīhala Vihāra, mentioned in an inscription of the Nāgarajunarkoṇḍa, belonging to the Vīra Purisadatta who lived in the second half of the third century A.C. The Theravādi monks who travelled from Sri Lanka had been involved in the propagation of Dhamma in this particular vihāra. Ptolemy has mentioned a grand business center which was at the bank of Kriṣṇar River, called Kaṇṭhatakossīla (Ellavala Hema 1962: 5).

Likewise, it is able to point out that a bhikkū who had migrated to India during the famine of Brahmana Tissa may have composed this book. Edward Hallett Carr has mentioned that history cannot be written unless the historian can achieve some kind of contact with the mind of those who have written the texts (1962:1-25).

The division of the chapters has also not been done properly and which shows the initial stage of composing a chronicle. The author has presented the facts by using the Pāli stanzas as well as the paragraphs. Bōpitiya area in Ruhūṇa, Sēthapabbataya, Vattēgama area in Tissadanauva, Bōmaṅgama grāma in Anurādhapura, Kāmojja grāma in Ruhūṇudanaouva, Dīgāugrāma, Vilgama near the Sāgiriya, Kālakandara Vihāra at Sithulpaouva could be known as the places relating to the story telling. This consists of the stories, surrounded by the countries Gujarat, Gandhar and China. Accordingly, it could be admitted that the bhikkūs of Sri Lanka have had religious relationships with those countries in the past. The expectation of the writer was, not to present the facts on the Sri Lankan history, but to direct the listener to familiarize with the Buddhism. The book has been able to present a great deal of historical facts. The stanza mentioning below, extracted from Sāliya Kumāra Vasthu highlights the expectation of the writer.

dasavidhakusalēsu appamatthō – bahuvividhānāpathe
smaṅgibhūtō
sugathigathapathā vasōdhayithvā - sakabhavanaṇ viya yatha
dēvalokaṇ

The writing of this particular style attracts its reader deep in to the story (*Sīhalavattthupparāṇa*, 1958: 23-27). It has been mentioned that certain stories should be explained as the story that of the Chulli Upāsaka story, and this fact could demonstrate the fact that, listener is attracted deep in to the story while it is being explained.

King Saddhātissa is the main character of this book as per Mahāvamsa, king Dutugāmuṇu who fought and defeated king Elāra at an intense battle is highlighted as superior who is much greater than that of king Saddhātissa. Mahāvamsa devotes 11 of its chapters on king Dutugāmuṇu. This particular consideration given by the author of Mahāvamsa about king Dutugāmuṇu could perhaps be attributed to the strong foundation laid by Dutugāmuṇu in establishing a social structure which transformed into the cultural and political aspects of the island which was well-established and stable (Wāvage Sumanasiri,2005:1-2). The contrary to the fact, main character of this particular book is about the king Saddātissa and also the war, fought by Dutugāmuṇu against Elāra which is not highlighted in this book. As per the story of king Kāvantissa, it is understood that Vihāramahādēvi and king Kāvantissa had been brought up together since childhood (*Sīhalavaththupakarāṇa*,1958:144). The above facts show that they have not met accidentally but had been known to each other since their childhood. In a story called Death of King Dutugāmuṇu, it was mentioned that having fought with prince Tissa, the king Dutugāmuṇu had been defeated several times by his brother Tissa. The way in which the minister of king Saddātissa and a daughter Sumanā had been engaged in meritorious activities which have also been mentioned in this book.

Sīhalavaththupakarāṇa is the oldest available book which gives the love story of Sāliya and Aśōkamālā. In the story of prince Sāliya as narrated in the *Sīhalavaththupakarāṇa* also mentions the story relating to the previous births of Sāliya and Aśōkamālā. As per this story, prince Sāliya was a clever blacksmith. A man who is involved in framing came to see the blacksmith with ālvī, pork, tender leaves of Vēvāl in order to get the farming tools. The blacksmith who received those items made a wish to have thousands of gifts either in a form of a life of a god or human being by offering alms, prepared by himself. The alms was offered to four bhikkūs who had arrived from the Puvangu Island. Due to this meritorious activities he was blessed with to have a birth by the Dēvi or consort of king Dutugāmuṇu. A lot of treasure was followed by after the concealment of the prince. *Sīhalavaththupakarāṇa* mentions that prince was named Sāliya due to the fact that treasure had been overflowing for 12 long years while the country had been self-sufficient in rice during that period (1958: 23-27).

According to the *Sīhalavaththupakarāṇa* a poor old woman delivered a baby daughter in a city of Baranasa during the time of the Kaśhaya Buddha. This old woman was used to offer alms two monks and one day those monks had arrived to receive the alms relatively earlier than the usual time. They preached Dhamma until the alms were ready. Having finished preparation of alms, the old woman advised her daughter to accord the two bhikkūs who were still preaching. Since the sermon got interrupted, the young lady patiently waited whilst, listening to the Dhamma. The old woman who was not convinced of the actual situation there said, “Thee the stubborn girl where had you been all this time?” and at this juncture the daughter having lost her temper retold her mother “Thee the sādol woman I had been listening to the Dhamma” owing to this insult and the demerit which she got owing to her harsh words, made against the poor mother she was born to a lower cast family in her next birth. She

was named Aśōkamālīnī since her mouth got radiant fragrance emanating from the flowers called Aśōka.

She was barely 12 years when she first met prince Sāliya on her way to Anurādhapura. She was frightened to have seen the prince and got covered herself by leaning to a nearby wall. Having noticed this, prince Sāliya had questioned as to who had been drawn such a beautiful picture on the wall. The servants had told him that it was not a true picture drawn, but a girl belonging to a sādol cast. The prince had asked his assistants, to be brought her to the harem and later declared that she could be his consort.

The King Dutugāmuṇu having heard that prince Sāliya got married to a girl from the Sādol cast expelled prince Sāliya from the city. *Sīhalavaththupakarāṇa* mentioned that having seen Aśōkamālā who fetched water in golden basket wash the feet of the king who was got mesmerized from her presence. The king had told “if she were not your wife, I would have taken her as my wife. Once you are in love, you disregard the cast, the creed and the clan”. According to this book it shows that king Dutugāmuṇu himself was not truly against the marriage of prince Sāliya to sōkamālā. In the *Mahāvamsa* 3rd stanza in 33 chapter gives some kind of narration of the prince Sāliya. It further mentions that he was even willing to abdicate the throne because, of the strong and the unblemished love he had with a young sādol damsel namely Aśōkamālā who lived in the sādol village established by king Paṇḍukābhaya (1967,33:1-3).

The *Vansaththappakāsini* which is considered as a tīkāva of the Mahāvamsa mentions that prince Sāliya was an extremely handsome young man, bestowed with a great deal of merits and having abdicated the throne and lived in the Sādol village established by king Paṇḍukābhaya whilst been seriously committed to Aśōkamālā. It further says that both of them were philanthropists in their previous lives. There was a blacksmith by the name of Tissa in the great village of Muṇḍagaṅga. His wife was known as Nāgā. Once a wild boar was given to him by a son of Vāddā in order to compensate the work he has done in the paddy field. This blacksmith having prepared a curry from that meat he wished that a pious arahat would arrive at his door step in the future. On the following day Dhammadinna thērō who lives in the *Thilaṅgapabbata Vihāra* of the *Puvangu island*, *Gōḍiyamahātissa* thērō, *Mahānāga* thērō of *Samudra Vihāra*, *Mahānāga* thērō of the *Kālavallikamaṇḍapa*, *Mahāsaṅgarakkitha* thērō of *Chōrakaṇḍakavihāra*, *Dhammagutta* thērō of *Patavivāḷaka*, *Mahānāga* thērō of the *Bhāthiyavaṅka*, *Malaya Mahādēva* thērō of the *Kōtapabbata* attended to the alms giving. The said person who gave alms died while recalling on the same action, which was meritorious enough to be born as a son of king Dutugāmuṇu. This was happened to be a meritorious deed done throughout his life.

In the meantime after the demise of the wife of above mentioned person born as the youngest among seven daughters of a senior carpenter of the village, situated at the Western entrance of the city of the Anurādhapura. Since gruel was had and it was scattered everywhere having returned after visiting the shrine the mother had asked “which slave woman had committed this?”. Having heard the above words, the mother herself was blamed by the using exactly the similar words and due to this insult, it is said that Aśōkamālā was born to a lower cast. Having seen Aśōkamālā plucking Hōpalu flowers in the garden prince Sāliya had accompanied her to his home (*Vansaththappakāsini*,2001:484-485).

III. THE ECONOMIC FACTORS

Although *Mahāvamsa* talks less about king Saddātissa, *Sīhalavattuppakarāṇa* fills this void. The story about king Saddātissa appears in the *Sīhalavattuppakarāṇa* gives an idea on the monetary transactions done in ancient Sri Lanka. King Saddātissa wanted to offer an alms giving to the Saṅga with the money earned by the hard work. The king had left the palace without informing anybody and had met a villager on the way, where he says that he is a labourer who is paid on a daily basis (1958: 28). If this news is accurate enough, it can be stipulated the fact that, at that time, there were people who were paid on a daily basis even by the 2nd century B.C.E in Sri Lanka. Further the above story narrates that, the king had been provided with paddy as his wage. It could be understood that in the distance past, the monetary transactions and also that of the exchange of goods had prevailed. The *Sīhalavattuppakarāṇa* further mentions that the wife of the king had taken juggery, Ghee and oil cakes by selling the paddy, received as the wage given to her husband (1958:29).

According to the story of Tissa the dress maker, king Saddātissa had donated dressmaker a house consisting of all the necessary items and goods, fifty thousand dresses and a village where treasure worth of thousand comes in to being (*Sīhalavattuppakarāṇa*,1958:3).

Most of the stories, mentioned in the *Sīhalavattuppakarāṇa* illustrates that monetary transactions was carried out by means of goods. As per the Harithala tissa's story of the same book, it is explained that the paddy of an amuṇa had been taken as the wage. An amuṇa is equal to 40 lāha and 4 pāllers. While a Lāha being equal to 4 nālies. A nāli is equal to 2 pounds (Gunawardana. R.A.L.H,1979:64.) Harithalatissa gives a quantity of paddy in one Amuṇa as the wage given to his wife and ask her to bring meat, fish, milk and Ghee (*Sīhalavattuppakarāṇa*,1958: 5). King Mahāchūlimahātissa had also worked in sugar factory and received sugar as his wage and further he had taken steps to offer arms with the sugar given to him (*Mahāvamsa*,1950,34:1-6). In this respect king has received sugar as his wage. Likewise, it is understood that the payments had been done by means of goods. The story about prince Sāliya of the *Sīhalavattuppakarāṇa* also speculates on sources which are able to understand that methods of exchange of goods had been in practice in the process of monetary transactions. The story further says that a certain farmer had obtained the farming tools by exchanging rice, pork, tender leaves of Vēvāl with a blacksmith (1958: 23).

The labourers who had worked in expecting a wage have also been introduced by as bhāthaka (*Niddēsattakathā in Kāmsūtra nirdēśha varṇaṇā*,2008:64). As per the story of the Mahānāga thērō king Saddhātissa had given money and goods for a villager (*Sīhalavattuppakarāṇa*,1958:78). The hundred male and the female workers and villages had been given to the Haṅkāla by king Saddhātissa (*Sīhalavattuppakarāṇa*,1958:81). *Mahāniddēsattakathā* gives information on a cross sections of people who has become servants by the birth itself. As per that it is clear that they had been servants both by the maternal and paternal side. As far as the *Mahāniddēsattakathā* is taken in to account some of the people had lived as servants until their death nearly because of solid poverty (2008:237).

Regarding the story of the Kuṅtha the goldsmith, king Saddhātissa has given gold for a goldsmith in order to get a golden plate made. Further, goldsmith had sold the same gold in order to

have alcohol and at the end of the story, the king who was impressed by the goldsmith had donated him a village, a Janapada and money (*Sīhalavattuppakarāṇa*,1958: 96). The reign of King Saddātissa's, having worked at night, a lady servant by the name of Chandrā had received a wage (*Sīhalavattuppakarāṇa*,1958:131). It is mentioned that the king having been impressed by her, also given her in marriage to a soldier where, a village and money had been given to him as a donation by the king himself (*Sīhalavattuppakarāṇa*, 1958:131). Likewise it is clear that goods and money had been given as the wage in the second century B.C.E.

In the story of the sixty monks of the *Sīhalavattuppakarāṇa* it is mentioned that a certain king and his consort had secretly left the palace and worked in a field as labourers. The king attended to the yielding of the harvest, the consort was engaged with the chopping paddy and for that received the wage (1958:126). Further a story in the *Sīhalavattuppakarāṇa* narrates that a king had paid money for a minister who gave him security and protection (1958: 122). During the famine of Bāminithiya a certain women had travelled all over the towns with a massa looking for food (*Sīhalavattuppakarāṇa*, 1958:137).

During the reign of king Saddātissa, a certain poor farmer mortgaged his daughter and gained eight kahavaṇu and with that money a land of 22 kiriya had been purchased, where the business making bricks had been started (*Sīhalavattuppakarāṇa*, 1958:108). A certain mother and a father having mortgaged their daughter received the 12 kahavaṇu (*Sīhalavattuppakarāṇa*,1958: 125). When the famine occurred in the Jaffna peninsula a daughter had been mortgaged by parents and received the forty kahavaṇu. The name of the daughter has been given in the text itself as Māthudēvikānāga. The above story further mentions that having signed a treaty with his master Māthudēvikānāga got the permission to work in the night and received the 60 kahavaṇu (*Sīhalavattuppakarāṇa*,1958: 132). The thousand worth of a gem has been sold by a man at the time of the famine (*Sīhalavattuppakarāṇa*,1958:105). Sivijāthaka of the *Dhammasaṅganippakarāṇa* mentions that even bōdhisattva himself had the practice of offering alms daily to the monks (2008:66).

Sīhalavattuppakarāṇa comments on a book call *Saṅuktamahāvagga* which shows that it takes three dawn to go through this particular text. Likewise it should be noted that *Saṅuktamahāvagga* had even been composed by this time. It is mentioned that a bhikku who was on board a ship had recited by heart the caption of *Dhammasaṅganippakarāṇa* (*Sīhalavattuppakarāṇa*,1958: 150).

As further *Sīhalavattuppakarāṇa* a Nāga king had fought over chair made of red sandal. The king Nāga of Nāga dīpa got married to a daughter of the Nāga of the sea. The Nāga king of the sea gifted her daughter with a valuable chair made of red sandal as a dowry. Later on the father of the Nāga princess demised and the brother of the Nāga princess sent a letter to his bother in law in which it had been requested the sandal plate to be written to him. As the request unheeded a war irrupted between both of them. The Nāgas of the land were determined to make the sea as the Nāga kingdom itself. It is mentioned in the *Sīhalavattuppakarāṇa*, seen this war the Lord Buddha had visited Nāga Dīpa by air in order to disciplined the Nāgas.

The story of the Mahānāga thērō convinces that the Bhikkūs were offered with alms which included with meat and flesh. “You the dear daughter offer the Bhikkūs āl rice flesh and meat cooked with addition of gee” and also it could be noted that meet had also been consumed by the bhikkūs. The story of Harithālatissa’s describes that the alms consisting of lunivila leaves prepared and offered to by Sumanā have been refused and thrown a way in her presence itself (*Sīhalavattupparāṇa*, 1958: 4-8).

During this particular period there had been times where the Bhikkus visiting the Uttarāpatha in order to worship the sacred Bō tree. They having come to Anurādhapura from Ruhūṇa while being on board of a ship of Mahākoṇḍa got down Kāvēripātuna while gradually approaching towards to Utrāpatha through the wood. Mahākoṇḍaya mentioned in this text could perhaps be the port of Mahātitha. Likewise, it is understood that the port Godavāya in Ruhūṇa at that time was not much significant. Several stories appearing in this book says that the bhikkus of the Puvangu Dīpa have arrived in Sri Lanka during the time at which the alms were daily offered. It can be speculated that this puvangu island as the Island of Puṅkuduthive or an area situated near by the reservoir Nāchchadūva.

The names given to some places mentioned in the stories in the vicinity of the Surrattha Janapada are available in the *Sīhalavattupparāṇa*. Sahuthala area, Ālārabālapatthna, Pōrimāsi River, Koṇḍapūdi Vihāra, Chittago Vihāra, Mahānīdi Parvata, Upasiṅga Vihāra, Achchimanthasēla Parvata, Vikkiṅṅa Nagara are the places surrounded by the Surattha janapada in Indian subcontinent. Though Rev. Polwatthe Buddhadatha thērō who translated this book into Sinhala sent a letter to professor P.V Bapath the head of the department of Buddhist studies of the Delhi University in order to ascertain the authenticity of the name of those palces mentioned, it is apparent that a reliable reply has not been received. If the authenticity of the name of those places can be proven, the reliability, pertaining to the facts given in this book could easily be highlighted. The story of lay devotee of Mahādeva commenced on a situation where the people of Sri Lanka been on board of a ship had sailed Suvarṇabōmi (the land of gold) in order to bring the gold back home (*Sīhalavattupparāṇa*, 1958:81-84).

IV. THE SOCIAL FACTORS

The book depicted a picture on the social status of Ancient Sri Lanka. The story of Haritāla Tissa mentions when a daughter was given in marriage, a nāli of rice, pot with a lid, mortar and pistol, and a plate to eat the rice had given as the dowry (*Sīhalavattupparāṇa*, 1958:4). This seems to be the society that existed with the less equipments.

It is understood that kahavaṇu and half of it had been in the usage. There had also been occasions where kahavaṇu been offered having sold the hair. This particular book is one of the classic examples which narrates as to how, the people of Sri Lanka faced with famine Brahmanatīya. It is mentioned in the story of Bandagrika Tissa it is clear that the parents, friends and the people who had been known also perished and the people had also travelled to the up country looking for food during the time of famine Brahman Tīya (*Sīhalavattupparāṇa*, 1958,102-106). The Story of Sumanā bālīka stipulates on a time where young lady, offering her only a dress to a bhikku and later been attired in poththiya, made of leaves (seehal 1958 110-112).

Piṅḍapāta viśuddhi narrates a story which gives information on a husband and a wife had mortgaged their daughter for twelve kahavaṇu. This clearly shows that the children were mortgaged at a time of critical situations such as famine. According to this particular book, it is clear that the famine had lasted for about 12 years. The weaving, pottery, making of musical instruments and jewellery could be introduced as the industries prevailed at that time.

V. CONCLUSION

As far as the above facts are taken in to account, it is understood that this particular book, demonstrates the historical, social, economic and cultural aspects of ancient Sri Lanka, while giving a considerable contribution to the restoration of the Sri Lankan history as well.

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Emperor Aśoka as depicted from vamsa tradition in Sri Lanka.

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Abstract- In this research paper, our attempt is to examine the role of the Emperor Aśoka as depicted in vamsa tradition in Sri Lanka. Aśoka's legend is found in the fifth century chronicles of Sri Lanka, the *Dīpavaṃsa* and the *Mahāvamsa* as well as in Buddhagohosa's commentary on the Vinaya. In addition to this, the commentary on the *Mahāvamsa*, the *Thūpavaṃsa* and the *Bōdhivaṃsa* were studied. The discrepancies in *Mahāvamsa* and *Divyāvadāna* has been discussed here. I have not discussed the third Buddhist council as discussed it in our next research article.

Index Terms- Vams, discrepancies, tradition, Buddhism

I. BIRTH OF AŚŌKA

The fifth chapter of *Mahāvamsa* has been dedicated to the Emperor Aśoka. The Brahman Cāṅkka anointed the king Candagutta. The *Vaṃsatthappakāsini*, which gives the name of Aśoka's mother as Dhammā, born of the Maurya clan, (Moryavamsajā Dhammā), narrated how her unusual pregnancy longings were interpreted by an Ājīvaka named Janasāna or Jarasōna. He is said to have been summoned by Bindusāra for this purpose as Brahmans of the court had been unable to interpret them. Janasāna is described as religious personage who frequented the queen's family "Bindusārassa aggamahesiyā kulūpago".¹ He had predicted that the son she was expecting was destined to be the emperor of Jambudīpa, exercising his suzerainty over its hundred kings.² The North Buddhist tradition speak of different Ājīvaka named Pingalavatsa in the Pāṃsupradānāvādāna of *Divyāvadāna*.

The Sri Lankan Pāli sources have preserved a tradition as regards the name of Aśoka prior to this consecration as king. According to it, Piyadassana or Piyadassi was his personal name and inferentially Aśoka was the throne name or else a second name.³ The antiquity of this tradition is suggested by the fifth century commentary by Buddhaghosa on the Dīghanikāya. Here, it is said that the prince was named Piyadāsa and he became king under the name of Aśoka "Piyadāso nāma kumāro chattam ussāpetvā Asoko nāma dhammarājā hutvā". W. P. Ananda

Guruge says "Several have attempted to prove that Piyadasi or Piyadassana was a family name applied also to his grandfather Chandragupta. The very flimsy evidence for this, however, comes from the word Piyadamsana in a Prakrit passage in the Mudrārksasa, which could be better explained as an epithet that proper name."⁴

As stipulated in the *Dīpavaṃsa* piyadassana was anointed as the king two hundred and eighteen years after the parinibbana of the Sambuddha.⁵ As reported when piyadassana was installed, many miraculous incidents occurred.⁶ These splendid rewards were received as a result of the gift of honey in his previous birth.⁷ As depicted by the *Mahāvamsa* Candagutta belonged to the clan of Moriya.⁸ He had slain the ninth (Nanda) Dhanananda. Candagutta reigned twenty four years and his son Bindusāra reigned twenty eight years. King Bindusāra had hundred and one sons. Among whom, Aśoka was the central concern. Aśoka was the sub king of Ujjeni. He was in charge of collecting revenue of that province. Once he came to the town of Vedisa, the daughter of Setthi, known by the name of Devi, having cohabited with him, gave birth to a noble son.⁹

As shown by the *Mahāvamsa*, Aśoka had slain his ninety nine brothers, born of different mothers, won the undivided sovereignty all over Jambudīpa. *Divyāvadāna* mentions a brother by the name of Susīma. He is said to have been born of senior queen before Aśoka's mother was introduced to the royal court. Susīma had a prior claim to the Maurya throne. But the chief Minister Khallāta considered him unfit to be emperor as he had slapped the chief ministers in fun. Some Aśokan scholars would suggest that Susīma was the same as Sumana of the Pāli records.¹⁰

He consecrated himself as a king in the city of Pāṭaliputta four years after his kingship. Due to all these facts, it could be presumed, that Aśoka had to face with a conspiracy. Aśoka raised his youngest brother Tissa, son of his own mother, to the officer of vice regent.¹¹ Aśoka's father Bindusāra had shown hospitality to sixty thousand Brahmanas, versed in the Brahma doctrine, and in like manner, he himself nourished them for three years.

Some scholars were now inclined to dismiss the legends as "downright and absurd mythological accounts."¹² Others held that one could glean from them, especially from the Sinhalese

¹ *Vaṃsatthappakāsini* 1935: 190-193.

² Guruge Ananda W.P, 1993: 26.

³ Ibid, 1993: 27.

⁴ Ibid, 1993: 28.

⁵ *D.v*, 1992, 6:1, 146

⁶ Ibid, 1992, 5:2-15, 150,151.

⁷ Ibid, 1959, 6:15, 151.

⁸ *M.v*, 1950, 5:17,27

⁹ *D.v*, 1992, 6:15, 147.

¹⁰ Guruge Ananda W.P, 1993: 30.

¹¹ *M.v*, 1950, 5:17,28

¹² Dikshitar, 277 & Strong S. John, 1989: 12.

chronicles, some valuable historical materials about Aśōka, although these must “be discredited when found lacking in corroboration from the inscriptions.”¹³ A full consideration of all the legends of Aśōka would be an overwhelming undertaking; there are stories about him not only Pāli and Sinhalese but in Sanskrit, Chinese, Tibetan, Japanese, Burmese, Thai and other Asian languages as well. We shall primarily be concerned with Pāli, Sinhalese, Sanskrit and Chinese.

II. THE PARALLELS AND THE DISCREPANCIES BETWEEN THE AŚŌKĀVADĀNA AND THE PĀLI TEXTS

John S. Strong has shown in his book, *The legend of King Aśōka*, many parallels between the Sanskrit and the Pāli recensions of the Aśōka. As he has shown both tell the story of Aśōka’s previous life, of his birth as the son of King Bindusāra, of his somewhat violent accession to the throne, of his conversion by a young Buddhist monk, of his construction of eighty four thousand Stūpas or Vihāras, of his donations to the Buddhist community, of his worship of the Bodhi tree.¹⁴ Despite these similarities, he further shows the differences between the two recensions. In the Aśōkāvadāna, Aśōka is said to have been born one hundred years after the parinirvāna of the Buddha; in the *Mahāvamsa*, however, he is said to have been consecrated king 218 years after the parinirvāna. Scholars, interested in chronological problems have spent much energy trying to deal with this discrepancy.¹⁵ Some have even argued that the *Aśōkāvadāna* has here confused the figure of the great emperor Aśōka with that of his reputed forefather, King Kālāśōka, who is unknown in the Sanskrit tradition, but who according to the *Mahāvamsa*, was reigning at the time of the Second Buddhist Council at Vaiśālī a century after the death of the Buddha.¹⁶ John S. Strong has come to conclusion on this discrepancy as follows.

“There is however, little reason to believe that the *Aśōkāvadāna*’s declaration that Aśōka lived one hundred years after the parinirvāna was intended as a chronological statement at all. On the one hand, it contradicts the text’s own indication that there were eleven generations of kings between the Buddha’s contemporary, King Bimbisāra and Aśōka; eleven generations can hardly fit into a single century. On the other hand, as well shall see, the designation.” “One hundred years was simply a traditional way of starting that Aśōka living at a time when there was no one still alive who had actually known the Buddha personally. What we are dealing with here, then is not a chronological issue, but something reflection a much greater difference in the whole outlook of these two texts; while the *Mahāvamsa* as a chronicle is naturally concerned with history and lineage, the *Aśōkāvadāna*, as an avadāna or a legend is not; its focus is on the religious and psychological setting of its story.”¹⁷

One of the important stories in the *Mahāvamsa* that is absent in the *Aśōkāvadāna* tells how Aśōka convenes and participates in the Third Buddhist council at Pāṭaliputra. In addition to the

differences mentioned, there are several episodes in the *Aśōkāvadāna* which do not figure at all in the *Mahāvamsa*. The story of Aśōka and his minister Yaśas, the tale of Aśōka’s pilgrimage with the elder Upagupta, the episode of his encounter with the great arhat Piṇḍola Bhāradvāja, and the tragic account of Aśōka’s final gift to the sangha of half a myrobalan.

Readers are principally familiar with the image of Aśōka, presented in the *Mahāvamsa* may be surprised to find that his portrayal in the *Aśōkāvadāna* is not always as bright and glorious as it is in the Sinhalese chronicle.¹⁸ In fact he is, in the text, presented as being physically ugly. His father cannot stand the sight of him; his skin is rough and harsh; and the young women in his harem refuse to sleep with him because of his repugnant appearance.¹⁹ Hendrik Kern, has given the worst idea of Aśōka. He says “If we knew him only by these Buddhist sources, we should have to conclude that he was a sovereign of exceptional insignificance, remarkable only in that he was half monster, half idiot.”²⁰

III. MEETING THE NIGRODHA SĀMAṆERA

Whilst Aśōka once standing at the window, saw an ascetic, the sāmaṇera Nigrodha, passing along the street, he felt kindly towards him. He was the son of prince Sumana, the eldest brother of all the sons of Bindusāra.²¹ When Bindusāra had fallen sick Aśōka left the government of Ujjeni conferred on him by his father, and came to Pataliputra. *Mahāvamsa* further says that when he had made himself master of the city, after his father’s death, he caused his eldest brother to be slain and took on himself to sovereignty in the splendid city.

Consequently the consort of prince Sumana, who bore the same name (Sumanā), being with child, fled straightway by the east gate and went to a caṇḍāla village, and there the guardian god of Nigrōdha tree, called her by her name, built a hut and gave it to her. As reported in the *Mahāvamsa* on the same day she bore a beautiful boy and gave her son the name Nigrodha, enjoying the protection of the guardian god. When the headman of the Caṇḍālas saw the mother, he looked on her as his own wife and kept her seven years with honour. Then as the thēra Mahāvaruṇa saw that the boy bore the signs of his destiny, the arahant questioned his mother and ordained him and at the same room where they shaved him, he attained to the state of arahant. When Nigrodha sāmaṇera going to visit his mother, he entered the splendid city by the south gate, and he passed the king’s court on his way. Having seen the sāmaṇera, a kindly thought arose on king. The sāmaṇera was invited by the king to the palace. According to the description in *Mahāvamsa*, since the sāmaṇera saw no other bhikkhu there he approached the royal throne.²² Leaning on the king’s hand the monk mounted the throne and took his seat on the royal throne under the white canopy. It further remarks, that seeing him seated there, King Aśōka rejoiced greatly that he had honoured him according to his rank.

¹³ Barua, B. M, 1968:6 & Strong S. John, 1989: 12.

¹⁴ Strong S. John, 1989: 21.

¹⁵ Ibid, 1989: 21.

¹⁶ Barua, Vol. I:41 & Strong S. John, 1989: 21.

¹⁷ Strong S. John, 1989: 21-22.

¹⁸ Ibid, 1989: 40.

¹⁹ *The Aśōkāvadāna*, 1963: 37,43 & Strong S. John, 1989: 40.

²⁰ Hendrik Kern, 1901-1903, vol. 2, 2: 335 & Strong S. John, 1989: 40.

²¹ *M.v.*, 1950, 5:37,29.

²² *M.v.*, 1950, 5:64,31.

The question that would naturally arise is why King Aśoka allowed this young sāmaṇera to sit on the royal throne under the white canopy at the initial stage of his kingship? Here it is clearly understood that there is claim for kingship for the sāmaṇera, as his father was the eldest son of King Bindusāra. King Aśoka was the one who plundered the throne and slain the father of sāmaṇera. Then the sāmaṇera preached to him, the “Appamādavagga.”²³ Finally King Aśoka bestowed eight perpetual supplies of food to the sāmaṇera, to the master of him, to his teacher and to the community of bhikkus.

It is interesting to compare this episode of Nigrodha with Samudra’s episode in the Sanskrit tradition of Aśokāvadāna. There lived in Śrāvastī a merchant who, along with his wife, embarked on a journey across the great ocean. While at sea, his wife gave birth to a son and he was given the name Samudra (Ocean). When, after twelve years, the merchant returned from his travels, he was robbed and killed by five hundred brigands. His son, Samudra, then entered the Buddhist order, and wandering throughout the land he arrived once at Pāṭaliputra. Unknowingly he approached the prison belonged to the Caṇḍragirika, the executioner of Aśoka. The king has given him the right to execute all those who enter here. Samudra was overcome by sorrow and started to cry. Samudra begged for a month’s stay of execution. He was granted seven days, and shuddering with the fear of death, he wrestled with the thought that in a week’s time he would be no more. Early On the seventh day, King Aśoka happened to see one of his concubines conversing with the gazing lovingly at a youth with whom she was enamored. As soon as he saw them together, he became furious and sent them both to the executioner. There they were ground with pestles in an iron mortar until only their bones remained. Samudra was thoroughly shaken by the sight of this event. He applied himself the whole night through to the teaching of the Buddha, he broke the bonds of existence and attained supreme arhatship.

The unmerciful monster Chandragirika, feeling no pity in his heart, threw Samudra into an iron cauldron full of water, human blood, marrow, urine and excrement. He lit a great fire underneath, but even after much firewood had been consumed, the cauldron did not get hot. Once more, he tried to light the fire, but again it would not blaze, He became puzzled, and looking into the pot, he saw the monk seated there, cross-legged on lotus. Straight away, he sent word to King Aśoka. Aśoka came to witness this marvel and thousands of people gathered, and Samudra, seated in the cauldron, and realized that the time for Aśoka’s conversion was at hand.²⁴ Samudra began to generate his supernatural powers. In the presence of the crowd of onlookers, he flew up to the firmament, and wet from the water like a swan, he started to display various magical feats. King astonished and made Anjali. Samudra said “Great King, with reference to you, the Blessed One predicted that one hundred years after his parinirvāṇa there would be in the city of Pāṭaliputra a king named Aśoka, a chakravartin ruling over one of the four continents, a righteous dharmarāja who would distribute his bodily relics far and wide, and build the eighty four thousand dharmarājikās. But instead your majesty has built this

place that resembles a hell and where thousands of living beings have been killed. Your highness, you should give to all beings a promise of security and completely fulfill the wish of the Blessed One.” Then Samudra departed from the place by means of his supernatural powers. We are lucky to encounter a somewhat similar story in *Rājāvalī*. The king Kāvantissa has punished a thēra by putting him in the cauldron of oil in the 2nd Century B.C.E.²⁵ As stipulated in the *Mahāvamsa* and its commentary thēra was slain and thrown into the sea.²⁶

John. S Strong says “There is thus, in the *Mahāvamsa*’s account of Aśoka’s conversion, no reference either to the infernal prison or to a display of supernatural powers, but only to the more common situation of a monk preaching a sermon. Nonetheless it is clear that both Samudra and Nigrodha share the element of personal charisma, and that this is fundamental in effecting Aśoka’s change of heart. In the *Aśokāvadāna*, this charisma manifests itself in the form of miraculous displays, while in the *Mahāvamsa* it is reflected in Nigrodha’s noble and peaceful bearing”.²⁷

IV. PERVERSITY OF LIFE OF AŚOKA

There is another piece of information in *Mahāvamsa*, which contributes some facts about the former life of Emperor Aśoka. Once in the time past there were three brothers, traders of honey. The one was used to sell honey, the two others used to collect the honey. A certain paccekabuddha, who was sick of a wound, and another paccekabuddha, who for his sake wished for honey, came to the city on his usual way of seeking alms. A maiden, who was going for water to the river bank, saw him. She pointed with hand outstretched and said “Yonder is a honey store, sir, go thither”. The trader, with believing heart, gave to the Buddha who came here a bowlful of honey, so that it ran over the edge. As he was the honey filling the bowl and flowing over the edge, and streaming down to the ground, he, full of faith, wished “May I for this gift, come by the undivided sovereignty of Jambudīpa and may my command reach for a yojana (upward) into the air and (downward) under the earth”.²⁸ When the brothers arrived seller of the honey said “A man of such and such a kind I have given honey”. The eldest brother said grudgingly “It was surely a caṇḍāla, for the caṇḍāla, ever clothe themselves in yellow garments”. The second said; “A way with thy paccekabuddha over the sea”. Then the maid who had pointed out the store wished that she might become the royal spouse and a lovely form with limbs of perfect outline. Aśoka was he who gave honey, the queen Asamdhimittā was the maid, Nigrodha he who uttered the word caṇḍāla, King Devānampiyatissa he who had wished him away over the sea. He who uttered the word “caṇḍala” lived in expiation thereof in caṇḍāla village, but because he had desired deliverance, he also, even in the seventh year, attained unto deliverance.

It is interesting to compare the episode of the gift of dirt in the *Aśokāvadāna* with the above story. In the *Aśokāvadāna*, Aśoka in his previous life is no longer portrayed as a trader of

²³ Ibid, 1950, 5:68,31.

²⁴ Strong S. John, 1989: 216.

²⁵ *Rājāvalī*, 1997,176.

²⁶ Peris. M, 2011: 44.

²⁷ Strong S. John, 1989: 76.

²⁸ *M.v*, 1950, 5:55,30.

honey but as a little boy who offered dirt to the Buddha. As mentioned in the *Aśokāvadāna*, when the blessed one was dwelling at Kalandakanivāpa in the Veṅṇavana near Rājagṛaha, he put on his robes, took his bowl, and surrounded by a group of monks and honored by the monastic community, entered Rājagṛaha for alms. The blessed one came to the main road where two little boys were playing at building houses in the dirt. One of them was the son of a very prominent family and was named Jaya, while the other was the son of somewhat less prominent family and was named Vijaya. Both of them saw the Buddha whose appearance is very pleasing, his body adorned with the thirty-two marks of the Great Man. And young Jaya, thinking to himself “I will give him some ground meal,” threw a handful of dirt into the Buddha’s begging bowl. Vijaya approved of this, by making an anjali. After presenting this offering to the Blessed One, Jaya then proceeded to make the following resolute wish “By this root of good merit, I would become king and, after placing the earth under a single umbrella of sovereignty, I would pay homage to the Blessed Buddha.” The Blessed One then displayed his smile. Ānanda thēra asked what made Buddha to smile. The Blessed One said “the boy who threw a handful of dirt into the Tathāgata’s bowl, one hundred years after the Tathāgata’s parinirvāna, will become a king named Aśōka in the city of Pāṭaliputra. He will be righteous dharmarāja, a chakravartin who rules over one of the four continents, and he will distribute my bodily relics far and wide and build the eighty four thousand dharmarājikās. This he will undertake for the well-being of many people.” Then the Blessed One gave all the dirt to the Venerable Ānanda and said; Mix this with some cowdung and spread it on the walkway (caṅkrama) where the Tathāgata walks.” And the Venerable Ānanda did as he was told.

Paul Mus is one of the few scholars who has sought to compare the *Mahāvamsa*’s “gift of honey” with the *Aśokāvadāna*’s “gift of dirt”.²⁹ A John S. Strong has discussed about the gift of dirt and the gift of honey.³⁰ He purports “The story of the gift of dirt was focal point for the feelings of ambiguity about Aśōka. On the one hand it expressed the rudeness of his character, the physicality and roughness of his person and kingship. On the other hand it pointed to this future greatness and to his dedication, as the king of the whole earth, to the Buddha, Dharma, and the sangha.”

V. OTHER MERITORIOUS DEEDS OF AŚŌKA

The *Mahāvamsa* states that the King Aśōka gave alms to sixty thousand bhikkhus.³¹ Having heard the greatness or the content of the dhamma by the Moggaliputta-Tissa thēra, he constructed eighty four thousand vihāras to honour the each of the dhamma. The king himself constructed the Aśokārāma.³² *Mahāvamsa* further says that by the miraculous power of the thēra Indagutta, who watched over the work, the ārāma named after

Aśōka was quickly brought to completion.³³ It further exemplifies on the spots where the Buddha trod, Aśōka himself visited and built beautiful cētiyas.³⁴ He bestowed the hundred thousand pieces of money for the three gem, for Nigrōdha and for the sick each day.³⁵ The King gave the tooth sticks called nāgalatā to the sixty thousand bhikkhus and to sixteen thousand women of the palace.

The legend of Aśōka’s failure to retrieve the relics from the nāgas was to spin a later Sinhalese tradition that those relics had been reserved for enshrinement in the Great Stūpa on the island of Sri Lanka. According to the tale in the *Mahāvamsa*, when Aśōka went to the nāga palace to get the Rāmagrāma relics, he was informed that he could not have them because the Buddha himself had set them aside for King Duṭṭhagāmaṇi of Sri Lanka.³⁶ The story then goes on to relate how the elder Soṇuttara, on Duṭṭhagāmaṇi’s behalf, descends to the nāga palace where he accuses the snake lords of not honouring the Buddha properly, more or less steals the relics from them, and returns with them to Sri Lanka where they are enshrined with great ceremony.³⁷

The divergence between this version of the story and the *Aśokāvadāna*’s reflects, of course, the different orientation of the two texts touched upon in chapter one.³⁸ In the *Aśokāvadāna*, the stress is at least nominally on the value of devotion to the relics, whether it be the devotion of Aśōka or of the nāgas. In the *Mahāvamsa*, on the other hand, the emphasis is on the glory of Sri Lanka and on its possession of some genuine Buddha relics.³⁹ Duṭṭhagāmaṇi is shown to have succeeded where Aśōka had failed. Nevertheless the failure of Aśōka to collect all the relics of the Buddha in the *Aśokāvadāna* highlights once again the less than perfect aspect of Aśōka’s rule. Even in this great deed of gathering the relics, Aśōka encounters certain obstacles that, ideally, he should have been able to overcome, but, in reality, was not.⁴⁰

The same notion is reinforced in Buddhism by stories recounting how the relics miraculously come alive and take on the bodily form (rūpakāya) of the Buddha himself, with all of his physical traits. In the *Mahāvamsa*, for example, when Duṭṭhagāmaṇi is about to enshrine the relics in the Great Stūpa, the casket rises up into the air. It then opens of itself and the relics come up out of it and “taking the form of the Buddha, gleaming with the greater and lesser signs, they performed, even as the Buddha himself.....that miracle of the double appearances that was brought to pass by the Blessed One during the lifetime.”⁴¹ In the *Aśokāvadāna*, we do not find such a spectacular coming alive of the relics, but it is quite clear that in Aśōka’s organized distribution of the relics, an attempt is being made to recapture, to make present, the Buddha’s rūpakāya.⁴²

Aśōka’s son Kunāla is born on the very same day on which King Aśōka built the eighty four thousand dharmarājikās and the Vītaśoka episode occurs shortly after the completion of the eighty four thousand dharmarājikās. The *Mahāvamsa* records that when Aśōka learns that there are eighty four thousand sections of the Dharma he decides to undertake his construction project and

²⁹ Strong S. John, 1989: 67.

³⁰ Ibid, 1989: 66.

³¹ *M.v.*, 1950, 5:75,32.

³² Ibid, 1950, 5:80,33.

³³ Ibid, 1950, 5:174,41.

³⁴ Ibid, 1950, 5:175,41.

³⁵ Ibid, 1950, 5:83,33.

³⁶ *Thūpavamsa*, 2010: 223.

³⁷ Ibid, 2010: 223.

³⁸ Strong S. John, 1989: 113.

³⁹ Ibid, 1989: 113.

⁴⁰ Ibid, 1989: 113.

⁴¹ Ibid, 1989: 116.

⁴² Ibid, 1989: 117.

honour each one of those sections by building a vihāra. By building the eighty four thousand stūpas or vihāras, Aśōka is also symbolically reconstructing the body of the Buddha's teaching on his dharmakāya.⁴³

VI. CAṆḌĀŚŌKA

According to the description given in the *Mahāvamsa* Aśōka was called as Caṇḍāśōka (the wicked Aśōka) in early times, by reason of his evil deeds, afterwards he was known as Dhammāśōka (the pious Aśōka) because of his pious deeds.⁴⁴

VII. CREATION OF THE FIGURE OF BUDDHA

Once the king Aśōka invited the Nāga king Mahākāla to create the figure of Buddha, the Nāga king created beautiful figure of the Buddha endowed with the thirty two greater signs and brilliant with eighty lesser signs.⁴⁵ The king was more uplifted with joy and hence, he kept the great festival called the "feast of the eyes" for seven days.⁴⁶ *Dīpavamsa* remarks only on the presence of the Mahākāla and he has offered flowers to king piyadassi.⁴⁷ There we encounter a resemble story of *Aśokāvadāna* with the above story. Māra takes the form of the Buddha at the request of Upagupta, in both cases, there is a vision of the physical form, the rūpakāya, of the Buddha, although he has achieved the bliss of parinirvāna.⁴⁸

VIII. GENEROSITY TOWARDS THE DOCTRINE OF THE BLESSED ONE

Once King Aśōka asked thēra Moggaliputta, "Whose generosity towards the doctrine of the Blessed one was ever so great?" He replied "Even in the lifetime of the Blessed one there was no generous giver like to thee". When the king heard this he rejoiced yet more and asked; "Is there a kinsman of Buddha's religion like unto me?" Thēra Moggaliputta replied "he who lets son or daughter enter the religious order is a kinsman of the religion and withal a giver of gifts". When king asked Mahinda and Saṅghamittā, they expressed their willingness to get themselves ordained. The king permitted his dear son Mahinda and his daughter Saṅgamittā, to be ordained with all solemnity. The *Vinayaṭṭhakathā* (*Samantapāsādikā*) which is written in Sri Lanka, gives information on the income and the expenditure of the emperor Aśōka. He got the income of four hundred thousand, from the four gates of the *pālalu nuwara*, one hundred thousand from the court which is situated in the middle of the city, five hundred thousand as the other income.⁴⁹ Further, it is explained as to how he spent the five hundred thousand;

1. One hundred thousand for the Nigrōda monk.
2. One hundred thousand to offer the fragrances to the Buddhist stūpa.

3. One hundred thousand for the scholarly Bhikkhus for the four requisites.
4. One hundred thousand for the monks.
5. One hundred thousand for the medicine.

It is further mentioned in the *Vinayaṭṭhakathā* (*Samantapāsādikā*), that emperor Aśōka built 84,000 temples, having spent ninety six million pieces of coins.⁵⁰ These practices of Emperor Aśōka must have set an example for the kings in Sri Lanka to work on the development of the Buddhism.

IX. THE STORY OF KUNTĪ

Mahāvamsa sheds light on the story of Kuntī (wood-nymph). Here it says having heard of the demise of the Tissa thēra, the son of Kuntī, king had made tanks at the city gates and filled them with remedies for the sick.⁵¹

X. PRINCE TISSA (AŚŌKA'S BROTHER) ENTERING THE BROTHERHOOD

The vamsa tradition sheds light on the own brother of King Aśōka. There are two short stories related to him in *Mahāvamsa*. One day the prince Tissa, the own brother of King Aśōka when hunting saw gazelles sporting joyously in the wild. Having seen this he thought; "Even the gazelles sport thus joyously, who feed on grass in the wild. Why not the bhikkhus joys and gay, who have their food and dwelling in comfort? After coming home prince Tissa told King Aśōka, his thought. The king handed over him the government of the kingdom for one week, saying "Enjoy, prince, for one week, my royal state; then will I put thee to death", thus said the ruler. When the week was gone, having seen the pale body of Tissa King asked the reason. Tissa replied, "by the reason of the fear of death". The king spoke again to him and said; "Thinking that thou must die when the week was gone by, thou waste no longer joyous and gay; how then can ascetics be joyous and gay, who think ever upon death? When his brother spoke thus, Tissa was turned toward faith in the doctrine of the Buddha.⁵²

There is another piece of information which contributes some knowledge about Aśōka's brother Tissa. Once prince Tissa was hunting he saw thēra Mahādhammarakkhita, self-controlled, sitting at the foot of a tree, and fanned by an elephant with a branch of a Sāla-tree. Having seen the thēra prince thought "when shall I, like this thēra, be ordained in the religion and live in the forest wilderness?" As well as prince Tissa saw the same thēra flying through the air, standing on the water of the pond in the Aśōkārāma, he leaving his goodly garments behind him in the air, plunged into the water and bathed his limbs. And when the prince saw this marvel he was filled with joyful faith. The prince received the pabbajjā from the thēra Mahādhammarakkhita and with him four hundred thousand persons ordained.⁵³ The nephew of śoka, Aggibrahmma ordained together with the prince.⁵⁴ As stipulated

⁴³ Ibid, 1989: 117.

⁴⁴ M.V, 1950, 5:189,42.

⁴⁵ Ibid, 1950, 5:91,33.

⁴⁶ Ibid, 1950, 5:94,34.

⁴⁷ D.v, 1959, 6:15, 151.

⁴⁸ Strong S. John, 1989: 122.

⁴⁹ *Vina. Att*, 2009:45.

⁵⁰ Ibid, 2009:97.

⁵¹ M.v, 1950, 5:225,45.

⁵² M.v, 1950, 5:154-159, 40.

⁵³ Ibid, 1950, 5:164-168, 40.

⁵⁴ Ibid, 1950, 5:170, 41.

in the *Mahāvamsa*, the prince Tissa's ordination was taken place at the fourth regnal year of Aśōka.

XI. CONCLUSION

In this research I made an attempt to gather historical facts which compiled in vamsa in Sri Lanka. I have identified some similarities in the stories of thēras Nigroda and Samudra. The practices of Emperor Aśōka must have set an example for the kings in Sri Lanka to work on the development of the Buddhism.

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Third Buddhist Council of Emperor Aśoka

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Abstract- In this research article we have focused our attention only to the 3rd Buddhist Council which patronized by Emperor Aśoka. We have not discussed about the previous life of Asoka, his conspiracy to the kingship or war against Kalinga. There is no mention at all either of the thēra Moggaliputata Tissa or of his third council in the Aśokāvadāna. Aśoka's legend is found in the fifth century chronicles of Sri Lanka, the *Dīpavaṃsa* and the *Mahāvāṃsa* as well as in Buddhagohosa's commentary on the Vinaya. In addition to this, the commentary on the *Mahāvāṃsa*, the *Thūpavaṃsa* and the *Bōdhivaṃsa* were studied. The discrepancies in *Mahāvāṃsa* and *Divyāvadāna* has been discussed here.

Index Terms- vams, tradition, patronized, council, Buddhist.

I. THĒRA MOGGALIPUTTA TISSA

A Brahmana Moggali had a son called Tissa. Tissa was well versed with mantras. Tissa's surname was Moggali. Moggaliputta tissa was made pabbja by the Siggava and Chandavajji thēras.¹ At the age of sixteen he mastered the whole Veda.² As mentioned in the *Dīpavaṃsa* in the second year of Chandragupta's coronation, fifty eight of king Pakuṇḍaka having elapsed, Siggava having just completed his sixty fourth year, Moggaliputta received from Thera Siggava the Upasampadā ordination.³ Maury Chandragupta reign from 321 B.C.E to 297 B.C.E.⁴ His second year was 323 B.C.E., and this is the year of thēra Siggava, had completed his 64th year. The King Pakuṇḍaka or Paṇḍukābhaya reign from 437 B.C.E. to 367 B.C.E.⁵ When Pakuṇḍaka was 58 years old thēra Moggaliputta received from thēra Siggava the Upasampada ordination. According to the *Dīpavaṃsa* thēra Moggaliputta has his ordination in the 379 B.C.E. *Dīpavaṃsa* further emphasized that the thēra Moggaliputtatissa learned the Vinaya from thēra Caṇḍavajji.⁶ All the pitakas have been taught to Moggaliputtatissa by thera Siggava and thēra Caṇḍavajji. Thēra Moggali was named as the Chief of the Vinaya by thēra Siggava and attained Nibbāna after having completed seventy six years.⁷ King Chandragutta ruled twenty four years, when he had completed fourteen years, thēra Siggava attained parinibbana.⁸ Most probably thēra Siggava had attained

to parinibbana by the year 307 B.C.E. Once G.P. Malalasekara has mentioned "Ceylon was in possession of continues and written chronicles, rich in authentic facts, not only presenting a connected history of the island itself, but also yielding valuable materials for elucidation that of India." The chronicles in Sri Lanka most of the time have been associated with the authentic dating system. But this is not compatible with the all the time but most.⁹ Thēra Moggali dwelled in a forest. When the King Dhammasoka has completed his eight year of the coronation, the thēra Moggali was 60 years.¹⁰ After Sambuddha had attained parinibbāna following theras taught Vinaya

Thēra Upāli
Thēra Dāsaka
Thēra Sōnaka
Thēra Siggava
Thēra Chandvajji
Thēra Moggaliputtatissa
Thēra Mahinda¹¹

At the twenty sixth regnal year of the king Dhammasoka, thēra Moggaliputta has attained to Nibbana.¹² Tissa Moggaliputta, chief of the vinaya attained Nibbana eighty six years after his upasampada.¹³

II. THE HERETICS AND THEIR UNRULINESS

As the revenues of the brotherhood were exceeding great, those who were converted later privileged it. Hence the heretics who had lost revenue and honour took likewise the yellow robe, for the sake of revenue, and dwelt together with the bhikkhus. They proclaimed their own doctrines as the doctrine of the Buddha and carried out their own practices even as they wished. Under these circumstances thēro Moggaliputta had committed his great company of bhikkhus to the direction of the thēra Mahinda, he took up his abode, all alone, further up the Gangese on the Ahogaṅga Mountain and for seven years he gave himself up to solitary retreat. As *Mahāvāṃsa* further records the great number of the heretics and their unruliness, the bhikkhus could not restrain them by the law; and therefore the bhikkhus in Jambudīpa for seven years held no upōsata ceremony. When the king was aware

¹ D.v, 1992, 5:57, 142.

² Ibid, 1992, 5:61, 143.

³ Ibid, 1992, 5:69, 143.

⁴ https://en.wikipedia.org/wiki/Chandragupta_Maurya

⁵ https://en.wikipedia.org/wiki/Pandukabhaya_of_Anuradhapura

⁶ D.v, 1992, 5: 70, 143.

⁷ D.v, 1992, 5: 72, 144.

⁸ Ibid, 1992, 5: 73, 144.

⁹ Malalasekara, G. P., 1994, 130.

¹⁰ D.v, 1959, 5: 21, 146.

¹¹ Ibid, 1992, 5: 95, 145.

¹² Ibid, 1959, 5: 43, 149.

¹³ Ibid, 1959, 5: 48, 149.

of this, he sent a minister to the Aśōkārāma to settle this matter and let the upōsata festival be carried out by the community of bhikkhus in that ārāma. When the minister asked them to follow the upōsata ceremony bhikkhus refused to hold the upōsata with heretics. Hence the minister stuck off the head of several thēras, one by one with his sword. When the king's brother, Tissa, saw that crime he came speedily and sat on the seat nearest to the minister. When the minister saw the thēra he went to the king and told him the whole matter. When the monarch heard, it he was troubled and went with all speed and asked the community of bhikkhus, greatly disturbed in mind; "who, in truth is guilty of this deed that has been done?" The King wanted to meet a bhikkhu who is able to set his doubts to rest and to befriend religion? The bhikkhu mentioned the Moggali thēra's name and as a result of this king sent the bhikkhus, ministers and the people to invite him restore Buddhism. In the third time when they invited by saying "be our helper venerable sir, to befriend religion", then only he agreed to come. They brought the thēra by ship on the Ganges and the king went to meet him. The king went down knee deep into the water and respectfully gave his right hand to the thēra, as he came down from the ship.¹⁴ As mentioned in the *Mahāvamsa* thēra was accommodated in the pleasure garden called Rativaḍḍana.¹⁵ When the king asked the thēra whether or not he himself shared the guilt of the murder of the bhikkhus by the minister. The thēra taught the king; there is no resulting guilt without evil intent, and he recited the Tittira-Jātaka.

III. THE THIRD BUDDHIST COUNCIL

Mahāvamsa mentions that all the bhikkhus were assembled by sending two yakkas. King seated with the thēra on one side and asked from the bhikkhus "What did the blessed one teach? Those who answered "he teaches the Sāssata doctrine" expelled from the order. Those who answered "he teaches the Vibhajja doctrine" held for the upōsata festival. The number bhikkhus who were expelled were sixty thousand. Thenceforth the brotherhood held the uposata festival. Out of the great number of the brotherhood of bhikkhus the thēra chose a thousand learned bhikkhus, endowed with the six super normal powers, knowing the three piṭakas and versed in the special sciences to make a compilation of the true doctrine. Mahākassapa and thēra yasa had held the council. In the midst of this council the thēra Tissa set forth the *Kathāvattuppakarāṇa*. This council was held under the protection of King Aśōka at the Aśōkarāma, ended by the thousand bhikkhus in nine months. *Mahāvamsa* says the seventeenth year of the king's reign the wise thēra who was seventy two years old closed the council with a great pavārana ceremony.¹⁶ *Dīpavamsa* records that the wise Moggaliputta, the destroyer of the schismatic doctrines, firmly established the Theravada and held the third council, having destroyed the different doctrines and subdued many shameless people and

restored splendor to the faith, he proclaimed *Kathāvattuppakarāṇa*.¹⁷ The thēra Moggaliputtatissa taught Pasmahasagiya (Five Nikāyas)
Saptaprakarana (seven sections of Abhidharmma)
Ubhatovibhaṅga (two vibhaṅgas of the Vinaya)
Parivārapāli
Kaṇḍaka¹⁸

One of the important stories in the *Mahāvamsa* that is absent in the *Aśōkāvadāna* tells how Aśōka convenes and participates in the Third Buddhist council at Pāṭaliputra. John S. Strong says that the whole thrust of this account is to associate the great King Aśōka with the specific sect of the Theravādins favoured by the authors of the *Mahāvamsa* and, by implication, by the island of Sri Lanka in general.¹⁹ In the *Aśōkāvadāna* however, there is no mention at all either of the elder Moggaliputta Tissa or of this Third Council. The L. A. Waddell is trying to identify the high priest of Upagupta with Moggaliputta.²⁰ Jone S. Strong's point of view is that there are difficulties with this parallelism.²¹ Following the account of the Third Council in the *Mahāvamsa*, there is another episode that does not figure at tall in the *Aśōkāvadāna* the dispatch of missionaries to spread the Buddhist faith.

"The converting of different countries" the twelfth chapter of the *Mahāvamsa* contains the nine adjacent countries which sent the dhamma after the Buddhist council of the third. Those countries and the thēras as follows.²²

thēra Majjhantika sent to Kasmīra and Gandhāra
thēra Mahādeva sent to Mahisamaṇḍala
thēra Rakkhita sent to Vanavāsa
thēra Yōnka Dharmarakṣita sent to Aparantaka
thēra Mahādhammarakkita sent to Mahārāṭṭha
thēra Mahārakkhita sent to Yōna
thēra Majjhima sent to Himalaya
thēras Sōṇa and Uttara sent to Suvanṇabhūmi
thēra Mahinda sent to Taṃbaparṇṇi

Buddhism spread more rapidly in Sri Lanka, than in the Northern countries.²³

The episode of dispatching the missionaries to the above countries can be testified with archaeology. The relics of some of the thēras mentioned in the *Mahāvamsa* have been unearthed by archaeologists at Sānchī. B.M. Barua says, that Buddhists are eager to show, Aśōka's adherence to their religion. We should not, therefore, take them seriously since they are nothing but the "mendacious fictions of unscrupulous monks."²⁴

IV. KING DEVĀNAMPIYATISSA AND THE EMPEROR AŚŌKA

King Devānampiyatissa became the king after his father's death. At the time of his consecration many wonders have happened. As mentioned in the *Mahāvamsa* treasures and jewels of the whole island of Lanka, that had been buried deep rose up to the surface of the earth owing to the meritorious effects of king.

¹⁴ M.v, 1950, 5:250-256, 47.

¹⁵ Ibid, 1950, 5:257, 48.

¹⁶ M.v, 1950, 5:280, 50.

¹⁷ D.v, 1992, 7: 40-41, 157.

¹⁸ Ibid, 1992, 7: 43, 157.

¹⁹ Strong S. John, 1989: 24.

²⁰ Waddell, L. A, 1899: 70-75.

²¹ Strong S. John, 1989: 24.

²² M.v, 1950, 12: 2-7, 82. *Pōjāvālī*, 1999: 759-760.

²³ Vajirapani. D.G.O 1966: 395.

²⁴ Barua, B. M, 1968: vol. I, 2-3, & Strong S. John, 1989: 14-15.

Having seen the treasures the king in Sri Lanka thought of sending them to king Dhammāsoka. As reported in the vaṃsa tradition Devānampiyatissa and Dhammāsoka had already been friends for a long time, though they had never seen each other.²⁵ The king in Sri Lanka, four persons appointed as his envoys; his nephew Mahāritṭha, a Brahman, a minister and an account. The priceless jewels, the three kinds of precious stones, and the three stems (like) wagon-poles, a spiral shell winding to the right, the eight kinds of pearls were gifted by these envoys.²⁶ The *Mahāvamsa* refers to eight kinds of pearls, presented to the Emperor Aśoka by the King Dēvānampiyatissa (circa 250-210 B.C.E.). The eight kinds of pearls are horse-pearl, elephant-pearl, waggon-pearl, myrobalan pearl, bracelet pearl, ring pearl, kakūḍha fruit pearl and common pearl. The Pāli literature *Abhidhānappadīpikā* also reports that, these eight types of pearl as quoted in *Mahāvamsa*.²⁷ Devaraj and Ravichandran say about one million chanks of different varieties are collected each year in the Gulf of Mannar region in recent years.²⁸

At the beginning of the second rock edict, Aśoka refers to the border people such as the Cōlas, the Paṇḍyas, the Satiyaputras and the Kēralaputras and Tāmraparṇi.²⁹ Tāmraparṇi has been generally identified with Sri Lanka, rather than with the river "Tāmraparṇi".³⁰ It is with the emergence of the Mauryas in the third century B.C.E. and particularly with the reign of King Aśoka that there is definitive reference to the development of maritime routes.³¹ Under the Mauryas this coastal network was expanded all along the coast to include Sri Lanka and it was through the sea route that Dhamma missions, reached Sri Lanka, even before the voyage of Mahinda (13th rock edict).

The envoys embarked at the Jambukola in seven days and thence in another seven days taken to reach the Pāṭaliputta. As mentioned in the *Mahāvamsa* envoys gave those gifts into the hands of king Dhammāsoka. As further mentioned, the monarch, in his joy bestowed on Ariṭṭha the rank of commander in his army, the dignity of chaplain on the Brahmana, the rank of staff bearer on the minister, and the guild lordship on the treasurer.³² The question that would naturally arise is why, King Aśoka bestowed the ranks to these four envoys? What is the authority that he had? Although the vaṃsa tradition gives evidence on political institutions in early Sri Lanka (before the 3rd Century B.C.E) this cannot be testified. In a way this symbolized introduction of the political institutions to Sri Lanka by the emperor in India. King Aśoka has sent everything needed for the consecration of a king. As elaborates in the *Mahāvamsa* a fan, a diadem, a sword, a parasol, shoes, a turban, ear ornaments, chains, a pitcher, yellow sandalwood, as set of garments that had no need of cleansing, a costly napkin, unguent brought by the nags, red coloured earth, water from the lake Anotatta and also water from the Ganges, a shell winding in suspicious wise, a maiden in the flower of her

youth, utensils as golden platters, as costly litter, yellow and embolic myrobalans and precious ambrosial healing herbs, sixty times one hundred wagon loads of mountain rice brought thither by parrots, nay all that was needful for consecrating a king was sent by the emperor by the king in Sri Lanka.³³ This consecration ceremony symbolized the transition of local leadership to the kingship in Sri Lanka. The kings in Sri Lanka did not have a proper coronation before this. This might be the reason for the request behind the second consecration for the king Tissa.

Aśoka sent the gift of the true doctrine by saying "I have taken refuge in the Buddha, his doctrine and his order; I have declared myself a lay disciple in the religion of the Sakya son, seek then even thou."³⁴ The envoys stayed seven months in India and having embarked at Tāmalitī landed at Jambukōla, arrived Lanka on the twelfth day. The ruler of Lanka consecrated for the second time by the envoys. The *Mahāvamsa* denotes that king Tissa used the name of the "friend of the god" (Devanpiya).³⁵

V. BŌDI TREE

As mentioned in the *Mahāvamsa* following the counsel of the Aśoka's minister Mahādeva,³⁶ had invited the community of bhikkhus and asked whether the great Bodhi tree be sent to Laṅka. The *Mahāvamsa* noted that thēra Moggaliputta answered "It shall be sent thither, as five great resolutions that the Buddha gifted." When king Aśoka having heard this, he was glad and had ordered to clean the road, seven yojanas long, leading to the great Bodhi tree.³⁷ And also he brought the gold to make a vasa to plant the Bodhi tree which is going to be sent to Sri Lanka. *Mahāvamsa* denotes that Vissakamma who appeared in the semblance of a goldsmith, having moulded gold with his hand made a vase in that very moment and departed. The *Mahāvamsa* further says that the measuring of the vase is nine cubits around and five cubits in depth and the three cubits across, being eight finger-breadths thick, having upper edge of the size of young elephant's trunk, being equal to the young (morning) sun.³⁸ There is similar description in *Bōdhivamsa* to the above.³⁹ The eighteenth chapter, the receiving of the great Bodhi tree further says that having seen the miracle of the Bodhi tree, the way that the king Aśoka worshiped the great Bodhi tree by bestowing kingship, consecrating the great Bodhi tree the king of his great realm thrice.

VI. PLANTING THE BODI TREE IN THE VASE

This incident has been depicted quite miraculously in the vaṃsa tradition. As reported in the vaṃsa, great Bōdi tree departed the southern branch itself and with thousand roots planted in the vase.⁴⁰ It is ten cubit height. Five branches extended to four cubits.

²⁵ *M.v.*, 1950, 11:19, 78.

²⁶ *Ibid.*, 1950, 11:22, 78.

²⁷ Childers 1976: 1061.

²⁸ Devaraj, M. and Ravichandran, V., 1991: 102.

²⁹ Bellana, N 2000: 31.

³⁰ Ray, H.P. 1994: 22.

³¹ *Ibid.* 1994: 21.

³² *M.v.*, 1950, 11: 23-24,79.

³³ *Ibid.*, 1950, 11: 27-32,79.

³⁴ *Ibid.*, 1950, 11: 34, 80.

³⁵ *M.v.*, 1950, 11: 42, 81.

³⁶ *Bodi.v.*, 1999, 188.

³⁷ *M.v.* 1950, 18: 23, 124.

³⁸ *Ibid.* 1950, 18:29,125.

³⁹ *Bodi.v.*, 1999, 189.

⁴⁰ *Ibid.*, 1999, 191.

It consisted of thousand small branches.⁴¹ Bōdi tree disappeared seven days, among the clouds. The vamsa tradition attempts to portrait this miraculously. The king Aśōka had anxiously waited for seven days to see the Bōdi tree. King has arranged many Bōdi Pujā ceremonies with the consort of Asandimittā and twelve thousand city women.⁴²

VII. CONSORTS OF THE KING

The Bōdhi tree was planted at the Mahāmeghavanārāma in the eighteenth regnal year of the Dhammāśōka.⁴³ Afterwards, the dear consort of the king, Asandhimittā died.⁴⁴ She is a faithful believer in Buddhism. The king raised the treacherous Tissarakkhā to the rank of queen in the fourth year after this. Tissarakkhā being jealous of the king's fondness of the Bodhi tree, destroyed it with Madu-thorn.⁴⁵ The king fall into the power of mortality in the fourth year after this. It was his thirty seventh regnal year.⁴⁶ The Aśōkāvādāna depicts a quite similar story to the above. Aśōka's faith was aroused by the Bōdhi tree, as that was where the Blessed one had realized complete unsurpassed enlightenment. He therefore sent to the place of Bōdhi an offering of the most precious jewels which made Aśōka's chief queen Tiṣṣarakṣitā annoyed.

John S. Strong has shown the basic difference in outlook between the Mahāvamsa and the Aśōkāvādāna as follows. "The dissimilarity in their world view resulted not only in their emphasis on different stories about Aśōka, it also led to radically different treatment of one and the same legend. For example he mentions both texts related the story of Aśōka's wicked queen, Tiṣṣarakṣitā (Pāli, Tissarakkhā) and her use of black magic on the Bōdhi tree at Bodhgaya. In the *Mahāvamsa*, she seeks to injure the tree soon after Aśōka sends one of its branches to Sri Lanka for transplanting, and her endeavor meets with success when the original tree withers and dies. The implication is, of course clear: Sri Lanka is now in the sole possession of the living tree of the enlightenment; what has died in India still thrives on the island. In the Aśōkāvādāna, however, Tiṣṣarakṣitā is not successful. She does not carry through with her plan, and the Bodhi tree, instead of perishing, recovers through Aśōka's devoted care.

VIII. CONCLUSION

Aśōka patronized the third Buddhist council which was held at the Ptaliputa. Mahinda thēra, one of his sons, and the daughter therī Saṃghamittā played a significant role introducing the Buddhism and the order of nuns to Sri Lanka. As a symbol of Maury Empire, Saṃghamittā arrived with the branch of the Bōdhi tree. It is well-known that Sri Lanka was one of the few countries in the world where Buddhism has been practised without interruption from the time of its introduction to the present day. The honorific term Devānampiyā was also conferred by Aśōka as an imperial honour upon the king of Sri Lanka, whose name was

only Tissa. No king in Sri Lanka before Devānampiyatissa seems to have used this prefix.

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The Political Risk Effects On Foreign Direct Investment: Lebanese Case

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Abstract- It examined and identified some political risks indicators (Government effectiveness, Political Stability and Absence of Violence, Control of Corruption, Law & Order, Regulatory Quality and Accountability and voice) that exist in Lebanon and may affect the investment decision of foreign investors. Empirical study for the Lebanese political risks and the inflow of FDI to this country was performed where the quantitative secondary data was collected for span between 2002 and 2016. For this job, a systematic approach of variable analysis and panel regression approach combined with factor analysis were used to test which political risk factor significantly affect the FDI inflow in Lebanon. The results were tested through ANOVA test with 0.05 significance. The results showed that corruption and law and order are the main factors that significantly predict the FDI inflow in Lebanon as well as the GDP per capita and the economy openness. At the end, it is recommended for the Lebanese government and Ministry of Economy and Trade in Lebanon to work on controlling corruption and the law and order should be improved through governance and control plans to shift the negative perception of foreign investors and build up good reputations about Lebanon as a host country.

Index Terms- Foreign direct investment, Politics, stability, GDP, Corruption, Government effectiveness, Law and orders.

I. INTRODUCTION

However, Lebanon enjoys an attractive investment environment with diversified industry and liberal economy his economy faced various political instabilities and violence which lead to different stagnations. Since 1990 when Lebanon faced the civil war, the Lebanese government tried to rebuild the country through attracting multinational companies to invest in Lebanon. In 1994, the General Office of Investment Promotion (IDAL) was established to provide some bureaucratic initiatives in order to attract and rise the FDI to the country. In 2001, IDAL Investment Law Number 360 was generated to state investment opportunities and incentives in different sectors for both local and foreign investors. The Lebanese government support law 360 by tax exemptions, and providing fiscal incentives. Between 2005 and 2009 tourism and real estate sectors were significant components of the country's economy. Moreover, the banking and finance sector was the key sector for growth levels in this period. Additionally, the free economic system in Lebanon and the effective banking system attract the global foreign investments to Lebanon. The FDI inflows increases in this period for about

\$2.6Bn in 2005 to double it \$4.8Bn in 2009. The crisis that the MENA countries faced in 2007 do not prevent the Lebanese and Arab investors from moving money to Lebanon to invest in the property market.

The global financial crisis and regional conflicts in 2011 influenced the FDI inflow to Lebanon mainly in the real estate sector where the GCC countries reduce their investments which lead to decline the FDI inflow by about 25.2% between 2010 and 2011 to be \$3.2Bn. The regional political volatility and tension and the internal political paralysis affected directly the Lebanese economy which was based on real estate, services and constructions. According to the ministry of Economy & Trade, 55 multinational companies including three U.S. companies, launched new branches in Lebanon where the foreign companies in Lebanon (year 2013) are distributed as 48.7% share of the new location, 26.5% for the new co-location and 24.8% for the expansion companies. The trade/retail, tourism and services sectors are the most investment sectors for the multinational companies (60% of the total investment projects). These companies choose Lebanon as a market for their products (pharmaceutical & chemical, machinery and equipment...etc.). Otherwise, the foreign companies invest different services branches including the financial consultant, transportation, education and research and healthcare. Also, they invest in hotels, media, information technology and telecommunication. Most of these investors were from Europe (45%) at the time the Arab companies decreases their investments in Lebanon. (IDAL, 2013). Additionally, the FDI inflows continue declining in 2014 by over 25% y-o-y. Meanwhile the Lebanese government was unable to recover the economy through new reforms at the time corruption is pervasive.

The internal political system in Lebanon is still facing paralysis especially due to the Islamic States fighters. This paralysis weakens the foreign direct investors' confidence in investing in Lebanon. Since May 2014, when Lebanon was without president and the parliament failed to make elections from June 2013 till 2017. This period was full with incursions by the Islamic State terrorist group. Lebanon faced bad economic performance due to tensions that threaten new investments in the country.

In 2015 many heightened tensions threaten foreign investors activity in Lebanon especially due to the geopolitical division between Iran which give military support for Hezbollah and Saudi Arabia which provide financial support for the Lebanese army cause a political split in Lebanon as well as the Syrian conflict do. Nonetheless, the postponed parliamentary

elections from June 2013 until 2017 creates a political turmoil in the country that lead in a way to slowing down the economy in the country despite the FDI remains the main component of the GDP. Due to the big importance and role that FDI play in the GDP, the Lebanese government made 54 bilateral agreements as a way to protect the foreign investors and provide them with a favorable investment environment and about 32 tax conventions that promote the capital inflow. The government provide these investors with security as well as equality in treatment and non-discriminable dealing.

FDI Key Players:

- 1- The General Office of Investment Promotion (IDAL): that play a critical role in rising the FDI level in Lebanon by attracting and facilitating foreign and local investments to Lebanon by offering incentives (Import Duty exemptions and VAT) and investment opportunities depending on up to date statistics and studies. IDAL provide administrative and legal advice to support these investors.
- 2- The Lebanese economic system which maintain free exchange and favorable tax climate compared with most of the MENA region countries. The government provide tax breaks that contribute to rise the capital inflow to Lebanon. The Investment Development Authority of Lebanon with the government has passed the Investment Law 360 in 1994 that aim to stimulate investment activities to Lebanon which as implemented in 2001 as well as various laws to attract these investments. Despite the political paralysis that occur in the country, the government commit in providing a safe business climate.
- 3- The Package Deal Contract (PDC) scheme: give different fiscal and labor incentives.

Research Hypothesis

HI₀. The investment decision of the multinational companies is significantly influenced by political risk indicators.

HI₁. Political risks negatively affect the FDI.

HI₂. Lebanese market has a major political factors that is affecting the FDI in Lebanon

II. RESEARCH METHODOLOGY

Few studies have been conducted based on the impact of political risk on the FDI inflows in Lebanon as a host country. This study is conducted for many goals in mind. First, to examine and

identify some political risks indicators (internal-external conflict, corruption, government effectiveness, religious and ethnic tensions, investment profile, civil violence, effectiveness of the government in the management of the country, terrorist attacks, quality of institutions, democratic accountability of the government, law and orders, socio-economic conditions) that exist in Lebanon and that may affect the investment decision of foreign investors. This study aims to capture the impact of political risks on the FDI inflow in Lebanon as a host country which is an important monitor of the economic growth in the country. According to the findings the hypotheses are tested to indicate whether the investment decision of the multinational companies is significantly influenced by political risk indicators. The results from this research will stimulate a financial discussion concerning the factors and criteria that affects foreign investors investment decision making process by finding the political components that mostly impact this process.

Description of variables and data:

Source of Data:

The data sources are provided by the World Bank reports and country data published by the Lebanese Ministry of Finance, Lebanese Ministry of Economy and Banque du Liban(BDL). It was supported and verified by comparing the data collected with reports and articles issued by local economic and finance institutions such as: Audi Bank, BLOM Bank and Byblos Bank.

Definitions of variables:

We consider the FDI inflows in the unit millions of dollar as a unique dependent variable. Moreover, different important control independent variables of the FDI in Lebanon were used: political risk, GDP per capita and openness of the economy. After that, other variables have been included in the study as political risk components such as: Government effectiveness, Political Stability and Absence of Violence, Control of Corruption, Law & Order, Regulatory Quality and Accountability and voice.

a. GDP per capita: since, theoretically, the year that holds the largest market size and GDP per capita, the more profits gained in this year by foreign investors and thus the higher FDI.

b. Openness of the economy: is denoted by the amount of exports and imports over GDP per capita.

The equation used in this study is algebraically expressed as follows:

$$FDI_t = \alpha + \beta_1 GDP_t + \beta_2 Openness_t + \beta_3 PRS_{kt} + e_t$$

Where t is the year and the table below can explain the variables used:

| Code | Variable | Description |
|---|--|--|
| FDI | Logarithm of Foreign direct investment net inflows (BoP, current US\$) | Foreign direct investment refers to direct investment equity flows in the reporting economy. It is the sum of equity capital, reinvestment of earnings, and other capital. Direct investment is a category of cross-border investment associated with a resident in one economy having control or a significant degree of influence on the management of an enterprise that is resident in another economy. Ownership of 10 percent or more of the ordinary shares of voting stock is the criterion for determining the existence of a direct investment relationship. Data are in current U.S. dollars (The World Bank, 2017) |
| GDPP | Logarithm of GDP per capita measured in current US\$ | This term measures the ratio of the nominal GDP over the population. (The PRS Group) |
| Openness | Openness of the economy | the amount of exports and imports over GDP per capita. |
| PRS_k | Logarithm of the Political Risk Component k of Lebanon | k refers to one of six political components: Government Effectiveness, Political Stability and Absence of Violence/Terrorist, Control of Corruption, Regulatory Quality, Law & Order and Voice and Accountability. |
| e | Estimated errors | |
| β₁, β₂ and β₃ | Coefficients | |

Table 1: Variables Description

Thus the equation will be in this form:

$$FDI_t = \alpha + \beta_1 GDPP_t + \beta_2 Openness_t + \beta_3 PRSGE_t + \beta_4 PRSCC_t + \beta_5 PRSLO_t + \beta_6 PRSAV_t + \beta_7 PRSPS_t + \beta_8 PRSRQ_t + e_t$$

Where the table below can explain the variables used:

| Code | Variable | Description |
|--------------|--------------------------|---|
| PRSGE | Government Effectiveness | The index of Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. (The World Bank, 2018) |
| PRSCC | Control of Corruption | The index for Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as capture of the state by elites and private interests (The World Bank, 2018) |

| | | |
|---|---|---|
| PRSLO | Law & Order | The index for Rule of Law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence (The World Bank, 2018) |
| PRSAV | Accountability and Voice | The index for Voice and Accountability captures perceptions of the extent to which the citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. (The World Bank, 2018) |
| PRSPS | Political Stability and Absence of Violence/Terrorist | The index of Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism. The index is an average of several other indexes from the Economist Intelligence Unit, the World Economic Forum, and the Political Risk Services, among others. (The World Bank, 2018) |
| PRSRQ | Regulatory Quality | The index of Regulatory Quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. (The World Bank, 2018) |
| $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \text{ and } \beta_8$ | Coefficients | |

Table 2: Political Variables' Description

In this equation we would be measuring the effect of each independent variable as one unit on the changes on the value of FDI.

Since the study examines a Lebanon data over a span of time, panel data is a more appropriate methodology for the study.

Data analysis methods:

The method employed to get answers for the research question was panel regression approach combined with factor analysis as a way to test which component of political risk affect more the deterring FDI inflow in Lebanon.

We choose simple OLS regression method for analyzing the effect of each variable on the FDI variable. This technique for estimation is applied using SPSS software where the results were tested through ANOVA test with 0.05 significance level (confidence level 95%) that aims to show the real and consistent effect of the control variables from one side and the FDI on the other side. This technique allows us to test the binding levels among the variables and to test the power of the suggested model. The results extracted from the regression tables will allow us to reject or fail to reject the null hypothesis at 0.05 level.

III. FINDINGS AND RESULTS

1. DATA ANALYSIS METHOD

1.1. Collected Data:

The following table includes all the needed data for the analysis:

| Index | Year | | | | | | | | | | | | | | |
|--|-------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| Foreign direct investment, net inflows (BoP, current US\$) (unique dependent variable) | 1335970000 | 2860020313 | 1898780570 | 2623502612 | 2674534372 | 3375980758 | 4333045470 | 4803602660 | 4279880835 | 3137050288 | 3111318172 | 2661096474 | 2907118548 | 2353206729 | 2610181957 |
| GDP per capita (PPP)(IDV) | 5436.595223 | 5425.66907 | 5424.22356 | 5339.441291 | 5372.065899 | 6014.271115 | 7109.466413 | 8480.945504 | 8858.283977 | 8734.189185 | 8922.896752 | 8721.254215 | 8536.682494 | 8452.443641 | 8257.294391 |
| Openness of the economy index(IDV) | 58.9 | 57.9 | 58.78571429 | 56.98571429 | 57.42857143 | 59.48571429 | 57.4 | 57.18571429 | 59.48571429 | 61.1 | 60.27142857 | 59.64285714 | 59.64285714 | 59.14285714 | 59.28571429 |
| Government effectiveness(IDV) | -0.29 | -0.21 | -0.26 | -0.19 | -0.26 | -0.33 | -0.42 | -0.47 | -0.28 | -0.27 | -0.35 | -0.4 | -0.38 | -0.47 | -0.53 |
| Control of corruption(IDV) | -0.48 | -0.67 | -0.66 | -0.53 | -0.94 | -0.89 | -0.82 | -0.83 | -0.88 | -0.9 | -0.87 | -0.92 | -1.04 | -0.88 | -0.97 |
| Rule and Order(IDV) | 29.33 | 29.5 | 29.65 | 29.51 | 29.15 | 29.04 | 29.08 | 29.27 | 29.34 | 24.25 | 24.13 | 19.14 | 18.98 | 18.88 | 18.8 |

e= error term

b1, b2, and b3 ... bi are the regression parameters

In standardized form:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8$$

Noting that X3, X4, X5, X6, X7, X8 are the elements of the Political risk as shown in the following table:

Political Risk Elements

| political risk | PRSk |
|---|------------|
| Government Effectiveness | PRSGE (X3) |
| Control of Corruption | PRSCC (X4) |
| Law & Order | PRSLO (X5) |
| Accountability and Voice | PRSAV (X6) |
| Political Stability and Absence of Violence/Terrorist | PRSPS (X7) |
| Regulatory Quality | PRSRQ (X8) |

Table 4: Political Risk Elements

Before Testing

Before we start our test, we are going to test simple regression for each separate independent variable and its effect on the FDI. If the selected variable is important, then we consider it in the global model, else, we are going to omit it from the system.

Significance level

We test the hypothesis at a significance level $\alpha = 0.05$ (5%)

Rejection region

Reject the null hypothesis if $p\text{-value} \leq 0.05$ and conclude significance with alternative hypothesis

FACT FINDING RESULTS

Model Analysis

Statistical summary

Table 1: Descriptive statistics of the variables

Model Descriptive Statistics

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|----|-------------|-------------|---------------|----------------|
| FDI inflows | 15 | 1335970000 | 4803602660 | 3.00E9 | 9.174E8 |
| GDP per capita | 15 | 5339.4413 | 8922.8968 | 7272.381515 | 1559.5345289 |
| openness of the economy | 15 | 56.98571429 | 61.10000000 | 58.8428571440 | 1.21598920025 |
| Government Effectiveness | 15 | -.53 | -.19 | -.3407 | .10173 |
| Control of Corruption | 15 | -1.04 | -.48 | -.8187 | .16128 |
| Law & Order | 15 | 18.80 | 29.65 | 25.8700 | 4.66492 |
| Accountability and Voice | 15 | -.66 | -.28 | -.4260 | .08887 |
| Political Stability and Absence of Violence/Terrorist | 15 | -2.12 | -.36 | -1.4267 | .53244 |
| Regulatory Quality | 15 | -.36 | .05 | -.1720 | .11876 |
| Valid N (list-wise) | 15 | | | | |

The above table summarizes all variables on focus with number of observation, the minimum, maximum, mean and standard deviation of each variable.

Correlation matrix of independent variables

The sig value in the table below represents the significance of the relation. At $\alpha = 0.05$ (5%), if $\text{sig} < 0.05$, Then the relation is important.

The table below shows correlation between variables and their importance:

Correlations

| | | GDP per capita | openness of the economy | Government Effectiveness | Control of Corruption | Law & Order | Accountability and Voice | Political Stability and Absence of Violence/Terrorist | Regulatory Quality |
|---|---------------------|----------------|-------------------------|--------------------------|-----------------------|-------------|--------------------------|---|--------------------|
| GDP per capita | Pearson Correlation | 1 | .568* | -.619* | -.679** | -.659** | .247 | -.556* | .282 |
| | Sig. (2-tailed) | | .027 | .014 | .005 | .008 | .376 | .031 | .309 |
| | N | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| openness of the economy | Pearson Correlation | .568* | 1 | -.115 | -.422 | -.543* | -.168 | -.226 | .090 |
| | Sig. (2-tailed) | .027 | | .683 | .117 | .037 | .550 | .418 | .749 |
| | N | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| Government Effectiveness | Pearson Correlation | -.619* | -.115 | 1 | .549* | .622* | .197 | .507 | .349 |
| | Sig. (2-tailed) | .014 | .683 | | .034 | .013 | .481 | .054 | .203 |
| | N | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| Control of Corruption | Pearson Correlation | -.679** | -.422 | .549* | 1 | .608* | -.221 | .831** | -.049 |
| | Sig. (2-tailed) | .005 | .117 | .034 | | .016 | .428 | .000 | .862 |
| | N | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| Law & Order | Pearson Correlation | -.659** | -.543* | .622* | .608* | 1 | .115 | .360 | .273 |
| | Sig. (2-tailed) | .008 | .037 | .013 | .016 | | .682 | .187 | .325 |
| | N | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| Accountability and Voice | Pearson Correlation | .247 | -.168 | .197 | -.221 | .115 | 1 | -.380 | .691** |
| | Sig. (2-tailed) | .376 | .550 | .481 | .428 | .682 | | .162 | .004 |
| | N | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| Political Stability and Absence of Violence/Terrorist | Pearson Correlation | -.556* | -.226 | .507 | .831** | .360 | -.380 | 1 | -.003 |
| | Sig. (2-tailed) | .031 | .418 | .054 | .000 | .187 | .162 | | .992 |
| | N | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| Regulatory Quality | Pearson Correlation | .282 | .090 | .349 | -.049 | .273 | .691** | -.003 | 1 |
| | Sig. (2-tailed) | .309 | .749 | .203 | .862 | .325 | .004 | .992 | |
| | N | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Table 6: Correlations

Regression results analysis**Variables Entered/Removed^b**

| Model | Variables Entered | Variables Removed | Method |
|-------|--|--|---|
| 1 | X8 = Regulatory Quality, X7 = Political Stability and Absence of Violence/Terrorist, X2 = openness of the economy, X3 = Government Effectiveness, X5 = Law & Order, X4 = Control of Corruption, X6 = Accountability and Voice, X1 = GDP per capita | . | Enter |
| 2 | . | X3 = Government Effectiveness | Backward (criterion: Probability of F-to-remove \geq .100). |
| 3 | . | X8 = Regulatory Quality | Backward (criterion: Probability of F-to-remove \geq .100). |
| 4 | . | X6 = Accountability and Voice | Backward (criterion: Probability of F-to-remove \geq .100). |
| 5 | . | X7 = Political Stability and Absence of Violence/Terrorist | Backward (criterion: Probability of F-to-remove \geq .100). |

a. All requested variables entered.

b. Dependent Variable: Y = FDI inflows

Table 2: Regression results analysis

In backward selection, SPSS enters all the predictor variables into the model. The weakest predictor variable is then removed and the regression re-calculated. If this significantly weakens the model then the predictor, variable is re-entered – otherwise it is deleted. This procedure is then repeated until only useful predictor Variables remain in the model.

Model Summary

Model Summary^f

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
|-------|-------------------|----------|-------------------|----------------------------|---------------|
| 1 | .947 ^a | .898 | .761 | 4.483E8 | |
| 2 | .947 ^b | .898 | .795 | 4.151E8 | |
| 3 | .947 ^c | .897 | .820 | 3.891E8 | |
| 4 | .947 ^d | .897 | .840 | 3.670E8 | |
| 5 | .942 ^e | .888 | .843 | 3.633E8 | 2.930 |

- a. Predictors: (Constant), X8 = Regulatory Quality, X7 = Political Stability and Absence of Violence/Terrorist, X2 = openness of the economy, X3 = Government Effectiveness, X5 = Law & Order, X4 = Control of Corruption, X6 = Accountability and Voice, X1 = GDP per capita
- b. Predictors: (Constant), X8 = Regulatory Quality, X7 = Political Stability and Absence of Violence/Terrorist, X2 = openness of the economy, X5 = Law & Order, X4 = Control of Corruption, X6 = Accountability and Voice, X1 = GDP per capita
- c. Predictors: (Constant), X7 = Political Stability and Absence of Violence/Terrorist, X2 = openness of the economy, X5 = Law & Order, X4 = Control of Corruption, X6 = Accountability and Voice, X1 = GDP per capita
- d. Predictors: (Constant), X7 = Political Stability and Absence of Violence/Terrorist, X2 = openness of the economy, X5 = Law & Order, X4 = Control of Corruption, X1 = GDP per capita
- e. Predictors: (Constant), X2 = openness of the economy, X5 = Law & Order, X4 = Control of Corruption, X1 = GDP per capita
- f. Dependent Variable: Y = FDI inflows

Table 3: Model Summary

The model summary contains five models:

Model 1 refers to the first stage in the multiple regressions when all variables (X1 to X8) are used as predictors.

In **Model 2**, X3 was omitted.

In **Model 3**, X8 was omitted.

In **Model 4**, X6 was omitted.

In **Model 5**, X7 was omitted.

In the column labeled R are the values of the multiple correlation coefficients between the predictors and the outcome. The next column gives us a value of R², which is a measure of how much of the variability in the outcome is accounted for by the predictors. For the first model its value is 0.898, which means that:

1. All variables (X1 to X8) accounts for 89.8% of the variation in the Investment value. However, for the final model (model 5), this value decreases to 0.888 or 88.8% of the variance in Investment value.
2. The Adjusted R Square value tells us that our model accounts for 84.3% of variance in the FDI – a very good model!

Finally, the Durbin-Watson statistic (found in the last column), informs us about whether the assumption of *independent errors is tenable*. The closer to 2 that the value is, the better. For these data, the value is 2.930, which is so close to 2 that the assumption has almost certainly been met knowing that Durbin-Watson is usually between 0 and 4.

NOVA Table

In ANOVA we are trying to determine how much of the variance is accounted for by our manipulation of the independent variables (relative to the percentage of the variance we cannot account for).

ANOVA^f

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|-------|------------|----------------|----|-------------|--------|-------------------|
| 1 | Regression | 1.058E19 | 8 | 1.322E18 | 6.578 | .017 ^a |
| | Residual | 1.206E18 | 6 | 2.010E17 | | |
| | Total | 1.178E19 | 14 | | | |
| 2 | Regression | 1.058E19 | 7 | 1.511E18 | 8.770 | .005 ^b |
| | Residual | 1.206E18 | 7 | 1.723E17 | | |
| | Total | 1.178E19 | 14 | | | |
| 3 | Regression | 1.057E19 | 6 | 1.762E18 | 11.639 | .001 ^c |
| | Residual | 1.211E18 | 8 | 1.514E17 | | |
| | Total | 1.178E19 | 14 | | | |
| 4 | Regression | 1.057E19 | 5 | 2.114E18 | 15.700 | .000 ^d |
| | Residual | 1.212E18 | 9 | 1.347E17 | | |
| | Total | 1.178E19 | 14 | | | |
| 5 | Regression | 1.046E19 | 4 | 2.616E18 | 19.821 | .000 ^e |
| | Residual | 1.320E18 | 10 | 1.320E17 | | |
| | Total | 1.178E19 | 14 | | | |

- a. Predictors: (Constant), X8 = Regulatory Quality, X7 = Political Stability and Absence of Violence/Terrorist, X2 = openness of the economy, X3 = Government Effectiveness, X5 = Law & Order, X4 = Control of Corruption, X6 = Accountability and Voice, X1 = GDP per capita
- b. Predictors: (Constant), X8 = Regulatory Quality, X7 = Political Stability and Absence of Violence/Terrorist, X2 = openness of the economy, X5 = Law & Order, X4 = Control of Corruption, X6 = Accountability and Voice, X1 = GDP per capita
- c. Predictors: (Constant), X7 = Political Stability and Absence of Violence/Terrorist, X2 = openness of the economy, X5 = Law & Order, X4 = Control of Corruption, X6 = Accountability and Voice, X1 = GDP per capita
- d. Predictors: (Constant), X7 = Political Stability and Absence of Violence/Terrorist, X2 = openness of the economy, X5 = Law & Order, X4 = Control of Corruption, X1 = GDP per capita
- e. Predictors: (Constant), X2 = openness of the economy, X5 = Law & Order, X4 = Control of Corruption, X1 = GDP per capita
- f. Dependent Variable: Y = FDI inflows

Table 4: ANOVA Report

This table reports an ANOVA, which assesses the overall significance of our model.

Conclusion:

At $\alpha = 0.05$ level of significance, there exists enough evidence to conclude that at least one of the predictors is useful for predicting FDI value. Therefore, as $p < 0.05$ (Model 3, Model 4, Model 5), are significant models.

Model Parameters

The next part of the output is concerned with the parameters of the model. We are more interested in the last model because this includes all predictors that make a significant contribution to predicting Investment value. Therefore, we will look only at the last model (Model 5) in the table. This model makes the most valuable contributions of the attributes.

Coefficients^a

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | Collinearity Statistics | |
|--|--|-----------------------------|-------------|---------------------------|--------|-------|-------------------------|--------|
| | | B | Std. Error | Beta | | | Tolerance | VIF |
| 1 | (Constant) | 1.240E10 | 1.338E10 | | .926 | .390 | | |
| | X1 = GDP per capita | 537316.584 | 233104.792 | .913 | 2.305 | .061 | .109 | 9.205 |
| | X2 = openness of the economy | -3.312E8 | 2.268E8 | -.439 | -1.460 | .195 | .189 | 5.299 |
| | X3 = Government Effectiveness | 56459486.95 | 3.214E9 | .006 | .018 | .987 | .134 | 7.445 |
| | X4 = Control of Corruption | -1.555E9 | 2.034E9 | -.273 | -.764 | .474 | .133 | 7.492 |
| | X5 = Law & Order | 1.611E8 | 67941731.10 | .819 | 2.371 | .055 | .143 | 6.997 |
| | X6 = Accountability and Voice | -5.784E8 | 3.852E9 | -.056 | -.150 | .886 | .122 | 8.164 |
| | X7 = Political Stability and Absence of Violence/Terrorist | -4.127E8 | 7.247E8 | -.240 | -.570 | .590 | .096 | 10.371 |
| | X8 = Regulatory Quality | 4.493E8 | 2.821E9 | .058 | .159 | .879 | .128 | 7.820 |
| 2 | (Constant) | 1.223E10 | 8.846E9 | | 1.383 | .209 | | |
| | X1 = GDP per capita | 534529.569 | 158131.336 | .909 | 3.380 | .012 | .202 | 4.942 |
| | X2 = openness of the economy | -3.282E8 | 1.397E8 | -.435 | -2.350 | .051 | .427 | 2.344 |
| | X4 = Control of Corruption | -1.559E9 | 1.866E9 | -.274 | -.836 | .431 | .136 | 7.357 |
| | X5 = Law & Order | 1.615E8 | 59504704.82 | .821 | 2.714 | .030 | .160 | 6.261 |
| | X6 = Accountability and Voice | -5.401E8 | 2.939E9 | -.052 | -.184 | .859 | .180 | 5.544 |
| | X7 = Political Stability and Absence of Violence/Terrorist | -4.079E8 | 6.195E8 | -.237 | -.658 | .531 | .113 | 8.841 |
| | X8 = Regulatory Quality | 4.495E8 | 2.612E9 | .058 | .172 | .868 | .128 | 7.820 |
| | 3 | (Constant) | 1.130E10 | 6.564E9 | | 1.722 | .123 | |
| X1 = GDP per capita | | 551602.929 | 115418.815 | .938 | 4.779 | .001 | .334 | 2.996 |
| X2 = openness of the economy | | -3.166E8 | 1.148E8 | -.420 | -2.758 | .025 | .555 | 1.802 |
| X4 = Control of Corruption | | -1.730E9 | 1.482E9 | -.304 | -1.167 | .277 | .189 | 5.286 |
| X5 = Law & Order | | 1.694E8 | 35341209.37 | .861 | 4.794 | .001 | .398 | 2.513 |
| X6 = Accountability and Voice | | -1.093E8 | 1.444E9 | -.011 | -.076 | .942 | .657 | 1.522 |
| X7 = Political Stability and Absence of Violence/Terrorist | | -3.291E8 | 3.916E8 | -.191 | -.840 | .425 | .249 | 4.021 |
| X8 = Regulatory Quality | | 4.495E8 | 2.612E9 | .058 | .172 | .868 | .128 | 7.820 |
| 4 | (Constant) | 1.125E10 | 6.160E9 | | 1.827 | .101 | | |
| | X1 = GDP per capita | 548365.699 | 101108.804 | .932 | 5.424 | .000 | .387 | 2.585 |
| | X2 = openness of the economy | -3.142E8 | 1.037E8 | -.416 | -3.029 | .014 | .605 | 1.654 |
| | X4 = Control of Corruption | -1.733E9 | 1.398E9 | -.305 | -1.240 | .246 | .189 | 5.282 |
| | X5 = Law & Order | 1.686E8 | 31848834.02 | .857 | 5.295 | .000 | .436 | 2.295 |
| | X7 = Political Stability and Absence of Violence/Terrorist | -3.229E8 | 3.610E8 | -.187 | -.894 | .394 | .260 | 3.840 |
| | X8 = Regulatory Quality | 4.495E8 | 2.612E9 | .058 | .172 | .868 | .128 | 7.820 |
| 5 | (Constant) | 1.159E10 | 6.087E9 | | 1.904 | .086 | | |
| | X1 = GDP per capita | 565718.541 | 98232.578 | .962 | 5.759 | .000 | .402 | 2.490 |
| | X2 = openness of the economy | -3.317E8 | 1.008E8 | -.440 | -3.289 | .008 | .627 | 1.595 |
| | X4 = Control of Corruption | -2.714E9 | 8.571E8 | -.477 | -3.167 | .010 | .493 | 2.027 |
| | X5 = Law & Order | 1.774E8 | 30016821.53 | .902 | 5.908 | .000 | .481 | 2.080 |

a. Dependent Variable: Y = FDI inflows

Table 5: Coefficients

In multiple regression the model takes the form of an equation that contains a coefficient (b) for each predictor. The first part of the table gives us estimates for these b values and these values indicate the individual contribution of each predictor to the model. The b values tell us about the relationship between FDI value and each predictor. If the value is positive, we can tell that there is a positive relationship between the predictor and the outcome whereas a negative coefficient represents a negative relationship. For these data, two predictors have positive b values indicating positive relationships and the other two has a negative value indicating negative relationships.

The tolerance values are a measure of the correlation between the predictor variables and can vary between 0 and 1. The closer to zero the tolerance value is for a variable, the stronger the relationship between this and the other predictor variables. You should worry about variables that have a very low tolerance. SPSS will not include a predictor variable in a model if it has a tolerance of less than 0.0001.

VIF is an alternative measure of collinearity (in fact it is the reciprocal of tolerance) in which a large value indicates a strong relationship between predictor variables.

Since all dependent variables has a variance inflation factor (VIF) very small, this indicates that no multi-collinearity between variables. In other words, Predictors variables has no multi effect. In general, As $VIF < 10$ it will be good.

We can summarize the result in the following table:

| Model 5 | B | t | Sig (p-value) |
|---|-----------------------|-------|---------------|
| (constant) | 11,589,958,548.214834 | 1.904 | 0.086 |
| X1 = GDP per capita (GDPP) | 565,718.5411062313 | 5.75 | 0.000 |
| X2 = openness of the economy (Openness) | -331,672,372.2129736 | -3.28 | 0.008 |
| X4 = Control of Corruption (PRSCC) | -2,714,237,318.662012 | -3.16 | 0.010 |
| X5 = Law & Order (PRSLO) | 177,352,175.22063538 | 5.90 | 0.000 |

Table 1: Results of the Analysis

Based on the above table we can conclude the regression equation as:

$$FDI = 11,589,958,548.214834 + 565,718.5411062313 * \text{GDP per capita} - 331,672,372.2129736 * \text{openness of the economy} - 2,714,237,318.662012 * \text{Control of Corruption} + 177,352,175.22063538 * \text{Law \& Order}$$

Or Shortly:

$$Y = 11,589,958,548.214834 + 565,718.5411062313 * X1 - 331,672,372.2129736 * X2 - 2,714,237,318.662012 * X4 + 177,352,175.22063538 * X5$$

Thus the conclusion investigates that the constructed model is significant where X1 (GDP per capita), X2 (openness of the economy), X4 (Control of Corruption), and X5 (Law & Order) are good predictors of the model at significance level 0.05 (5%).

This means that the null hypothesis is accepted for predictors: control of corruption and law and order that significantly are good predictors for the FDI in Lebanon.

IV. CONCLUSIONS & RECOMMENDATION

Foreign direct investment plays an important role in the development of the economy in Lebanon. Many different factors

are to be taken into consideration from the foreign investors' side before they make their investment's decision. The purpose of this study- was initially presented- to analyze the linkage between these political factors as well as both openness of the economy and the GDP per capita in Lebanon with the foreign direct investment. This study covered data about six independent political variables (Government effectiveness, Political Stability and Absence of Violence, Control of Corruption, Law & Order, Regulatory Quality and Accountability and voice), openness of the economy, GDP per capita and a unique dependent variable which is the FDI for the span between 2002 and 2016 in Lebanon. The results of the study can be summarized by a regression equation for the FDI ($FDI = 11,589,958,548.214834 + 565,718.5411062313 * \text{GDP per capita} - 331,672,372.2129736 * \text{openness of the economy} - 2,714,237,318.662012 * \text{Control of Corruption} + 177,352,175.22063538 * \text{Law \& Order}$). This shows that the FDI in Lebanon responds in various ways to these different political factors. The results show that the political risk factors: control of corruption and law and order as well as the GDP per capita and the openness of the economy variables are considered to be good predictors of the Foreign direct investments' inflow to Lebanon with a significant level 0.05 while the remaining factors are not significant at the 5% level.

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Comparative Study Of Pharmaceutical Standardization And Antifungal Activity Of Modified And Conventional Dadruvidravan Malahar In Case Study.

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Abstract- According to WHO, the prevalence rate of superficial mycotic infection has been found to be 20-25% worldwide. In India, more than one million cases per year were found of fungal infection.

Tinea, superficial fungal infections caused by three species of fungi tinea corporis (general skin), tinea cruris (groin) and tinea pedis (feet) collectively known as dermatophytes.

In this scenario, though oral antifungals are the mainstay of therapy, the role of topical antifungals is also crucial. But the increased use of antifungal agents in recent years has resulted in the development of resistance to these drugs. Also these drugs cause many hazards to body and general irritation of the skin. The significant clinical implication of resistance has led to heightened interest in the study of some ayurvedic rasa aushadhi's as antifungal formulation.

In present study a herbo-mineral preparation dadruvidravan malahar of rasatarangini was made with some modification as its smell is very annoying and patient does not like its smell. So it is prepared by different methods, one as mentioned in text having the same base sesame oil, added with essence tea tree oil and one with modification having base coconut oil. Coconut oil is used, as it removes that anxious smell and also in some researches the antimicrobial activity of coconut oil is proven. These formulations are evaluated for its analytical test and its antifungal activity in 10 cases of dadru.

Acceptability, penetrability, non-irritant effect and antifungal activity of dadruvidravan malahar had to be proven in case series of ten patients in this study.

Index Terms- Coconut oil, Chakramada beej, Dadruvidravan malahar, Dadru, Ghandhak, Tankan, Tila taila.

INTRODUCTION

Tinea, superficial fungal infections mostly caused by three species of fungi¹. Their name are based on the involvement of body part - tinea corporis (general skin), tinea cruris (groin) and tinea pedis (feet) collectively known as dermatophytes. With some pertinent exceptions, dermatomycosis is typically confined to the superficial keratinized tissue² and thus can be often treated with topical antifungal medications³. According to Ayurveda fungal infection is diagnosed as "dadru". The involved dosha is kapha- vata⁴. Kapha and pitta dosha manifest in the skin and cause accumulation of toxins. These toxins accumulate in deeper

tissues of skin like rasa (nutrient plasma), rakta, (blood), mamsa (muscles) and lasika (lymphatic). These toxins cause contamination of deeper tissues. Contamination of deeper tissues and aggravation of kapha/pitta dosha leads to ringworm. Third involved dosha is vata. Thus it is tridoshaj disease, in which prime involved doshas are kapha and pitta.

External application is the shortest route to reach the skin; hence the drug shows good effect when applied externally. In present study a herbo-mineral preparation dadruvidravan malahar of rasatarangini⁵ was made with some modification as its smell is very annoying and patient does not like its smell. So it is prepared by different methods, one as mentioned in text having the same base sesame oil added with essence tea tree oil and one with modification having base coconut oil. Coconut oil is used, as it removes that anxious smell and also in some researches the antimicrobial activity of coconut oil is proven⁶.

These formulations are evaluated for its analytical test and its antifungal activity in 10 cases of dadru. Acceptability, penetrability, non-irritant effect and antifungal activity of dadruvidravan malahar had to be proven in case series of ten patients in this study.

NEED FOR THE STUDY

According to WHO, the prevalence rate of superficial mycotic infection has been found to be 20-25% worldwide. In India, more than one million cases per year were found of fungal infection.

In this scenario, though oral antifungals are the mainstay of therapy, the role of topical antifungals is also crucial. But the increased use of antifungal agents in recent years has resulted in the development of resistance to these drugs. Also these drugs cause many hazards to body and general irritation of the skin. The significant clinical implication of resistance has led to heightened interest in the study of some ayurvedic rasa aushadhi's as antifungal formulation.

In present study a herbo-mineral preparation dadruvidravan malahar of rasatarangini was made with some modification as its smell is very annoying and patient does not like its smell. So it is prepared by different methods. In this modern era of development, attempt of modification is done and evaluated.

AIM

To assess the antifungal activity of the modified and conventional dadruvidravan malahar.

OBJECTIVES

1. To prepare and standardize both the conventional and modified dadruvidravan malahar in accordance with API and AFI guidelines.
2. To compare the modified and conventional malahar for its acceptability, non-irritant effects and penetrability.
3. To compare the antifungal activity of conventional and modified dadruvidravan malahar in 10 patients.

TYPE OF STUDY:

Case Series

CASES STUDY

In this study, 10 Patient with dermatophytes are randomly selected irrespective of their age group, sex, religion and occupation, etc. 5 patients were treated with the conventional malahar and 5 are treated with the modified malahar.

STUDY PARAMETER

Relief of symptoms - kandu, pidika, srava and raga. They are assessed with scores.

METHODS AND MATERIAL

Collection of the raw material is done and then Dadruvidravan malahar is prepared as per Rasatarangini and with modification. It was prepared by using two different bases - one by taking tila taila as mentioned in text as a conventional dadruvidravan malahar and one with the coconut oil as a modification in the form of modified dadruvidravan malahar.

PREPERATION OF CONVENTIONAL DADRUIDRAVAN MALAHAR

In conventional method, take one part of bee wax and 5 part of tila taila and melt both of them together and siktha taila was prepared. Take 120gm of siktha taila and melt them on the low flame. And add 10gm of shuddha ghandak choorna and 5gm of each shuddha tankan, chakramad beej choorna and laksha choorna into it and heat is given till it forms a homogeneous mixture. Then 4-5 drops of essence was added to it.

PREPERATION OF MODIFIED DADRUIDRAVAN MALAHAR

In modified method, take one part of bee wax and 5 part of coconut taila and melt both of them together and siktha taila was prepared. Take 120gm of siktha taila and melt them on the low flame. And add 10gm of shuddha ghandak choorna and 5gm of each shuddha tankan, chakramad beej and laksha choorna into it and heat is given till it forms a homogeneous mixture. Both are made by fusion method.

STANDARDISATION AND ANALYTICAL COMPARISON OF BOTH MALAHAR

Then the standardisation of both conventional and modified dadruvidravan malahar was done.

CASE SERIES

Selection of patients who are diagnosed with the dadru. Then intervention of malahar and were assessed for its non-irritability, acceptability, penetrability and antifungal activity in 5 patients each.

RESULTS

Both the malahar are standardize by using the analytical methods. The results of the analytical test are shown in the table1

| Sr. No. | Name of the Analytical test | Conventional dadruvidravan malahar | Modified dadruvidravan malahar |
|---------|-----------------------------|------------------------------------|--------------------------------|
| 1 | Appearance | Thick creamy paste | Thick creamy past |
| 2 | Colour | Light creamish brown | Light creamish yellow |
| 3 | Loss on drying | 6.88% | 7.29% |
| 4 | Ph | 5.6 | 5.8 |
| 5 | Spreadibility | Uniformly spreadable | Uniformly spreadable |
| 6 | Acid value | 9.05 | 8.65 |
| 7 | Density | 0.8905 | 0.894 |
| 8 | Tannis | Present | Present |
| 9 | Alkaloids | Present | Present |
| 10 | Texture | Smooth | Smooth |

CASE STUDY OF 10 PATIENTS

5 patient of conventional dadruvidravan malahar:

Non-irritant effect: 3/5patient

Penetrability: 12/20 mg

Relief of symptoms: 3/5

5 patient of modified dadruvidravan malahar:

Non-irritant effect: 5/5patient

Penetrability: 19/20mg

Relief of symptoms: 4/5

DISCUSSION

1. Loss on drying of modified DVM is 7.29% which is more than conventional DVM which is 6.88%.A modified DVM has more loss on drying indicating that coconut oil has more moisture content.

2. PH of modified DVM is less than conventional DVM both acidic i.e 5.8(conventional) and 5.6(modified) which is good for the skin. As skin also have the acidic ph from 4-6 so products that is locally applied on the skin must have the same ph if it is alkaline then it can disturbed the acidic mantle of the skin.

3. Acid value of modified DVM is 8.65 which is less than conventional DVM which is 9.05. Low acid value is considered safe for making skin care products though high acidity may be harmful for the skin. Also more the acid value less is its stability.

4. Alkaloids and tannins which are found in both the malahar have antifungal properties. Both have the smooth texture.
5. Spreadability of formulations, that is, the ability of a ointment to evenly spread on the skin, plays an important role in the administration of a standard dose of a medicated formulation to the skin and the efficacy of a topical therapy. The values refer to the extent to which the formulations readily spread on the application surface by applying a small amount of shear.
6. Ointments are weighed about to 20 mg and then is applied on the skin by round movements for 30 seconds and then left out ointment is collected and weighed again to check its penetrability. Penetrability is increased in modified DVM from average of 12 mg to the 19 mg.
7. 2 patients out of 5 develop the skin irritation on using conventional malahar and no 5 patient develop skin irritation who are using modified malahar.
8. 60% of patient get relief by conventional DVM and 80% get relief by modified DVM

CONCLUSION

Modified Dadruvidravan malahar is better than the conventional Dadruvidravan malahar as it has more moisturising content, almost same ph as that of the conventional , low acid value, uniform speradibilty, more penetrability than that of conventional DVM. Modified DVM shows no skin irritation but the conventional DVM shows skin irritation in 2 patients out of 5. The reason for this may be that gandhak has its ushna properties and tila taila also have ushna properties so may be off excessive ushanta it caused skin irritation but in modified DVM coconut oil is used which is sheeta virya which may be neutralizing the ushanta of the gandhak. Both the conventional and modified Dadruvidravan malahar shows antifungal activity but the reliefs of symptoms were seen more in patients of modified Dadruvidravan malahar.

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Comparison between differently synthesized hydroxyapatite composites for dentistry applications

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Abstract- Hydroxyapatite and its composites have applied in several biomedical applications as a bioceramic. This research used to examine chemical and structural suitability of newly synthesized Eppawala hydroxyapatite composite varieties as dental filling material, by comparing and contrasting them with human tooth as well as commercially available glass ionomer cement (GIC), used in dentistry applications. Commercially available 2-hydroxyethyl methacrylate monomer used to reinforce solid state sintered and sol gel synthesized hydroxyapatite ceramic to prepare its composites and their physical, chemical properties were compared. Results show there is a close similarity between synthesized products and human tooth while crediting high thermal stability, good crystalline, and porous properties than the commercial product. Finally, study concluded newly synthesized composites can be applied directly as a substitution for human tooth while having different properties from each other.

Index Terms- Hydroxyapatite, Dental fillings, 2-hydroxyethyl methacrylate, Human tooth

I. INTRODUCTION

Hydroxyapatite is a widely used bioceramic which has a close chemical and structural similarity with human hard tissues and performs several outstanding properties biocompatibility, non-inflammatory in nature, osteoconductivity, non-toxicity, bioactivity etc. [1-11]. As a result it has a range of biomedical applications mainly in the fields of orthopedics and dentistry. [12-20]

Here in this study we have synthesized hydroxyapatite by converting chloroapatite using solid state sintering method and sol gel technique considering its ability to replace chlorine with other groups due to the increase of reactivity as its chlorine positions are under strain in the structural framework. [21,22] Chloroapatite were collected from Sri Lankan Eppawala apatite deposit, which usually contains 34-40% total phosphorus expressed as percentage of Phosphorus pentoxide (P_2O_5). [21-25] Apart from that, for sol gel technique, ethanol and dil. nitric acid were used and for solid state sintering technique Calcium hydroxide was used. Further synthesized hydroxyapatite is reinforced with a reactive resin, 2-hydroxyethyl methacrylate. It is a hydroxyester and a monomer resin widely used as a desensitizing agent for dentistry applications, as its ability to

stimuli pain by get sealing into sensitive areas in the teeth and blocking the dentinal tubules at the dentin surface. [26]

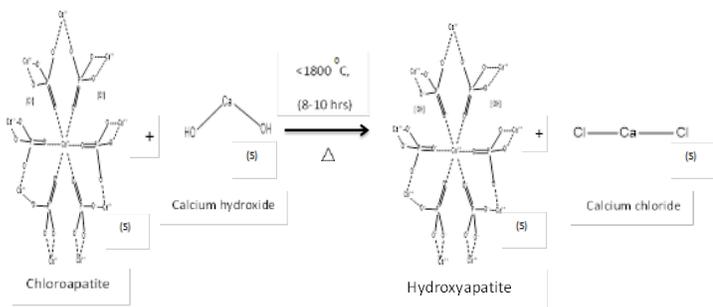
This study mainly focused to find out structural suitability of synthesized hydroxyapatite composites as dental filling material, by comparing and contrasting it with human tooth as well as commercially available glass ionomer cement, which is currently used for dental applications in Sri Lanka. Selected commercial product containing two main parts as GIC majorly consists of fluoroaluminosilicate glass and 2-hydroxyethyl methacrylate polymer, is currently used self-curing conventional glass ionomer restorative material in Sri Lankan government hospitals which indicates for non-stress bearing restorations, deciduous teeth restorations, geriatric restorations, intermediate restorative and base material for cavities using sandwich technique, cervical restorations, cold build ups, temporary fillings and dentine replacement etc. It is prepared directly before use by mixing its powder component with polymer component clinically and resulted paste is cured within a few seconds. [27]

II. EXPERIMENTAL PROCEDURE

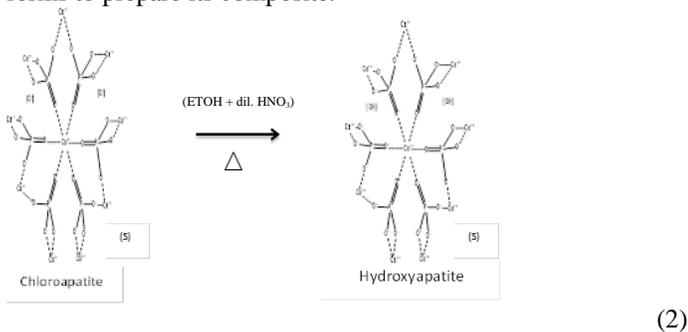
A. Sample preparation

As the first step, natural raw apatite mineral were collected from the Eppawala apatite site. Then they were sorted as high grade rock phosphate (HERP) by the visual appearance of less coated apatite. After removing mud, collection of apatite rocks were dried under sunlight, crushed using a jaw crusher (Serial no: 1720011, China) into small crystals /powder, grind further into micron/Nano level HERP powder using a planetary Ball Mill (XQM – 4.0A) and sieved using sieve set (A060_01AC/0219, Scotland). Less than 63 micron range particle size powder were collected and oven dried at a temperature around 120 °C for 5 hrs to prepare moisture removed HERP powder (MHERP).

Solid state sintered composite sample was prepared as mentioned bellow. MHERP powder was added with needed weight of $Ca(OH)_2$ powder, after well mixing, sieving and high temperature heat treating solid state sintered Eppawala hydroxyapatite powder (SSHAp) was synthesized according to equation (1). [12,22] Then the synthesized ceramic powder was mixed with commercial methyl methacrylate (MMA) liquid monomer, until the ductile dough forms to obtain its composite.



Sol gel synthesized Eppawala hydroxyapatite (SGHAp) was prepared under sol gel technique acidified route using MHERP, absolute ethanol, and diluted acid as the raw materials as mentioned in equation (2). Mixture of MHERP and dil. Acid (1:1 ratio) was stirred well in absolute ethanol medium for 4-6 hrs until the formation of gel. Then it was oven dried to a temperature less than 120°C for 15 hrs and again two stage heat sintering were done starting from 400°C to 750°C for 8hrs. [12,22] Finally the synthesized ceramic powder was mixed with commercial 2-hydroxyethyl methacrylate polymer until a paste forms to prepare its composite.



As the fourth step, commercial GIC powder and 2-hydroxyethyl methacrylate were mixed together until a paste forms, that sample was used to compare synthesized ceramic composite.

B. Sample characterization

Before mixing with the polymer, commercial GIC powder and Eppawala hydroxyapatite was examined under X-ray fluorescence spectroscopy (Rigaku XRF Spectrometer) to find out its elementary composition and presence of impurities. The polymer was identified using Fourier transform infrared spectroscopy (Bruker – Alpha FTIR Spectroscopy) under ATR technique. Then the mixtures of newly synthesized product and commercial product along with the human tooth were characterized using XRD, FTIR, TGA, and SEM with EDS techniques. The crystallographic phases of samples were determined by X-ray diffractometer (Rigaku – Ultima. IV diffractometer) in reflection mode with $\text{Cu K}\alpha 1$: 0.154 nm radiation. $1.5^{\circ}\text{ min}^{-1}$ scanned speed was used to collect data within 2θ range from 15° to 80° angles. The presence of functional groups was confirmed by FTIR over the region $400\text{-}4000\text{ cm}^{-1}$ using KBr pellet technique. The resolution of the spectrometer was 4 cm^{-1} . The surface morphology and microstructural features of samples were studied using Hitachi SU6600 analytical variable pressure field emission scanning electron microscope

(FE-SEM) and oxford instruments EDX with AZtec software. Furthermore, thermogravimetric analysis (TGA) was done using a thermal analyzer (SDT Q600) with N environment, $10^{\circ}\text{C min}^{-1}$ heating rate, and 1450°C maximum temperature to find out the thermal stability of samples.

III. RESULTS AND DISCUSSION

Both solid state sintered Eppawala hydroxyapatite (SSHAp) and sol gel synthesized Eppawala hydroxyapatite (SGHAp) powder contain Ca, P and O include in higher weight percentages and Fe, Al and Si as the impurities with hexagonal crystal structure showing a close similarity with mammalian tooth and consists of many correlated, microcrystalline structures/particles/ spherulites while credenting good thermal stability. Specially, SSHAp powder interprets porous properties and SGHAp powder interprets highly crystalline structure. [12,22]

Table 1. XRF results for Commercial Glass Inomer Cement

| Element | Spot 1 | Spot 2 | Spot 3 | Spot 4 | Spot 5 | Spot 6 |
|---------|--------|--------|--------|--------|--------|--------|
| | Mass % |
| 13 Al | 49.46 | 42.39 | 43.03 | 45.82 | 43.29 | 43.13 |
| 16 S | 0.30 | - | - | - | - | 0.25 |
| 20 Ca | 0.48 | 0.35 | 0.39 | 0.32 | 0.31 | 0.30 |
| 26 Fe | 0.23 | 0.17 | 0.20 | 0.17 | 0.18 | 0.20 |
| 38 Sr | 49.34 | 56.79 | 55.36 | 53.29 | 55.94 | 55.87 |
| 40 Zr | 0.19 | 0.20 | 0.27 | 0.28 | 0.27 | 0.16 |
| 56 Ba | - | 0.10 | 0.74 | 0.12 | - | 0.08 |

Table 1 shows that sample contains Al and Sr in higher amounts and Zr, S, Fe, Ca and Ba in less amounts. [26]

Table 2. SEM with EDS results for Solid state product with mixture, results for Sol gel product with polymer mixture, commercial GIC with polymer mixture and Human tooth

| Element | Solid state sintered product with polymer mixture | | | Sol gel product with polymer mixture | | | Commercial GIC with polymer mixture | | | Human Tooth | | |
|---------|---|--------|--------|--------------------------------------|--------|--------|-------------------------------------|--------|--------|-------------|--------|--------|
| | Spo t1 | Spo t2 | Spo t3 | Spo t1 | Spo t2 | Spo t3 | Spo t1 | Spo t2 | Spo t3 | Spo t1 | Spo t2 | Spo t3 |
| | Wt % | Wt % | Wt % | Wt % | Wt % | Wt % | Wt % | Wt % | Wt % | Wt % | Wt % | Wt % |
| O | 58.4 | 60.0 | 60.1 | 61.4 | 58.9 | 55.4 | 53.5 | 57.4 | 57.0 | 63.7 | 58.3 | 49.2 |
| C | 16.0 | 17.0 | 17.2 | 17.7 | 16.5 | 20.5 | 13.8 | 17.3 | 17.1 | 19.4 | 14.9 | 7.4 |
| Ca | 18.1 | 15.8 | 15.9 | 13.6 | 15.8 | 12.6 | - | - | - | 10.2 | 17.3 | 28.9 |
| P | 6.7 | 6.4 | 6.2 | 6.8 | 7.6 | 10.5 | 0.8 | 0.5 | 0.5 | 5.2 | 8.8 | 13.8 |
| Cl | 0.7 | 0.7 | 0.6 | 0.6 | 0.8 | 0.9 | - | - | - | - | - | - |
| Al | - | - | - | - | 0.3 | - | 7.3 | 5.1 | 5.2 | 0.3 | - | - |
| Fe | - | - | - | - | 0.1 | - | - | 9.8 | - | 0.2 | - | - |
| Sr | - | - | - | - | - | - | 7.2 | 4.8 | 4.9 | - | - | - |
| Si | - | - | - | - | - | - | 6.4 | 4.3 | 4.4 | 0.5 | - | - |
| Na | - | - | - | - | - | - | 1.0 | 0.8 | 0.7 | 0.3 | 0.3 | 0.7 |
| F | - | - | - | - | - | - | 9.8 | - | 10.1 | - | - | - |
| Co | - | - | - | - | - | - | 0.1 | - | - | - | - | - |
| Mg | - | - | - | - | - | - | - | - | - | 0.2 | 0.4 | - |

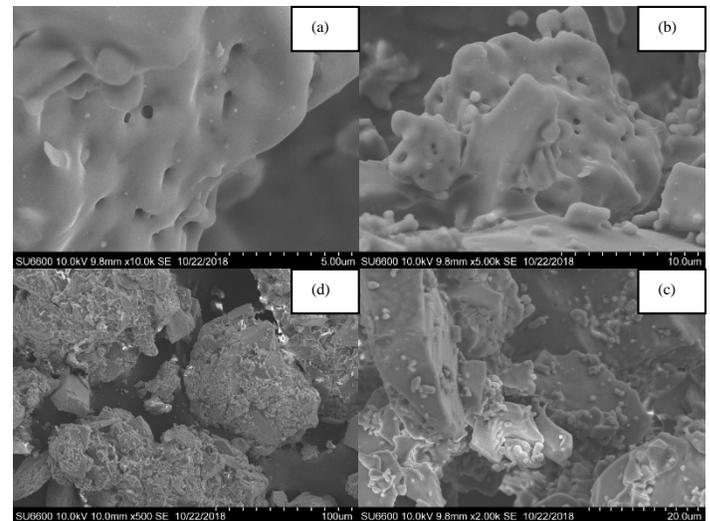


Figure 1. SEM images for SSHAp with polymer mixture, 10.0 kv, a) 10K b) 5KX c) 2KX d) 500X

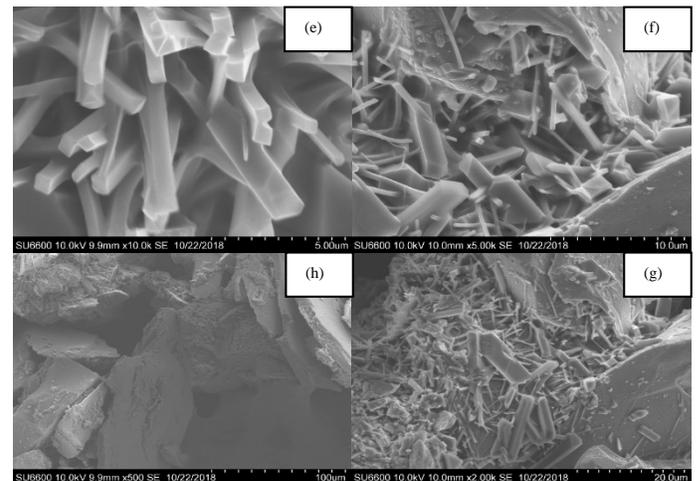


Figure 2. SEM images for SGHAp with polymer mixture, 10.0 kv, e) 10K f) 5KX g) 2.2KX h) 500X

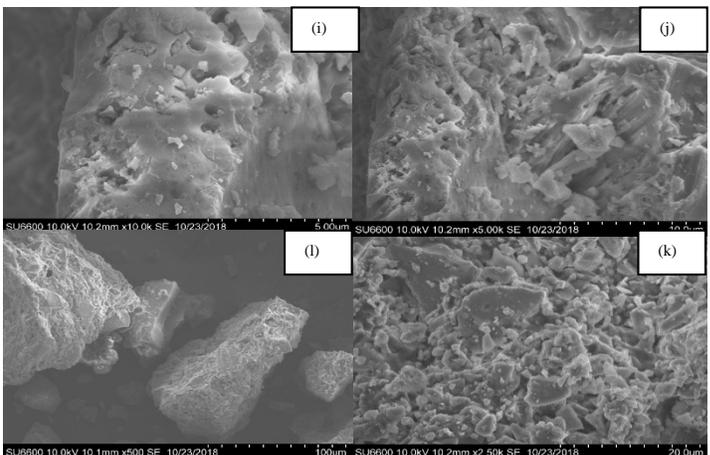


Figure 3. SEM images for Commercial GIC with polymer, 10.0 kv, i) 10KX j) 5KX k) 2.2KX l) 500X

Results for SEM with EDS analysis of solid state product with polymer mixture, sol gel product with polymer mixture, commercial GIC with polymer mixture and human tooth are given in the Table 2. According to that; SSHAp with polymer sample contains O, Ca in higher amounts and then P, C, Cl in order. SSHAp with polymer sample contains O in higher amounts and then C, Ca, P, Cl in order and also Fe in very less amount as an impurity. Commercial product mixture contains O, C presence in higher amounts of the products and in order F, Al, Sr, Si, N, P and negligible amount of Ca. Human tooth contains O presence as the highest amount and then C, Ca, P and Si in order. Na, Al, Fe, Mg presence in very fewer amounts. When comparing results, it can be stated that both SGHAp with polymer and SSHAp with polymer mixtures have similarity with human tooth in composition. Among synthesized composites SSHAp with polymer sample contains more Ca percentage, which may occur due to the addition of Calcium hydroxide at the beginning for preparation of ceramic.

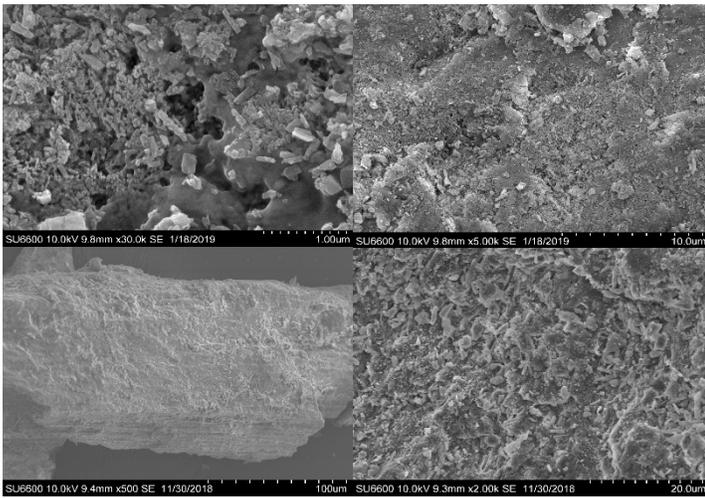


Figure 4. SEM images for Human tooth, 10.0 kv, i) 30KX j) 5KX k) 2KX l) 500X

Considering Figure 1-4; SEM images of all mixtures and human tooth show that there are good correlations of particles. SSHAp with polymer mixture and human bone only carried out micropores as shown in the Figure 1. Porosity would be helpful for tooth ingrowth as well as for good blood circulation to the tooth. Figure 2 carries good microcrystalline needle shapes particles for SGHAp product mixture. Commercial GIC mixture shows microporous structure as mentioned in Figure 3. According to Figure 1, 2 & 4, some crystalline property can be found in human tooth, both SSHAp with polymer and SGHAp with polymer mixtures. Among them crystallinity is higher in SGHAp mixture.

Figure 5 shows that the resulted graph for polymer it has coincided with the FTIR characteristic graph for 2-hydroxyethyl methacrylate, therefore polymer in the commercial product was confirmed as the 2-hydroxyethyl methacrylate polymer. It interprets several peaks related to stretching vibrations including a sharp intense peak at 1731 cm^{-1} related to the presence of ester carbonyl group, broad peak nearly 1150 cm^{-1} due to the C-O (ester bond) and a peak nearly 1250 cm^{-1} is due to the vibrations of C-C bond. Also literature shows the broad peak ranging from $(3000-3500)\text{ cm}^{-1}$ is owing to the presence of stretching vibration.^[27] As shown in the Figure 6, all peaks for phosphate groups in the 560 cm^{-1} , 640 cm^{-1} , 963 cm^{-1} , 1028 cm^{-1} and 1110 cm^{-1} wave no range and characteristic peak for OH/ Hydroxyapatite nearly 3572 cm^{-1} wave no appeared in the Human Tooth as well as the SSHAp with polymer and SGHAp with polymer mixtures.^[12,22] It confirms that even after the mixing, the presence of hydroxyapatite in both SSHAp product and SGHAp product. When considering commercial product mixture, it shows peak nearly 3572 cm^{-1} wave no range, which may due to the presence of OH⁻ group, but that couldn't be identified as hydroxyapatite characteristic peak, as no peaks found related to phosphate groups. Apart from that, some peaks can be found commonly in both commercial product mixture, SSHAp mixture and SGHAp mixture except in human tooth nearly 750 cm^{-1} - 2000 cm^{-1} and 3000 cm^{-1} wave no range in Figure 6, they are the related peaks for 2-hydroxyethyl methacrylate. As a result it can be concluded that both commercial product, SSHAp and SGHAp mixed well with the polymer.

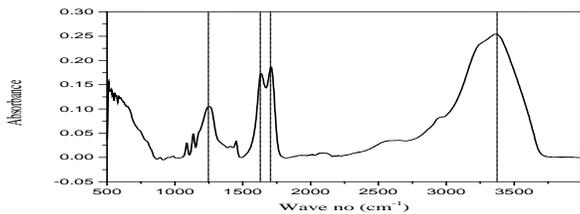


Figure 5. FTIR graph for polymer

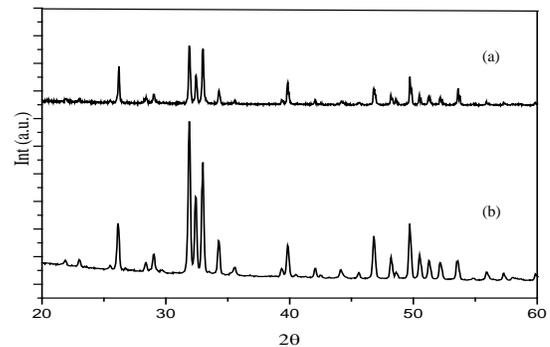


Figure 7. XRD pattern for (a) SSHAp with polymer mixture (b) SGHAp with polymer mixture

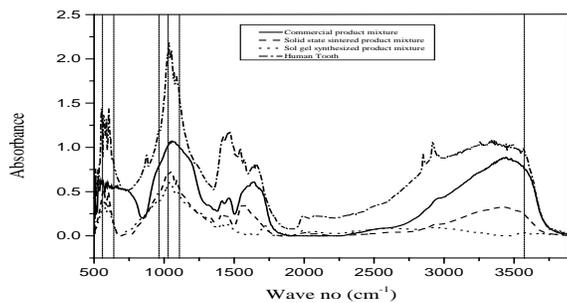


Figure 6. FTIR comparison for Commercial GIC with polymer mixture, SSHAp with polymer mixture, SGHAp with polymer and Human tooth

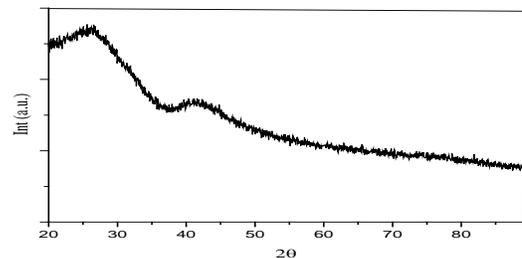


Figure 8. XRD pattern for Commercial GIC with polymer mixture

Figure 7 (a) & (b) explains even after mixing 2-hydroxyethyl methacrylate polymer, XRD results of both SSHAp and SGHAp mixtures have shown all characteristic peaks related to the crystallographic phases 002, 210, 211, 112, 300, 202, 310, 222, 213 and 004 of hexagonal hydroxyapatite, which shows similarity to human tooth. [12,22,28,29,30,31,32,33] Comparing those results with Figure 8, XRD pattern for commercial GIC with polymer it has carried out an amorphous structure without crystalline properties.

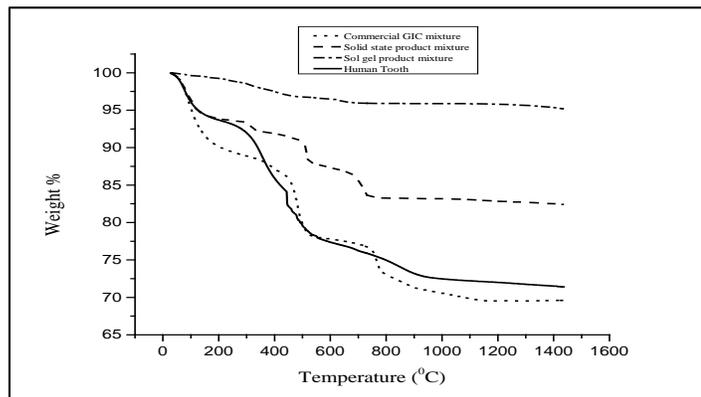


Figure 9. Comparison between TGA results of Human Tooth, Commercial product mixture, Sol gel product mixture and Solid state product mixture

When comparing TGA results for human tooth, commercial GIC with polymer mixture, SSHAp with polymer mixture and SGHAp with polymer mixture according to Figure 8, human tooth, SSHAp and SGHAp mixtures have shown the same pattern of weight loss, which was slightly different from commercial product mixture. At the beginning they show weight losses nearly 100 °C to 400 °C which may associate with the dehydration of samples, following that again samples have reduced their weight nearly 600 °C to 700 °C which may occur due to the gas elimination. Then again from 700 °C up to 1400 °C weight losses have occurred due to the incipient transformation of produced hydroxyapatite in β - TCP. [12,22,28,30,31,32,33]

Therefore, it indicates the presence of hydroxyapatite in products as well as in human tooth. Those results confirm the composition similarity of human tooth and synthesized composite mixtures, as they were containing hydroxyapatite.

Also due to the least amount of weight loss in synthesized composite mixtures than human tooth and commercial product mixtures, it can be concluded that the synthesized SSHAp with polymer and SGHAp with polymer mixtures perform high thermal stability and good material stability in nature and application.

IV. CONCLUSION

The study concludes that SSHAp with 2-hydroxyethyl methacrylate and SGHAp with 2-hydroxyethyl methacrylate composites have chemical and structural similarity with human tooth and perform high thermal stability and good material stability in nature. Also SGHAp composite interprets microporous structure with less than 50 micron range particles and SSHAp composite consists highly crystalline particles.

Therefore, both resulted composites can be used as a direct substitution for human tooth.

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ICT and Future of work: Implications for Economy and Society with Special Reference to Policing

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Abstract: The study analyzes the initiatives taken by Punjab Police to promote e-governance and ICT in police department with a socio-economic lens. In order to have a better understanding of this contemporary phenomenon, the research focuses on digitization and automation of FIR and Public Complaints system in City Police Gujranwala during the last five years. The study also analyzes the impact of these e-initiatives on the transformation brought by ICT tools in user satisfaction index, public satisfaction index, trends in crime, service delivery indicators, resolution of public complaints, completion of investigations etc. For quantitative analysis, the data has been collected following Probability Sampling technique and Purposive sampling technique and interviews and surveys have been conducted among the stake-holders in District Gujranwala. There are three major findings of the study: 1) the implementation of e-policing has made disposal of complaints quicker in district Gujranwala; 2) e-policing has exerted a significant impact on the efficiency of police department and 3) the prevalence of law and order condition has declined the crime rate in Gujranwala.

Index Terms: ICT, e-governance, e-policing, e-FIR, CCP, PAFIS, PS

1. INTRODUCTION

With the advent of Industrial Revolution, each aspect of our life and work has become more digitalized and automated. Computer aided dispatch systems and appliances are now used as a major tool for strategic planning and decision making across. Information and communication technology (ICT) and e-governance¹ are being introduced in public sector at a fast pace. This is going to change the work output and performance efficiency of public sector organizations including police in many ways. Police department across globe has benefitted a lot from ICT by running systems related to record management, crime investigation and complaint filing and efficient resource allocation.

In Pakistan, Policing is the major area of governance. Its performance and service delivery exerts a direct impact on socio-economic development of the country. Improvement of law and order and security situation can lead to economic growth and social stability while its deterioration can have equally adverse effects on the economy and society. Since Pakistan has experienced a lethargic e-government growth rate over the last few years due to plethora of political and economic constraints and also due to the deterioration of government institutions (Arfeen & Kamal, 2014), the need to strengthen the tiers of government through ICT and to deliver public services to the key stakeholders has become crucial.

The introduction of ICT in police framework especially in Punjab is immensely has immensely effected the culture of work, effectiveness and efficiency of the department by making citizens able to lodge complaints through email which are the directly addressed by relevant authorities. It has not only made complaint and FIR lodging easier but has also minimized the opportunity cost of time and travel associated with it. It is thus important to study the transformation of police from conventional methods to the use of ICT and to assess the potential impacts of this transformation on the service delivery. In order to make rich and in depth analysis, the study has been limited to the implementation of Online FIR and Citizen Complaints Portal in Gujranwala Police during the last five years. Moreover, the study will be limited to the context of socio-economic development.

The study will analyze the transformation of Punjab Police from conventional work methods and tools to ICT, results of this transformation, ensuing challenges, and its socio-economic the implications. In order to have a better understanding of the phenomenon, the research will focus on digitization and automation of FIR and Public Complaints system in City Police Gujranwala during the last five years. Since FIRs and Public Complaints are directly related to public service delivery, they can have significant socio-economic implications. Therefore, the impact of these e-initiatives on crime prevention, performance efficiency and public satisfaction will also be studied and discussed.

¹ E-governance is defined as the process of adapting information and communication technology (ICT) tools for digitizing and automating internal operations of government and for facilitating its external interactions i.e. with citizens and agencies (OECD, 2009).

The study aims to address the following research questions:

1. To study the initiatives taken to implement E-Governance and ICT in Punjab Police.
2. To examine the impediments in introduction of ICT and E-governance in Punjab Policing
3. To understand and evaluate the impact of this technological transformation on police work-culture, service delivery and performance efficiency in District Gujranwala

2. LITERATURE REVIEW

A large amount of literature is available on the subject of ICT and future of work and its implications for society and economy. It reveals that governments are increasingly moving towards E-Government, whether in developed or in developing countries. In developed countries, the implementation of E-Government initiatives aim more and more at effective service delivery to citizens (Mahmood, 2013). The E-Government paradigm emphasizes coordinated network building, external collaboration, and customer services rather than the traditional bureaucratic paradigm, which emphasizes standardization, departmentalization, and operational cost-efficiency.

For many developing countries, successful implementation of E-Government programmes is dependent both on national IT plans and e-readiness assessment plans. The most significant implementation challenge is perhaps security which requires security solutions like encryption, digital signatures, passwords and user names (Alshehri and Drew, 2010). (Chan, Brereton, Legosz, & Doran, 2001) emphasized that rapid flow of information has enhanced the performance of the police department in Queensland. It has also transformed the department by upgrading the methods of dealing with crime and law disorder. The technological advancement in Queensland Police Service (QPS) further sheds light on the apprehension that increased access to computers and information is not a short cut to improve the functioning of police department. In order to increase the return on investment in IT, the organizational structure of police department also needs to be changed.

(Frank & Binpe, 2013) examined the role of information and communication technology (ICT) in effective policing by employing cross-sectional survey method for data collection. The sample comprised of six hundred respondents selected using multi-stage random sampling technique and purposive technique. For empirical evaluation of the relationship between the variables, Pearson's Product Moment Correlation technique was used. The results confirmed that ICT and other technologies improve the performance of the police department.

(Jackson, Greenfield, Morral, & Hollywood, 2014) analyzed the potential correlation between information technology and the performance of police activities. Logic model was employed to empirically analyze the budgetary and productivity effects of IT investments. The findings confirmed that IT system exerts a significant positive impact on law enforcement. The study further stressed that the role of IT is that of a multiplier to increase potential productivity of police department.

Since digitalization and automation of work in Punjab police is a rather contemporary phenomenon in case of Pakistan, only a few studies have analyzed the impact and implications of this transformation in police department in the socio-economic perspective. The absence of appropriate data for research is the major limitation in this regard. However, (Ellahi & Manavari, 2010) examined the key determinants behind the acceptance of technology and attitude of police officers towards the use of information and communication technology. For empirical analysis, data was collected from 200 respondents across Pakistan. The results concluded that psychological response and organizational reactions of implementing ICT in police department cannot be neglected if we want to improve the performance of police department otherwise, this extraordinary development rate of IT can make the economies suffer from additional costs. The study further suggested that the police department and IT policy makers should collaborate for better outcomes.

(Perito & Parvez, 2013) argued that the effectiveness and efficiency of police department can be enhanced by improving police-public relation. In this regard, the role of media is significant. One such attempt to halt extremist violence is by broadcasting police activities in the community and also by reporting district and provincial level news on local television channels. The study further concluded that implementation and adoption of innovative technology is assisting to fight against criminal violence, terrorism and has made the process of filing complaints quicker and easier.

(Arfeen & Kamal, 2014) explored the future prospects of e-government and ICT in Pakistan by briefly describing various e-government projects and a number of diverse initiatives in Balochistan province. Case-Study-based approach was used for data collection and analysis at provincial and district level. The findings confirmed the willingness of government officials to use ICT as a tool to speed up operations and to improve their performance. The findings further declared that lack of IT skills, capacity building and cultural issues to be the major impediments in efficient utilization of resources.

(Haider, Shuwen, & Abbassi, 2015) investigated the variables that facilitate the adoption of e-government driven institutions in Pakistan. The study stressed that e-government has become an integral part of public administration and employed "unified theory of acceptance and use of technology" (UTAUT) model to analyze the penetration of e-government services in Pakistan. The data was collected through online survey. Factual spellbinding examination was applied on the response received from 200 Pakistani nationals. The findings suggested that government needs to publicize the rights of individuals and spread awareness among them about an appropriate way of using them to make the system more efficient.

The review of literature reveals that there is a serious dearth of knowledge on the subject with special reference to policing in the context of Pakistan. It emerges that no research on 'implementation of E-Governance in City Police Gujranwala' has been conducted so far and this is what this study shall focus upon. Thus, the study of City Police Gujranwala in this context is unique and new in its orientation and scope.

3. DATA AND METHODOLOGY

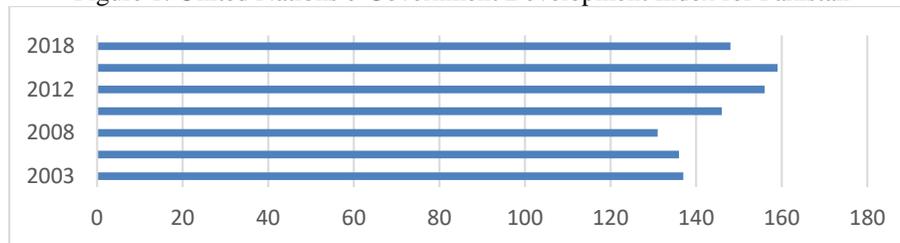
For this study a mix of Quantitative and Qualitative research methods has been used. The Quantitative method has been applied to studying the numerical data pertaining to status of implementation of ICT and the changes brought by this change of work tools vis a vis trends in crime, service delivery indicators, resolution of public complaints, completion of investigations etc. in order to study objective outcomes of this transformation. Qualitative method has been applied to understand and analyze the challenges of this transformation and its socio-economic impact by conducting key informant interviews, raising and focusing on the relevant aspects of the research questions, including but not limited to; How ICT is changing the future of policing work? How is ICT influencing the perception of transparency? Why many people still resist this transformation? How is this transformation impacting the society?

For data collection Probability Sampling technique has been used to conduct interviews and surveys among the stake-holders i.e., clients or users of the Citizen Police Portal among general public and complainants of E-FIRs in District Gujranwala. Both primary and secondary sources have been used for this study. Primary sources include interviews and surveys which have been carried out to collect first hand data primarily from general public and police officials. Citizens and police officials randomly selected from each of the ten police sub-divisions in Gujranwala District, including Qila Didar Singh, Noshehra Virkan, Khiali, Cantt, Wazirabad, Satellite town, People's Colony, Kotwali, Kamoke and Model Town, were interviewed and surveyed upon. The secondary sources include books, journals, newspaper articles, websites and research papers. The sample of the study comprised of 190 respondents. To triangulate the findings of the survey, have deeper insights and include the perceptions of the diverse stakeholders, approximately ten community members and ten police officers from each sub-division of District Gujranwala were included in the survey. The first category of questionnaire is filled by 45 citizens who have ever interacted with police department within District Gujranwala; the second category is filled by 45 police officers from the target area; the third category is again filled by 50 citizens and the fourth category is filled by 50 police officers. The data gathered through this survey is entered into an SPSS database and then frequency tables and cross-tabs have been generated to respond to the key question.

4. E-GOVERNANCE IN PAKISTAN

Pakistan passed its first ever national IT policy in 2000. With substantial shifts in technology, National IT policy was replaced by Digital Pakistan Policy in 2017. As per United Nations e-government survey, Pakistan ranked 137th out of 192 countries in 2003, 136th in 2005 and 131st in 2008. In 2010, the ranking fell drastically to 146th. Similarly, in 2012, it further dropped to 156th. In 2016, Pakistan stood at 159th position and as per latest measure, the country's position is 148th as of 2018.

Figure 1: United Nations e-Government Development Index for Pakistan



Source: United Nations e-government survey 2018 (Pakistan)

The major high score countries include United States, Canada, Denmark, Finland, Netherlands, Japan, Australia and all high income countries that have enough resources to expand e-governance initiatives. However, the neighboring emerging economies such as India and China rank 96th and 63rd as per 2018's ranking whereas, Afghanistan ranks 177th and Iran holds 86th position. The major contributing factor behind Pakistan's low ranking has been the system of public service delivery being outdated and cumbersome. During the period 1976 to 1997, more than 200 recommendations were formulated and recommended by Pakistan Public Administration Research Center to cater the quality of public service delivery. However, only 53% of the total recommendations were approved which resulted in wide range of inefficiencies.²

4.1. E-governance initiatives in Punjab

Since a great deal of practices are associated with provincial and local administrations, Punjab government has taken multiple initiatives during last five years and also passed Punjab IT Policy in 2018 to automate governance. The major initiatives include: 1) digitization of all police stations in the province; 2) attendance through biometric verification; 3) deployment of Hospital management information system (HMIS) at district and tehsil level headquarters (DHQ and THQ); 4) supervision of field staff and monitoring of health, agriculture, livestock, irrigation, education, irrigation through mobile phones; 5) Vaccination coverage from 22 percent to 92 percent ; 6) digitization of agricultural land record and use of remote sensing techniques using satellite imagery.

The digital policy further recommended to introduce e-procurement system to renovate the landscape of public procurements, to implement office automation systems as communication platform and e-filing systems. Moreover, the policy also ensured the integration of law and order initiatives such as traffic management, video surveillance and safe cities project. The Punjab IT policy

² Punjab passes its first ever IT policy", Published in MIT Technology review on May 29, 2018. To be retrieved at: <http://www.technologyreview.pk/punjab-set-to-pass-its-first-ever-it-policy/>

2018 further aims to implement some initiatives in years to come which include: provision of trainings on Internet of Things (IoT), setting up regional offices of PITB across the province and provision of free and easily accessible ICT resources to socially vulnerable people in an inclusive manner.

4.2. ICT initiatives in Punjab Police

Punjab police has taken the lead in embracing the new technologies. All the police stations of Punjab have been equipped with ICT infrastructure and personnel. As a major initiative electronic registration of FIR (E-FIR) has been successfully implemented all over the province without exception. All the police station record including daily station diary and progress on investigations has been digitalized and made available online across Punjab. Currently, different online portals, applications and technologies are being used by Punjab police on regular basis to carry out day to day official business including Crime Mapping, Police Station Record Management System, Pakistan Citizen's Portal (Prime Minister Delivery Unit), IGP Complaint Cell, Tenants Registration System, Hotel Eye System, Bio Metric Identification Devices, Online Beat Book, E-Gadget, Anti Vehicle Lifting System, Human Resource Management Information System, Driving License Management System, Police Kidmat Markaz, Police Khidmat Counter DHQ, Welfare Eye, Pukaar (15), Criminal Record Management System, Video Conferencing, Online Video Surveillance of Police Stations, Front Desk and E-FIR. The whole system is integrated and is centrally monitored by the Inspector General of Police (IGP) office or Central Police Office, Lahore.³ Out of all these tools of e-governance, E-FIR and Citizen's Complaint Portal are directly related to the public and service delivery. Therefore, it is most important to study and analyze the performance of these two e-initiatives in detail.

4.2.1. Electronic First Information Report (E-FIR)

The process of investigation against each FIR in terms of recovery and arrest has been a huge challenge in the presence of manually maintained records. Starting from FIR registration to culprit nomination, case proceedings till a case closures, retrieval of FIR requires a lot time and work. Before the advent of E-FIR, 25 registers were maintained by each Police Station that comprised of crime reports, case diaries and FIRs etc. However, electronic First Information Report (E-FIR) launched in March 2017 under smart policing approach has transformed the conventional methods into a modernized policing regime by introducing an online registration mechanism where Police Complaint Center receives complaints through Short Message System (SMS) and voice calls on a short code (8787).⁴ Moreover, latest Android-based smart phones are loaded with various applications for recording and documenting crime. This technology has replaced the traditional pocket notebooks and has connected citizens with central command room. Now the life cycle of FIR i.e. from registration to tracking a FIR has been digitalized. The system automatically generates e-copies of FIR and the reports required at all levels of Punjab Police leadership i.e. from Station House Officers (SHOs) to IGP. Moreover, the process is integrated with Police Human Resource Management Information System, NADRA and Anti Vehicle Lifting System etc. The system has transformed traditional methods and established a new regime of modern policing. The project is operational in all the 714 police stations across Punjab province.⁵ The PITB and the Punjab Police have also replicated this model in Sindh and Gilgit Baltistan. Installation of the same software in Balochistan is in progress. Since its launch 878,000 electronic FIRs have been registered which were 311,895 in 2016.⁶ This shows the acceptability and adaptability of the program.

4.2.2. Front Desk, Complaint Management System (CMS) and Police Station Record Management System (PSRMS)

Front Desks were established in District Gujranwala in 2016 which function as Reception desks in police stations. The complainants approach the Front Desk where the complaint is entered in an e-application creating a permanent record of that complaint ensuring that no application is lost or ignored. That complaint has to be resolved in a stipulated time period by concerned police staff. The high-ups monitor all the entries made at police station level and analyze the public feedback and ratio of complainants satisfied with police performance in resolving their matter. Monitoring of complaints ensures that complaints are being cleared in a timely manner and no complaint is filed without valid or justified reason by investigation officers. Complainants can check the status of their complaints online using particular complaints credentials given to them at the time of entering a complaint. The E-FIR uses a QR code as well which eliminates the fabrication of fake FIRs. All the police station registers are now being maintained in PSRM. E-FIR includes full life cycle of an FIR i.e. from registration of an FIR to suspect details, investigation, case proceedings, recovery and closings all the record is maintained digitally and is available to all supervisory officers online for analysis and reports generation. Therefore, tracking progress of a case is now much easier.

³ Source: Punjab Police Website. To be retrieved at <https://www.punjabpolice.gov.pk/>

⁴ Dogar, A. "Introducing Smart Policing", Published in MIT Technology Review. To be retrieved at: <http://www.technologyreview.pk/introducing-smart-policing/>

⁵ PITB official website. To be retrieved at: <https://pitb.gov.pk/efir>

⁶ PITB official website. To be retrieved at: <https://pitb.gov.pk/efir>

4.2.3. Citizen’s Complaint Portal (IGP Complaint Centre-8787)

One of the initiatives of Punjab Police is the establishment of an integrated IGP Police Complaint Center. Previously the complaints were received through post or a person had to travel to Lahore to submit his complaint in person at the Inspector General of Police office. This initiative aims at receiving complaints through SMS and voice calls on a short code (8787). Moreover, complaints are also received online as well as through emails. A dedicated team of young IT professionals has been deputed to handle these complaints in an expeditious manner. The system is highly interactive and the complainant is kept in the loop till the disposal of the complaint. The complainant can view the progress of his complaint online and can send his feedback at any moment, online or through SMS. Following nature of complaints are entertained at the IGP Complaints Center: 1) Non-Registration of FIRs, 2) Faulty investigations, 3) Illegal detentions, 4) Arrests of innocent persons, 5) Registration of false FIR, 6) Slackness in Duty and 7) Demand of illegal gratification.

All complaints are sent to senior ranking officers for due action and in any case they are not marked to an officer below the rank of a Sub Divisional Police officer, who is bound to call the complainant himself within 8 hours and report to the IGP Complaints center that he has made contact with the complainant. Moreover, these officers have to send their final reports within stipulated timelines. For complaints of Illegal detentions and demand of illegal gratification the replies have to be submitted within 24 hours. Similarly, for complaints of Non-Registration of FIRs and Arrests of innocent persons the replies have to be submitted within 72 hours, and for rest of the types of complaints the reports are to be submitted within two weeks. Replies received from respective offices are cross checked by the staff at Police Complaints Center by making telephonic calls to the complainants. In case of any ambiguity or the complainant has expressed dissatisfaction regarding the reply, the matter is sent to a senior officer for verification. The complaint is not disposed of till it’s either redressed or has proved to be false after verification by a senior officer. So far, 141,521 complaints have been entertained across Punjab, out of them 136,304 have been disposed of.⁷

Table 1: Performance of District Gujranwala - IGP Complaint Cell

| IGP Complaint Cell 8787 Gujranwala | | | |
|------------------------------------|----------------|----------|---------|
| Year | Total Received | Resolved | Pending |
| 2015 | 786 | 786 | 0 |
| 2016 | 954 | 954 | 0 |
| 2017 | 544 | 544 | 0 |
| 2018 | 502 | 502 | 0 |
| 2019 | 523 | 431 | 92 |

(Source: City Police Office Gujranwala, 2019)

5. Results and Discussion

Gujranwala is one of the prominent industrial cities of Pakistan. It is the 5th largest city of the Punjab and 7th amongst the most populous cities of Pakistan with 500,000 workers deployed in different industrial units of the city. Moreover, its share in national production is 9 percent and in revenue, it is 8 percent.⁸ This section undertakes an in-depth analysis regarding the role of E-policing in ensuring law and order condition in Gujranwala and its impact on user satisfaction index, public satisfaction index, trends in crime, service delivery indicators, resolution of public complaints and completion of investigations etc. In this backdrop, the present study analyses the impact of E-FIR and Citizens’ Complaint Portal in terms of service delivery and public satisfaction. The analysis primarily focuses on assessing the impact of E-FIR on police work culture and on assessing the impact of Citizen Complaint Portal in terms of service delivery and public satisfaction and police work culture in 10 sub-divisions of Gujranwala district.

5.1. E-FIR from Complainants’ Perspective

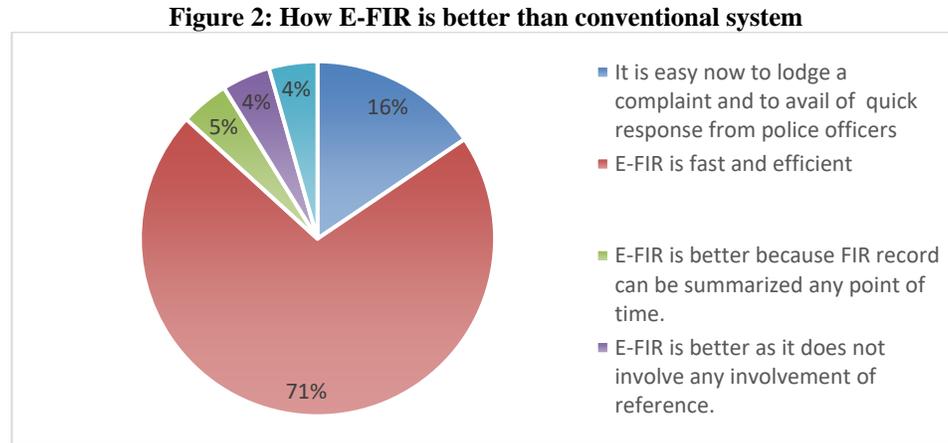
5.1.1. E-FIR vs. Conventional FIR

Tracing the progress of investigation against each FIR and its retrieval at all levels had been strenuous procedure in conventional system. On the contrary, E-FIR is integrated with NADRA, CRO, AVLS and several other IT initiatives. When different applications are sharing data it ensures that record is integrated and away from anomalies. If an E-FIR case file has a proclaim offender credentials mentioned in it, then by integration with other applications, that offender is very easy to track using Hotel Eye, TRS etc. To analyze the progress and prospects of E-FIR, surveyed citizens were asked how they find E-FIR better than conventional system, 71.1% of the citizens responded that current E-FIR system is better as it is fast and efficient. 16% of the citizens were of the view that E-FIR has made it easy now to lodge a complaint and to get quick response from police department. 4.4% of the citizens responded that E-FIR is better as the newly born electronic system does not involve any reference of some third party for FIR registration or resolving of the

⁷ Punjab Police Website accessed on 28.12.2019. Date retrievable at https://www.punjabpolice.gov.pk/igp_complaint_center_8787

⁸ Gujranwala’s role in national economy. Published in Dawn on Aug 17, 2016
<https://www.dawn.com/news/206246>

matter. Another 4.4% of the citizens responded that E-FIR is better because FIR record can be summarized and retrieved at any point of time.



Source: Author's own calculations based on surveyed data

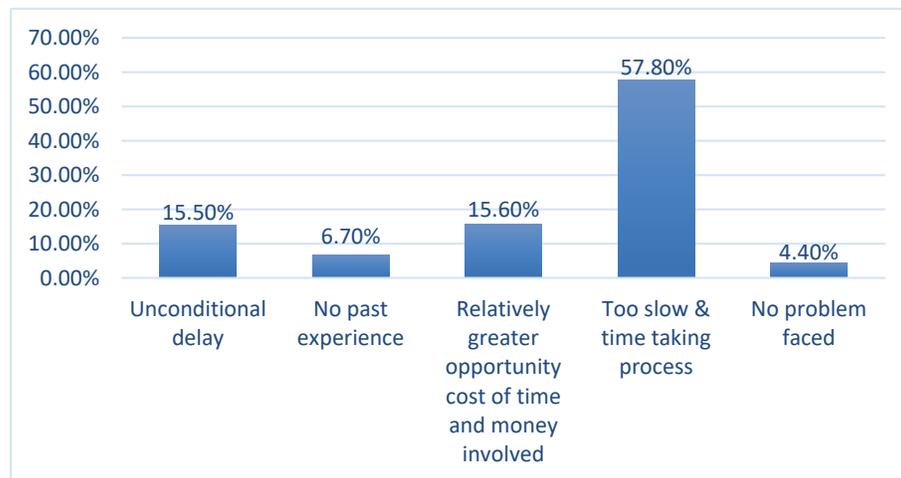
5.1.2. E-FIR and User satisfaction

An important question to be addressed here is the technology absorption and adaptability level of the citizens. Therefore, three different questions were asked from the respondents to determine their satisfaction level which eventually ensures adaptability: 1) When citizens were asked about their computer skills set to see if their low level of computer skills hindered them in using E-FIR, findings revealed that despite either being completely devoid of computer skills (32% of the citizens) or having basic level computer skills (68% of the citizens), none faced any difficulty dealing with electronic system. They reported cooperative behavior of well-educated front desk staff to be the reason behind astonishing results; 2) when the citizens were asked if the time gap between getting FIR registered and action taken on it by department has been reduced, 73.3% of the citizens were of the view that the time gap has been substantially reduced whereas, 22.2% of the citizens responded that although the time gap has been reduced, there is yet a room for improvement and; 3) when citizens were specifically asked if police efficiency has been improved, 78% of the citizens confirmed that the efficiency of police department in Gujranwala has been significantly improved.

5.1.3. Cons of conventional FIR

Prior to E-FIR, the respondents were suffering from unresponsiveness from the department and unnecessary delay in the proceedings. Not only the system was lethargic, there was huge involvement of risk in the form of chronic data misplacement and theft. Moreover, the process of retrieval of information about a specific case also used to require the complainant to personally visit police stations. However, with the advent of E-FIR, the services of police departments can be accessed by making a call on short code "8787" or by texting on the same number. When sampled population was asked about the problems they faced dealing with conventional FIR system, around 58% of the citizens expressed the apprehension that the previous system was too slow and time consuming, 15.50% of the citizens reported unnecessary delays to be the major barrier and 15.6% of the citizens responded that conventional FIR involved relatively greater opportunity cost of time in the form of visiting the police station personally and opportunity cost of money in the form of getting a number of documents photocopied etc. and undergoing through various formalities.

Figure 3: Problems faced by citizens while getting conventional FIR registered



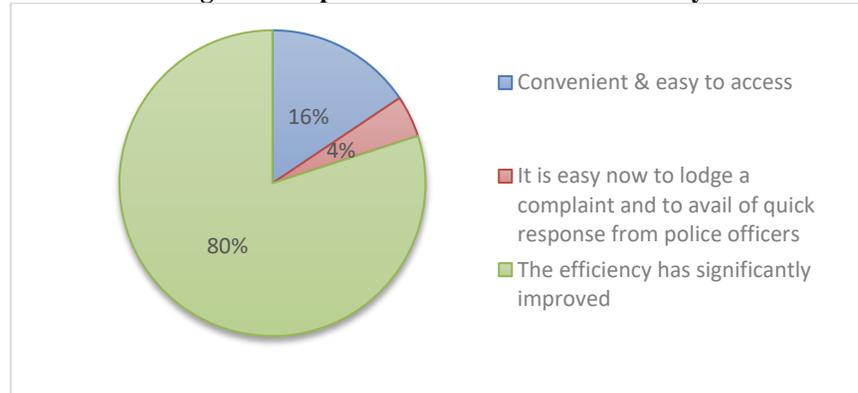
Source: Author's own calculations based on surveyed data

5.2. E-FIR FROM POLICE OFFICERS' PERSPECTIVE

5.2.1. E-FIR & performance of Police department

Surveyed population also comprised of Police officers from different Police stations⁹ of the district. Police officers being the ultimate users of electronic system were asked to evaluate the performance of E-FIR system with the objective to analyze users' satisfaction. 80% of the police officers were of the view that efficiency of the police department has been significantly improved. 15.6% of the officers responded that E-FIR is convenient and easy to access for public. And 4.4% of the officers responded that it has now become relatively easier to lodge a complaint and to get quick response from police officers.

Figure 4: Impact of E-FIR on Police Efficiency



Source: Author's own calculations based on surveyed data

5.2.2. E-Policing & Transparency

Police department relies primarily on information¹⁰ which if available on time may significantly reduce crime rate. E-FIR has a proclaim offender credentials section on it what has made it very easy to track the offender using Hotel Eye, TRS etc. Moreover, the status of the criminal remains recorded permanently in system integrated with NADRA, CRO, AVLS and several other IT initiatives. This helps in timely identification and arrest of accused. 98% of the surveyed police officers were of the view that transparency of the system is one of the major contributors towards the successful implementation of the electronic system i.e. it has made FIR readable not only for complainants but also for high police officers who can directly monitor registered FIRs. Moreover, the copies of E-FIR can also be taken directly from front desk. Screenshot below gives pictorial representation of the online portal to which electronic FIRs and complaints are entered. This system is accessible not only for the police officers of a specific police station but can also be viewed by high police officials at Headquarter Lahore.

5.2.3. E-Policing & Crime Rate

When the police officers were asked the impact of E-policing on crime rate, 80% of the respondents responded that crime rate in the district has been declined. Reduction in crime rate has various socio-economic implications for District Gujranwala as it is the leading industrial city of the Punjab with 9% share in national production is 9 percent and 8% in revenue.¹¹ In such an economically flourishing city, markets take reduction in crime rate is taken as a good news. In this regard, 99% of our respondents confirmed that because of the prevalence of law and order situation, confidence level of markets has also been increased. When the police officers were asked the impact of E-policing on crime rate, 80% of the respondents responded that crime rate in the district has been declined. Reduction in crime rate has various socio-economic implications for District Gujranwala as it is the leading industrial city of the Punjab with 500,000 worker¹² been deployed in different industrial units of the city. Moreover, its share in national production is 9 percent and in revenue, it is 8 percent.¹³ In such an economically flourishing city, markets take reduction in crime rate is taken as a good news. In this regard, 99% of our respondents confirmed that because of the prevalence of law and order situation, confidence level of markets has also been increased.

5.2.4. E-FIR & Challenges Faced By Department

The increase in police efficiency and quick responsiveness of the department comes at the cost of various challenges faced by the department. Around 59% of the police officers have expressed the notion that E-FIR has put an additional burden on the department

⁹ PS Ladhewala Warrach, PS Noshehra Virkan, PS Tatlay Aali, PS Sabzi Mandi, PS Khiali, PS Aroop, PS Civil lines, PS Cantt, PS Ahmad Nagar, PS Sohdra, PS City Wazirabad, PS Satellite town, PS Jinnah Road, PS Eminabad, PS People's colony, PS Kotweli, PS GarJakh, PS Baghban pura, PS Model Town, Dhullay, PS Wahndo, PS Muzaffar Gharh, PS Waniky Tarar, PS Gakhar, PS Nidhoki and PS B Division SKP.

¹⁰ Information that Police department relies on is of three types: 1) police information (primary, secondary and tertiary), 2) intelligence (prospective, retrospective and applied) and 3) operational strategies (preventive, prospective and reactive) each of which interacts to decode, encode, process and obtain information (Manning, 1992).

¹¹ Ibid

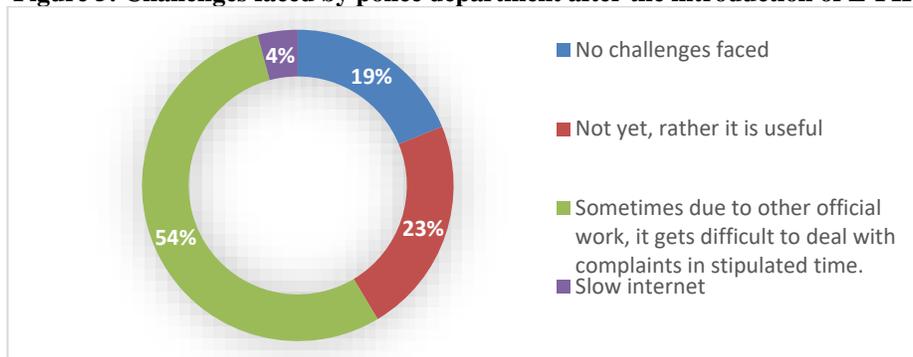
¹² Gujranwala's role in national economy. Published in Dawn on Aug 17, 2016

<https://www.dawn.com/news/206246>

¹³ Ibid

by making them alert and active 24/7. They reported that e-policing has made dealing with registered complaints/FIR a time bound procedure for police officers which does not allow them to make any delay in the proceedings. Slow internet is also considered the major challenge that hampers the connectivity of the police department with online portal thereby paralyzing the police efficiency. However, 23% of the officers responded that they find the system rather useful, 19% of the officers responded that they have not faced any challenge so far. Figure 12 shows the response by police officers when asked if E-FIR has made them deal with challenges.

Figure 5: Challenges faced by police department after the introduction of E-FIR



Source: Author's own calculations based on surveyed data

5.3. Citizen's Complaint Portal from Complainants' Perspective

5.3.1. Citizens' Complaint Portal Vs. Conventional System

Citizens' Complaint Portal is another online integrated citizen grievance redressal system connecting all government organizations both at Federal and Provincial levels integrating the IGP Complaint Cell 8787, Chief Minister Complaint Cell and Prime Minister Complaint Portal. Citizens' Complaint Portal is equipped with the facility to receive complaints from all over Punjab through: 1) telephonic call on short code "8787"; 2) SMS on 8787; 3) Punjab Police website 4) email; 5) in person and; 6) by post. Moreover, the complainants can check the status of their complaints online using particular complaints credentials given to them at the time of entering a complaint.

Under the light of these initiatives, the surveyed citizens were asked if they find Citizen's Complaint Portal any better in order to determine the adaptability level by them. Our findings reveal that 61.5% of the citizens consider Citizen's Complaint Portal to be better, faster and more efficient compared with conventional system. 17.1% of the citizens responded that it is easy now to lodge a complaint without personally visiting police station and to get quick response from the department. 7.7% of the respondents responded that CCP is better because complaint record can be summarized any point of time and has minimum risk of data misplacement. 3.8% of the complainants responded that CCP is better as it does not involve any involvement of reference or third party. Another 3.8% of the respondents responded that CCP has ensured transparency by digitizing the system.

Table 2: Citizen Complaint Portal vs. Conventional system

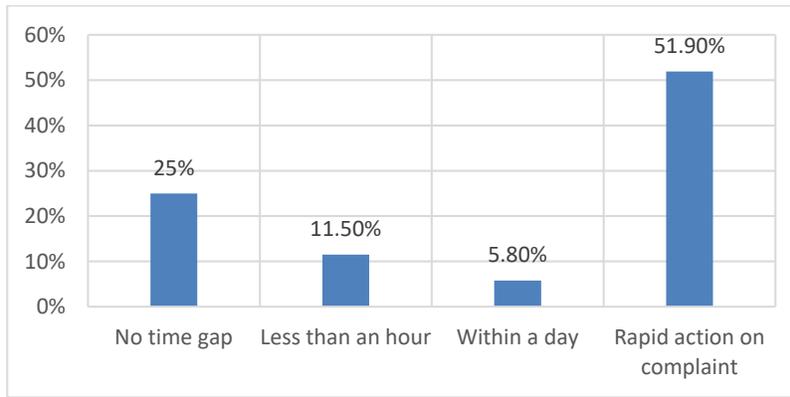
| Response | Percentage of respondents |
|---|---------------------------|
| CCP is less time consuming, quick and get effective response | 17.1% |
| CCP is fast and efficient | 61.5% |
| CCP is better because complaint record can be summarized at any point of time and has minimum risk of data misplacement | 7.7% |
| CCP does not involve any involvement of reference | 3.8% |
| CCP has ensured transparency | 3.8% |
| Total | 100% |

Source: Author's own calculations based on surveyed data

5.3.2. Citizen's complaint portal and user satisfaction

In the light of this massive accountability system, surveyed citizens were asked two different questions to determine their satisfaction level: 1) When asked about how has CCP addressed their matter, 94% of the citizens expressed that their complaints were addressed in a way more efficient than conventional methods of complaint addressal and; 2) when asked about the effect of e-services on time gap between the lodging a complaint lodging and its addressal, around 60% of the respondents surveyed citizens responded that the time gap has been substantially reduced and rapid action was taken against their complaint, 25% of the citizens responded that their complaint was addressed within no time, 11.5% of the citizens responded that their complaint was addressed within an hour whereas, around 6% of the citizens claimed to have their complaints addressed within a day. This confirms not only the improvement in police efficiency but also in public satisfaction.

Figure 6: time gap between complaint lodging and action taken

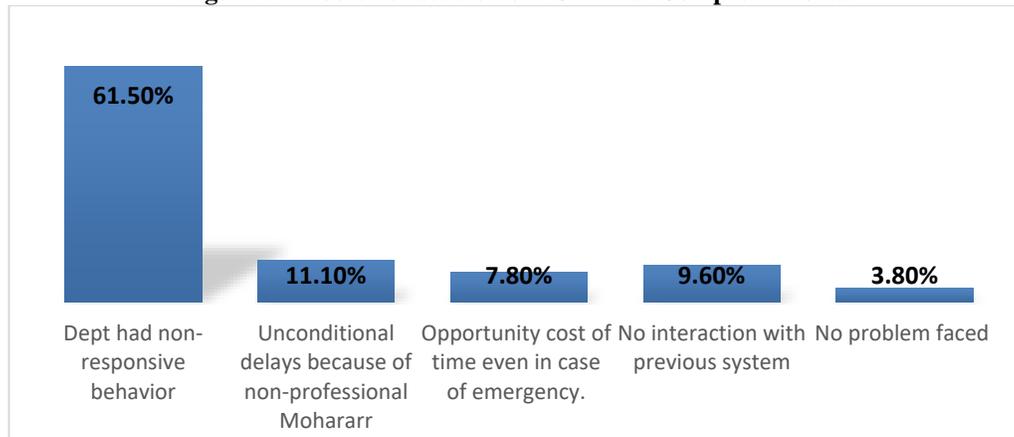


Source: Author's own calculations based on surveyed data

5.3.3. Problems faced by citizens before CCP

As far as the problems that citizens were facing prior to the advent of Citizen Complaint Portal are concerned, 61.5% of the citizens expressed the apprehension that the department had non-responsive behavior previously. However, they claimed to have observed it changing gradually after the introduction of online portal. 11.1% of the citizens responded that prior to front desk system, they used to suffer from unconditional delays due to the lethargic behavior of Mohararr whereas, around 6% of the citizens responded that previous system involved greater opportunity cost of time.

Figure 7: Problems faced before Citizens' Complaint Portal



Source: Author's own calculations based on surveyed data

5.4. CCP from Police Officers' Perspective

5.4.1. CCP's performance and users' satisfaction

When the surveyed police officers were asked to evaluate the impact of digitization on police efficiency, 74% of the police officers expressed that since the responsiveness of the department has been improved, the system has become faster. 10% of the officers responded that the portal has helped the department in maintaining permanent record with no risk of chronic data misplacement. Another 10% of the officers responded that it is convenient to read and access the complaint through e-tag issued by department after receiving applications and 4% of the officers responded that the system has paved path for quick disposal of complaints.

Table 3: Impact of digitization on police efficiency

| Response | Percentage of respondents |
|--|---------------------------|
| Easy to lodge a complaint, no photocopy required (money & time saved), no reference needed | 2% |
| Faster system, rapid action, source feedback, check on police | 74% |
| It is convenient to read the complaint and access the system through e-tags | 10% |
| Permanent record, no chronic misplacement of data, senior officers directly monitor the progress | 10% |
| Quick disposal of complaints | 4% |
| Total | 100% |

Source: Author's own calculations based on surveyed data

6. CONCLUSION

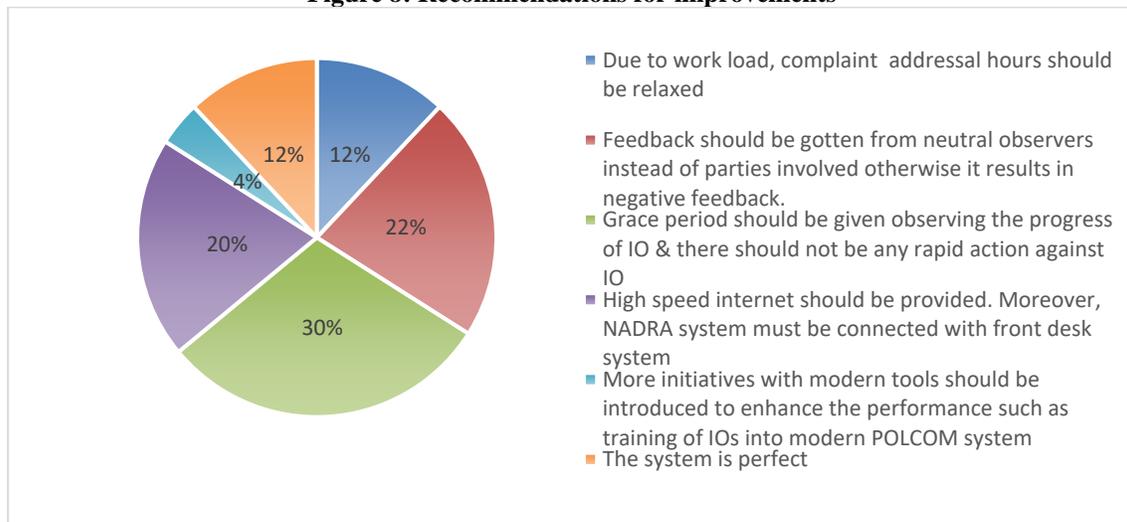
The term e-governance is defined as the process of adapting information and communication technology as a tool for digitizing and automating internal operations of government and facilitating its external interactions i.e. with citizens and agencies (OECD, 2009). Digitization of these operations not only improves the efficacy by reducing the overhead costs but also by minimizing the expected time required for proceedings. It is relatively a new branch within the field of information systems and economies around the globe have launched various projects targeting the provision of electronic services to the citizens. (Patel & Jacobson, 2015). The success of e-government depends much on how an economy works and how the information related to the changes within the government body flow to the citizens. E-government is more about transforming government so that it can become more citizen-centric. Information technology is playing a very important role in the life of people all over the world and is changing the life of people and changing the rules of business. E-government has been one such area whereby government is using Information and communication technologies (ICTs) to provide speedy and efficient services to people at large. Although the aim of e-government is to enrich the lives of citizens, business, employees and other agencies the journey is not smooth and without obstacles. Obstacles like citizen awareness about e-services, and shortage of skilled and technical workers in this direction poses major obstacles towards e-government in developing economies. Also the complexity in e-government program is very wide and this poses major challenges before the government machinery to implement on a larger scale.

Information and Communication Technology (ICT) is believed to have brought positive changes in the efficiency of police department. The implementation and adoption of innovative technology is assisting to fight against criminal violence, terrorism and has made the process of filing complaints quicker and easier in district Gujranwala. Not only has it exerted a significant impact on the efficiency of police department but the prevalence of law and order condition has also declined the crime rate which in turn has increased market level confidence in the district thereby contributing to make Gujranwala a prominent industrial hub and economically stable district.

7. POLICY RECOMMENDATIONS

It is important to note the recommendations given by police officers for the better functioning of the department. 30% of the challenges ridden officers recommended that grace period should be given observing the progress of IO & there should not be any rapid action against IO. 20% of the respondents responded that high speed internet should be provided as slow internet has tendency to completely paralyze police efficiency. Moreover, the officers also stressed that front desk should be integrated with NADRA system to make the functioning of the system more efficient and reliable. 22% of the respondents recommended that feedback should be gotten from neutral observers instead of parties involved in a criminal or civil activity otherwise it would result in negative feedback. 12% of the officers recommended that due to work load, sometime it gets difficult to address complaints in stipulated time therefore, complaint addressal hours should be relaxed. 4% of the officers recommended that more initiatives with modern tools should be introduced to enhance the performance of the department such as training of IOs into modern POLCOM system.

Figure 8: Recommendations for improvements



Source: Author's own calculations based on surveyed data

Apart from these, the effectiveness and efficiency of police department can also be enhanced by improving police-public relation. In this regard, the role of media cannot be neglected. One such attempt is to broadcast police activities in the community and also to

reporting district and provincial level news on local television channels. Moreover, psychological response and organizational reactions of implementing ICT in police department cannot be neglected if we want to improve the performance of police department otherwise, this extraordinary development rate of IT can make the economies suffer from additional costs. Therefore, the police department and IT policy makers should collaborate for better outcomes.

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Profile Of Understanding The Concept Of Students Rectangular Based On The Theory Of Pirie-Kieren Reviewed From Different Types

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Abstract- Mathematics is a science that plays an important role in human life which is also a basic science taught from the most basic level or elementary school to varsity level. In addition, mathematics is also a continuous science in which there are basic material (prerequisite material) that must be mastered by students by understanding the problems in the material before entering into higher material. Every student has different ways of understanding a problem. One of them is the way of male students and female students intellection. This is caused by the slow pace of students in receiving and processing information to understand problem. The Importance of Understanding in Mathematical Learning Becomes the Basics of Pirie-Kieren developed a Theory of Understanding. Pirie and Kieren's theory states that the development of mathematical understanding is formed based on the initial understanding and the form of repetition of understanding to the outermost understanding that when in the learning process students return to the previous level of understanding and then progress to the next level of understanding. In the development of one's understanding there are 8 levels namely *Primitive Knowing*, *Image Having*, *Image Making*, *Property Noticing*, *Formalising*, *Observing*, *Structuring* and *Inventising*. This research is a descriptive study with a qualitative approach that aims to describe students' understanding of concepts according to Pirie Kieren's theory based on gender differences.. The selection of research subjects was determined based on gender differences, namely men and women. The research subjects chosen were 1 male student and 1 female student. Data collection techniques were carried out by giving TPKS and the results of student interviews. Research data in the form of TPKS results and interview results. Based on the results of the study, the male subject (ANY) shows that at the *primitive knowing* level, he knows the sides and the angles and define them. Measuring angles with a protractor, recognize rectangles according to their characteristics, in *image making* level, can develop ideas from previous knowledge that able to classify and mention the forms of flat facets, and able to measure the lengths of the sides and angles of the rectangles. At image having level, he have done mental activities namely with the existence of ANY media can identify two-dimensional figure of rectangular, and then explain the activities that are in his mind when using the media. At the level of *property noticing*, suspect the existence of a relationship between flat shapes or differences between flat quadrilateral, then ANY TPKS complete accord with surprise, and On *formalising* level, can determine the circumference and area flat segiempat, and can be explained that the steps undertaken in determining the circumference and area can be used. While the female subject (TFH) shows that at the *primitive knowing* level, it can know the sides and angles and define them. Measuring angles with protractor, recognizing rectangles according to their characteristics, at level 1 *image making*, can develop ideas from previous knowledge that is able to classify and mention the forms of flat, fixed shapes, and can measure the length of the sides and quadrilateral angles. At the level of having image, it has done mental activity namely in the presence of TFH media can identify flat earthquake construction and then describes the activities he has in mind when using media At the property noticing level, suspect the existence of a relationship between the flat shape of the view or the difference

between the rectangular flat building, then TFH completes the TPKS according to the expectations. At level *formalising*, can determine the rectangle circumference and area, you cannot explain that the steps taken in determining the circumference and area can be used.

Keywords : Pirie- Kieren Theory , Concept Understanding, Quadrangle, Gender

I. Introduction

One of the basic knowledge taught in elementary school is mathematics. Mathematics is one in among the subjects which emphasizes a lot on deep understanding of solving a problem. Every day without realizing it or not, humans will face a problem. Problems faced by humans are sometimes a matter of mathematical concept. With the emergence of problems, people will definitely try to understand the problem to solve it . The main emphasis of good mathematics learning is how to better understand mathematical concepts. In order for students to be able to understand mathematical concepts, mathematics learning must be able to provide students the opportunity to construct mathematical concepts, so that students are not only crammed with abstract mathematical material that makes it difficult for students to understand mathematics. The link between the information contained in the concept and the net structure of cognition (schema) that has been owned by someone (Hiebert & Carpenter, 2007, p.42). This can be identified through two things, namely: 1) through the number of network linkages between elements / attributes (information) that build a concept with the knowledge scheme that the individual has; and 2) through the strong functional relationships of the linking networks formed.

Understanding comes from the word "understand". According to KBBI (2015), understanding means understanding, which can be interpreted as a learning process that follows learning outcomes in accordance with learning objectives. In addition, the term *understanding* was also described by Hiebert and Carpenter (in Styliandes, 2008) as " *a mathematical idea or procedure or fact is a part of an internal network. More specifically, the mathematics is a mental representation of a network of representations* ". Based on the above opinion, a mathematical idea or procedure or fact is said to be understood if this becomes part of the internal network. More specifically understanding in mathematics can be interpreted as a *mathematical idea (procedure or facts) that understood if the mental representation is an element of the representation network* . It means that the relationship ethics between internal representations of constructive ideas, then there is formed a network of knowledge. Therefore a mathematical idea, procedure, or fact is perfectly understood if it is strongly interwoven with existing networks and has more connections. In other words, mathematics will be understood if the mental picture thought by students can be clearly related to the representation it has.

NCTM (2000, p. 11) mentions " *Student must learn mathematics with understanding actively building new knowledge from experience and previous knowledge*". Learning with understanding is building a new knowledge gained and associating with various kinds of knowledge that have been previously owned by students that must be able to learn mathematics with understanding, by actively building a new knowledge from experience and initial knowledge that has been previously owned .

Understanding is one of the things that must be considered in the learning process. Every student is expected to understand what is and has been learned. Students' understanding is one indicator of achieving learning goals. Gragae (2001, p. 232) states " *The importance of understanding is crucial by the entire world. To the teacher, students' understanding of mathematics is a sign of achievement having met the goal of teaching* . For educators, student understanding is a sign of achievement in learning.

Piaget (Mousley, 2004, p. 378) states that " *understanding as constructed, developed and organized as a result of cognitive interaction between sensory experience and existing and existing schema* ". According to Piaget, understanding is built, developed and organized as a result of cognitive interactions between existing sensory experiences and schemes. This shows that there is a process of constructing knowledge actively from students, so that students not only receive knowledge from passive teachers.

In accordance with constructivism theory, educating is not the process of transferring information to students and learning is also not a passive activity in absorbing information from teachers or books. But in educating teachers it should help students in constructing their own ideas using the knowledge they have had before. There are three

factors that can be used to develop classroom learning, namely: 1) conditioning students' reflective thinking, 2) creating social interactions between students and student-teachers, and 3) using models or tools for learning.

In reality, the teacher is currently carrying out learning with the stages of presenting definitions and then giving examples and finally giving the task to be done at home. In this way the students learning tends to be as a listener and recipient information, and then students work on assignments as s u dah modeled by teachers. Students work procedurally and understand mathematics without reasoning, so understanding mathematics is not meaningful.

As a result of the process students are only limited to "imitating" procedures (steps of completion) that have been done by the teacher. Even students often "do not know" why they should use such a procedure, which is important for students is "already" using the procedure exemplified by the teacher and obtaining answers that are in accordance with what is desired by the teacher. In this case students do not need to think of alternatives (other ways), which may be more efficient and effective.

One of the things that is more supportive of this "imitation process" is the desire of educators to be faster in evaluating. In this case the evaluation will be easy to do, if the way done by students is uniform. Therefore the emphasis on procedures (how to answer) becomes dominant in learning. As a result the learning process does not develop an understanding of concepts that are not well constructed.

Brown and Cocking (NCTM, 2000, p. 20) suggest that conceptual understanding is an important part of knowledge that is needed to solve a problem. This also relates to the opinion expressed by Djaramah (2008, p. 152) that procedural knowledge and conceptual understanding are equally important for building skills in mathematics, learning with understanding will make the next learning process easier.

The concept is one mathematical object. According to Soedjadi (2000) "In mathematics the object being studied is a basic object consisting of 1) facts, 2) Concepts, 3) Relations or rules and (4) Principles".

According to Budiarto (2016) students can be said to understand a concept or understand the concepts given in the learning process when he is able to express or re-explain the concept by using his own words and not just memorizing. In addition, it can also find and explain the relationship between concepts and other concepts that have been studied first. Therefore, students must be accustomed to bring up new ideas, solve problems, and find something that can be used for their needs, and familiarize students to construct their own knowledge. To ascertain whether or not students understand mathematics or not is to identify how that understanding occurs (Gulkilik et al., 2016). A theory from Pirie and Kieren (1994) describes the process of mathematical understanding such as the statement "*It is a theory of the growth of mathematical understanding as a whole, dynamic, leveled but nonlinear, transcendental recursive process*" (p. 166). Pirie and Kieren (1994) see understanding as a whole process of growth.

According to Pirie (1992), understanding is the ability to explain a situation or an action. From this understanding, understanding is *ability* someone to search for, choose and create an active learning *situation* to capture the meaning and meaning of *a* concept.

Pirie and Kieren's theory states that mathematical understanding is formed based on initial understanding and the form of repetition of understanding to the outermost understanding that when in the learning process students return to the previous level of understanding and then progress to the next level of understanding. In the development of one's understanding there are 8 levels namely *Primitive Knowing, Image Having, Image Making, Property Noticing, Formalising, Observing, Structuring and Inventising* .

S ISWA often do not understand the concepts in mathematics, and are far from understanding the true meaning of mathematical concepts. Because all mathematical concepts and procedures are built into mind (Steffe, 2001, 2004; Thompson, 2003; von Glasersfeld, 1983), understanding mathematics can be difficult. This is an important problem, and needs to be considered to assess students' understanding of mathematical concepts (Pirie & Kieren, 1989; Skemp, 1976). Assessment of student understanding of mathematical concepts is not an easy task, thus only a limited part of student understanding can be assessed (Sierpiska, 1994).

One concept in mathematics is the concept of geometry. Geometry is a branch of mathematics that does not prioritize relationships between numbers, even though it uses numbers. But geometry studies the relationship between dots, lines, angles, fields and flat and built up spaces (Susanah & Hartono, 2012, p. 1).

Geometry has an important role in mathematics. Walle & John stated several reasons for the importance of studying geometry. 1) Geometry is able to provide more complete knowledge about the world. 2) Exploration of

geometry can develop problem solving abilities. 3) Geometry plays an important role in learning other concepts in mathematics learning. 4) Geometry is used every day by many people. 5) Geometry is a fun lesson.

From the statement, it is expected that geometry material can be mastered and understood by students. But in fact there are still many students who have not mastered and understood geometry, especially in quadrilateral, because quadrilateral is one of the important geometrical material, which is often found in everyday life.

Quadrangle is one of the concepts that forms the basis of geometry. When learning the concept of quadrilateral students construct a quadrilateral concept in an effort to understand the concept. An understanding that has been formed about the concept of quadrilateral will be stored in the long-term memory of students. At certain times the quadrilateral concept is needed again, for example to understand other concepts related to quadrilateral concepts. Because the quadrilateral concept has been stored in the memory of students, then to use the quadrilateral concept in these situations must reconstruct the quadrilateral concept that has been understood before. Because the fourth place is also one of the prerequisite materials in learning to build space in the next class.

But most students still have difficulty when understanding quadrilateral. This difficulty can be seen from many students who experience errors when solving quadrilateral problems (Anzora, 2013). Molle (2000) argues that the errors experienced include quadrilateral concepts, symmetry concepts, mobile concepts and principles and concepts and broad principles of flat building. In accordance with Dian (2014), which revealed that there were several problems that resulted in students tending to make mistakes when solving quadrilateral. In solving contextual problems related to geometry students often experience difficulties, for example making images that correspond to the purpose of the problem and students often find it difficult to connect between a concept and another concept. These errors are thought to be caused by a lack of understanding of students on quadrilateral material.

Researchers choose Elementary School (SD), because elementary school is one form of formal education unit that organizes general education at the basic education level (PP NUMBER 17 OF 2010 Article 1 Paragraph 8). Also because since elementary school lay the foundation or foundations of all scientific disciplines including mathematics. The considerations for the selection of fifth grade elementary school students as research subjects are as follows: (1) According to Havighurts (Sofyan, 2016, p. 12-13) the task of developing children and schoolchildren (6-12 years) is related to attitudes, behavior and skills that should be mastered with the age or phase of development, namely learning basic skills in counting; (2) The age of grade V elementary school students when associated with intellectual stages, Piaget (Omrod, 2008, p. 45) students at ages 6 or 7 years to 11 or 12 years, enter the concrete operational stage. At this stage the child has begun to use clear and logical rules and is characterized by *reversibility* and eternity. Children have logical thinking skills, but only with objects that are protective; (3) when children enter the operational *operation stage (concrete operation stage)*, their thinking processes become organized into a larger system of mental processes, for example, *operations*, which make it easier for them to think more logically based on information given to them. Even though students who demonstrate concrete operational thinking have featured many features of logical thinking, their cognitive development is in perfect numbers.

Mulyono (2011) argues that basically every individual is unique. Each individual has distinctive characteristics, which are not shared by other individuals. One of them is the difference in ability possessed by each individual in dealing with mathematical problems. In this regard, mathematics learning in schools must involve male and female students, many opinions suggest that women are not successful enough to learn mathematics compared to men. . This opinion was concluded from the opinion of some experts in the field of psychology, for example (Bratanata in Suprianto, 2017, p. 81) saying that women are generally better in memory and men are better at logical thinking. Likewise, (Katono in Suprianto, 2017, p. 81) argues that however good and brilliant the intelligence of women is, but in essence women almost never have a thorough interest in theoretical questions like men, women are also more close to theoretical life issues, women are also closer to abstract aspects. From the expert's opinions, related to mathematical abilities, it resulted in women being portrayed as being less intelligent in mathematics than men.

Carr and Davis (Casey, 2001. p. 29) shows "*further the first grade boys could use manipulation as well as the girls, but the girls could not use retrieval the facts" as well as boys, even when instructed to retrieve the facts*". It can be said further that first-class boys can use manipulatives as well as girls, but girls cannot use fact-finding like boys, even when instructed to take facts. In a *longitudinal* study Fennema (in Cesey, 2001, p. 29) also found that in

classes one and two, girls were more likely to use more abstract solution strategies that found conceptual understanding.

Based on the explanation of some of these things, the researcher was interested in conducting a study entitled "Profile of Understanding the Concept of Elementary School Quadrilateral Students According to Pirie and Kieren Theories Viewed from Sex Differences ". This study aims to . 1) Describe the profile of quadrilateral conceptual understanding of female students according to Pirie-Kieren theory, 2) Describe the profile of understanding the quadrilateral concept of male students according to the Pirie-Kieren theory

II. Research Elaborations

The design of this study is included in Qualitative research . This study aims to analyze students' understanding of concepts according to Pirie Kieren's theory based on gender differences then this research is descriptive with a qualitative approach. Qualitative research is research that is used to examine natural conditions. In addition, this study aims to uncover and provide an overview of the object of scientific research. Researchers choose qualitative research because researchers want to reveal and give an idea of the object of scientific research. Researchers chose qualitative research because researchers wanted to reveal and illustrate the profile of understanding the concept of quadrilateral students according to Pirie Kieren theory based on sex in natural conditions.

This research was carried out at SDN MADANI PALU. The selection of the subject of this study is in accordance with the consideration that the fifth grade elementary school students have studied square, rectangular and parallelogram material in class V. The research subjects selected amounted to two students, consisting of one male and one female student.

Techniques in choosing research subjects in this study are started from Determination of classes then Establish criteria for prospective subjects , Criteria to consider are mathematical abilities. Prospective research subjects must have equivalent mathematical skills. The subject's mathematical abilities are seen from the results of tests of mathematical abilities that have been given by researchers. In addition, the researcher also asked for consideration from the mathematics teacher who knew the ability of prospective research subjects in the field of mathematics , then grouped students by sex , and finally selected one student from each group .

The instruments used in this study are two, namely, the main instrument which is the researchers themselves and supporting instruments, namely the task of understanding quadrilateral concepts (TPKS) and interview guide texts made by researchers based on desired objectives in this study and audiovisual recording tools

an early-stage stage pursued by researchers in conducting this study of merencanakan research instruments up to prepare a report of the research is the first planning done at the planning stage are the Develop research proposals, research instruments covering Designing Concept Training Task Quadrilateral (TPKS) , Validating the research instrument , Requesting permission to conduct research from the campus and the school where the data was collected , and visiting the school to conduct research . Both t AHAP implementation conducted at the implementation stage is where the research m elakukan observation, m entukan subject of study by gender, m emberikan TPKS to the subject of research, m elakukan penelitian interview on the subject, and m arius transcript of the interview. Third, the data analysis carried out at the stage of analyzing this data is to clarify / categorize data , reduce data , present data , interpret / interpret data , and draw conclusions . And the last stage in the implementation of this research is t AHAP make a research report

III. Results or Finding

Based on the results of research that has been obtained in this study , the level of understanding according to Pirie and Kieren's theory in male students is obtained as follows.

The level of understanding of the male subject concept (ANY) starts at the *primitive knowing* then moves forward to *doing the image* level and then advances again to *image reviewing* at this level the flow of understanding the ANY subject goes to the level of *predicting* that is aware of the relationship quadrangle building, then back again to level *image seeing* and can explain the activity, namely doing mental activities and explaining what is in his mind, meaning ANY has been at the level of *image saying* , then the subject ANYWAY moves forward to the level

of *property predicting and property recording* ie ANY subject completes the task in accordance with his expectations, in completing the task to go to *formalizing* level , ANY subject moves back again to level *image seeing* , ANY performs mental activity (using media) to help him complete the next task, then moves forward to the level *method* for determine area and twill g waking up in a square, then moving forward to the ANY *justifying method* can explain that the method and steps taken can be used.

At the level of *Primitive knowing* male students, namely ANY, have initial knowledge related to the concept of quadrilateral (jajargenjang, rectangle and square). ANY defines the length, rectangle and square with its own language, besides ANY it can also know the sides and angles and define them. To explain what is meant by the expression expressed, ANY says that the line has a face that is equal to the length, even the square is the same as the number but has a different angle, and for the ANY square it says that all sides of the square are the same. ANY can also define sides and angles with their own language, that is, sides are lines that are interconnected so that they can form a flat shape, whereas for ANY angle it also shows that angles are two lines that meet each other and the meeting point is determined by an angle. The ability of the ANY to define quadrilateral, is needed to understand the properties of a quadrilateral. This is consistent with the statement from Mokwebu (2013, p.8) that "*the Primitive knowing which piece of mathematics starts*", which means that this level indicates the existence of an initial understanding that students have as a basis for growth in understanding mathematics.

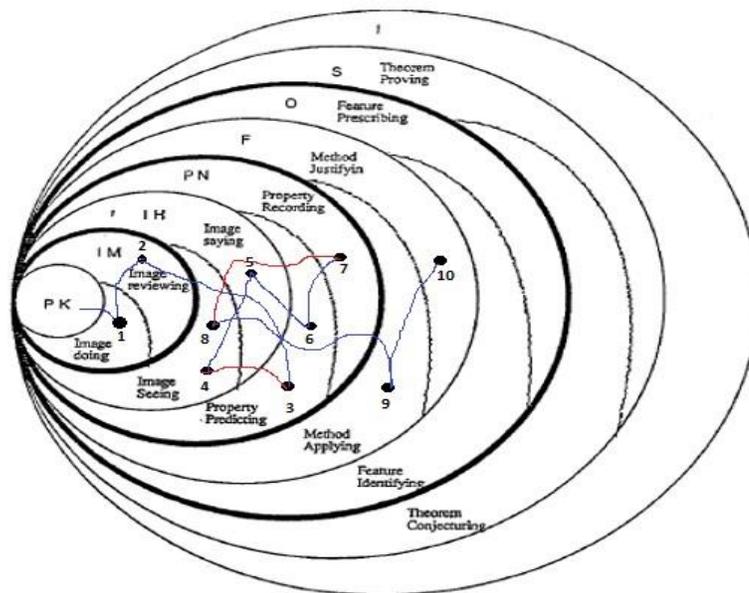
In the *making image* level ANY determines the value of the side length and the size of the angle using the previous knowledge about the background point of view and also the meaning of the sides and angles. ANY measures the sides and angles of each square, but ANY understands that to measure the length of the sides and the width of the sides of the rectangle and the length of the wall can only measure once and to measure the square ANY simply measures the sides and angles once, at this level ANY has taken a mental action, this mental action occurs after ANY doing physical action, that is when playing or moving the media movements provided so realize that there is a relationship between the square and the jargon. Meel (2003, p.144) states "... *The actions at this layer involve the learner doing, either mentally or physically, something to an idea about a concept*". In accordance with that opinion ANY tries to determine the results of the measurement of the sides and angles of a flat rectangular build ANY has acted either mentally or physically which aims to get an idea of a concept.

At level *image having* , ANY explains again about the solutions that have been previously worked out verbally, that is, determining each result from measuring the sides and angles of a flat, flat angle. Initially ANY measures the edges and angles of angles by measuring each side and angle, but after getting the value of the side and angle of the angle, ANY realizes that to measure the side of the contents and angles one side can be measured and just one corner, so that in performing tasks at this stage ANY can accomplish with a fairly short time, far from the time predicted by the researcher. This is in accordance with the statement of Mokwebu (2013, p. 8) that "*At the level of the learner can use a mental construct about an activity without having to do certain activities which brought it about*". This means that at this level ANY can use mental construction about an activity without having to do physical activity, ie students also have ideas in their minds. Manu (2005, p. 49) also states "... *A learner demonstrates the use of a mental construct or 'mental plan' about the topic that is able to use that particular image without doing the activity itself ...*". The statement means that the ANY student has shown how students make mental constructs or (mental plans) of the topic without having to work on examples. Therefore students may replace the picture of knowledge that has been obtained previously and replaced by mental knowledge (Meel, 2003).

At the level of *property noticing* , ANY describes the properties of rectangles using their own language and also at this level ANY understand and suspect that there is a relationship between each rectangular flat build. ANY can explain how to measure the lengths of the sides and angles and begin to suspect that there are differences in properties between flat shapes and then do the activity from the guesswork that is only measuring once for the length and width on a rectangle and also just measuring one side to square. Likewise the angle ANY guesses that the four angles in the rectangle and square are the same, so ANY only takes one measurement at the rectangular and square angles. Pirie and Kieren (1994b, p.170) stated that "*A fourth level of understanding can be used to construct context specific, relevant properties*" This statement means that understanding is made when students can manipulate or combine aspects from one mental picture to build a specific context based on the relevant nature of a particular topic. Furthermore Pirie-Kieren states that at the *level of property noticing* students record differences, combinations or relationships between images and determine various details of the image. From these statements, it can be concluded that at the level of the *noticing ANY property*, you can associate, combine and differentiate the properties of a concept that has been understood at the previous level to be used on the next relevant topic or material.

On the *formalizing* level ANY applies a quadrilateral flat shape when measuring the circumference and width of a rectangular flat wake. In completing the ANY problem, it has been understood that there is a relationship between flat shapes, it can be seen that when ANY explains to measure long lines and rectangle can use the rectangular area formula. So that it can be concluded that ANY is able to associate the initial knowledge with the knowledge that has just been obtained. Besides that ANY can also provide an explanation or statement that in order to find a wide range of spaces is the same as looking for a rectangular area. This is consistent with the statement of Mokwebu (2013, p. 9) that, "There is a need for generalizing what is happening and it is not longer needed to relate back to specific mathematical contexts that gave rise to understanding". Based on the statement of the second statement that on the ANY *formalising level* is able to generalize what he has gained from *property noticing* and does not need to reconnect with certain mathematical contexts to bring out his understanding .

The understanding flow obtained by male students in understanding quadrilateral concepts according to Piere-kieren theory is illustrated in the following graph.



While the results of the research obtained , the level of understanding according to Pirie and Kieren's theory on female subjects was obtained as follows.

The level of understanding of the concept of female subject (TFH) starts from the *primitive knowing* level , then moves forward to the level of *doing image*, namely TFH can measure the length and angle of the quadrangle, then move forward to the level *image reviewing* because TFH can expose steps from the activities he did, then TFH moved forward to the level of *image seeing* as well as *predicting property* because it had identified a flat building in his mind by using media and guessing the existence of links between quadrangular groups, then moving forward to the level *image saying* namely TFH explains what has been known about the media about flat quadrilateral construction. Furthermore, the flow of understanding of the subject of TFH went backwards to the level of *doing image* and moved forward again to the level of *property predicting* and *recording property* that TFH knew and suspected that there was a relationship between each rectangular flat building, ie not measuring the sides repeatedly as before. Next, go again to the *formalizing* level, but at this level TFH only reaches the *aplying method section*. TFH is not up to the level *metho justifying* because it can not explain the steps performed may be used.

At the *primitive level of knowing* female students , namely TFH, they have initial knowledge regarding quadrilateral concepts (jajargenjang, rectangle and square). The TFH defines lengths, rectangles and squares with its own language, besides TFH can also know the sides and angles and define them as evenly as they can recognize shapes of rectangular flat shapes by showing a number of available flat shapes around the room. This is in accordance with the statement from Mokwebu (2013, p. 8) that "*the Primitive knowing which piece of mathematics starts*", which means that this level indicates the initial understanding that students have as a basis for growth in mathematical understanding.

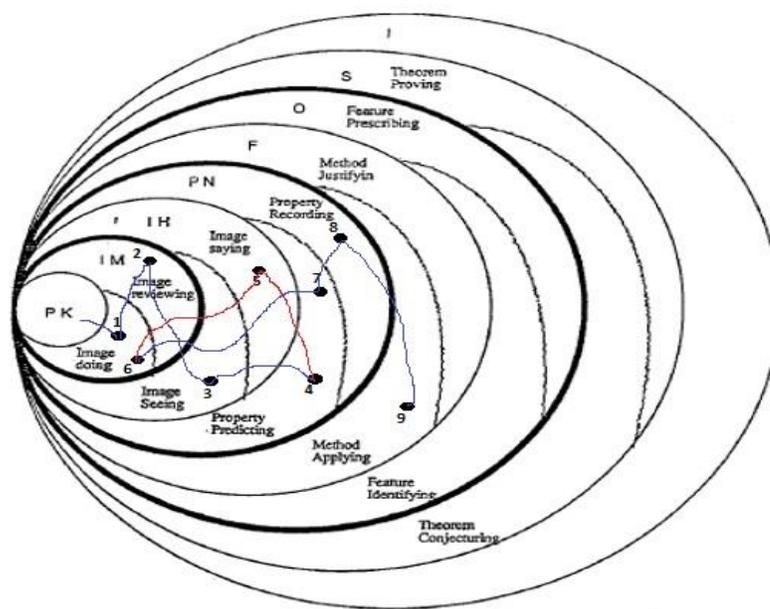
At the level of *image making* TFH determines the value of the side length and the size of the angle by using previous knowledge about rectangular flat shapes and also the meaning of the sides and angles. TFH understands the difference between flat building after measuring the sides and angles of each flat wake. But at this stage TFH in determining its sides and angles TFH takes repeated measurements, so that the TFH takes a long time to complete its task. Meel (2003, p.144) states "... *The actions at this layer involve the learner doing, either mentally or physically, something to an idea about a concept*". In accordance with this opinion TFH tried to determine the results of measurements of the sides and angles of a rectangular flat build TFH has acted both mentally or physically which aims to get ideas from a concept.

At the level of *image having* , TFH can explain what he already knew after using the media, TFH realized that there was a relationship between square and square structures, while square and rhombus. TFH also explained that the relationship between the flat building is located on the side. TFH has been at the level of *having image* because it has identified a flat build in its mind by using media and then explaining what has been understood about the media about rectangular flat builds. This is in accordance with the statement of Mokwebu (2013, p. 8) that "*At the level of the learner can use a mental construct about an activity without having to do certain activities which brought it about*". This means that at this level TFH can use mental construction about an activity without having to do physical activity, that is, students also have ideas in their minds.

At the level of *property noticing* , TFH describes quadrilateral properties using its own language and also at this level TFH understands and suspects that there is a relationship between each rectangular flat building. TFH can explain how to get a circumference value on a rectangular flat building and has understood that to get the circumference of a flat building that is by adding together its sides. Pirie-Kieren states that at the *level of property noticing* students record differences, combinations or relationships between images and determine various details of the image. From these statements, it was concluded that at the level of *property noticing* TFH has been able to associate, combine, and distinguish the characteristics of a concept that has been understood at the previous level to be used on the topic or subsequent relevant material.

At the TFH *formalizing* level it can complete the task by determining the width of the space according to many tiles. But in completing the task, TFH cannot provide a reason, that is to determine the extent of using a formula. In this case TFH does not reach the *formalizing* level because it contradicts the statement of Mokwebu (2013, p. 9) that, "*The learner is able to generalize what he has seen in property noticing and no longer needs to relate back to specific mathematical contexts that gave rise to his understanding*". Based on the statement that TFH has not been able to generalize what he has gained from *property noticing* .

The understanding flow obtained by female students in understanding quadrilateral concepts according to Piere-kieren theory is illustrated in the following graph.



IV. Conclusion

Profile Concept Training Quadrilateral Male students according to the theory of Pirie and Kieren namely (ANY) has a level of understanding of the concept began in the *primitive knowing* then move forward to the level of *image-doing* and then bergrak forward again to *image reviewing* these levels groove understanding of the subject ANY walked to *Property predicting* level that is to realize and suspect that there is a relationship between quadrangle building, then return to level *image seeing* and can explain the activity, namely doing mental activities and explaining what is in his mind, meaning ANY has been at the level *image saying* , then the ANY subject moves forward to the level of *predicting property and property recording*, ie ANY subject completes the task according to his expectations, in completing the task to go to the *formalizing level* , the ANY subject moves back again to level *image seeing* , ANY does mental activity (using media) to help him complete his next assignment, then move forward to the *method level apying* to determine the area and circumference of a flat square building, then move forward to the ANY *justifying method* that is able to explain that the method and steps taken can be used

Profile Concept Training Quadrilateral Student woman by theory Pirie and Kieren namely (TFH) has a level of understanding of the concept of starting from a *primitive knowing*, then move forward to the level of *image doing* that TFH can measure the length of the side and a large corner bangundatar quadrilateral, then move forward again to level *image reviewing* because TFH can explain the steps of the activities that it does, then TFH moves forward to the level of *image seeing* and *property predicting* because he had identified a flat building in his mind by using the media and guessing the relationship between the quadrangular groups, then moving forward to the level *image saying* that TFH explained what had been known about the media about quadrilateral flat builds. Furthermore, the flow of understanding of the subject of TFH went backwards to the level of *doing image* and moved forward again to the level of *property predicting* and *recording property* that TFH knew and suspected that there was a relationship between each rectangular flat building, ie not measuring the sides repeatedly as before. Then it goes back to the *formalizing level* but at this level TFH only arrived at the *aplying method section*. TFH does not reach the level of justifying method because it cannot explain the steps taken can be used.

Based on the results of the research and discussion in this study , it can be concluded that male and female students have different mathematical abilities, namely male students can reach the level of formalizing that is up to the *aplying method* and the *Justtifying method* , and female students can reach the *formalizing level* but only reaches the *aplying method level*

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Identification of Eddy in Bone Bay By Using Landsat-8

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Abstract

Bone Bay is a fairly potential water area in eastern Indonesia, especially in its fisheries. Eddy can indirectly affect water fertility, so it is necessary to identify eddy to see which areas are fertile. Identification of Eddy is done by utilizing AVISO and LANDSAT- 8 which was processed in Envi 5.1 then included in ArcGIS where eddy points can be produced in July as many as 33 points, August 74 points, September as many as 46 points and October as many as 15 points, where eddy currents gather in the middle of the Bone bay caused by current movement.

Keywords

Eddy, Bone Bay, Arc Gis, Temperature, Landsat

INTRODUCTION

Bone Bay is a fairly potential water area in eastern Indonesia, especially in its fisheries. Bone bay has fertile waters, rich in nutrients so it is usually used as a place for spawning and maintenance. The fertility of a waters characterized by increased nutrient can affect the abundance of phytoplankton because nutrient is needed to support the growth of phytoplankton (Nybaken, 1992).

Nutrients needed by phytoplankton can be carried by upwelling while downwelling carries large oxygen content (Azis, 2006). In the area that occurs upwelling is known as O₂ that is rich in dissolved nutrients, phosphate and nitrate which can support plankton growth because the surface is rich in nutrients which will provide food for fish. There will be the food chain where phytoplanktons act as primary producers, whereas zooplanktons play an important role in moving energy from primary producers to a higher level of consumers. Whereas downwelling which occurs alternately with upwelling can carry gas compounds that are needed by living things under the sea to stay alive. In the eddy cycle phytoplankton can change, variations in eddy properties change the distribution and level of phytoplankton by influencing upwelling displacement and the swirling horizontal scale of the vortex (Liu, 2018).

In the simulation of the barotropic 3-dimensional current model, upwelling is viewed from the parameters of the vertical current that moves from a certain depth to a more shallow / surface layer. The simulation results also show the phenomenon of sinking/downwelling currents around the waters of the Gulf of Bone, but with a not so significant speed. Upwelling phenomena in the Gulf of Bone waters occurs due to the existence of Ekman Transport which attracts surface water masses to the West from the east coast of Bone Bay so that the water mass from the bottom layer rises to the surface to fill the void (Pranowo et al. 2014).

Eddy current transport, trap and disseminate chemical elements, dissolved substances, nutrients, small organisms, and heat. Eddy can trap water masses for months within hundreds of kilometers. Eddy initially provides heat transfer and nutrients horizontally and vertically but over time moves away and eventually the vortex dies (Williams, 2011). There are two types of eddy movements, namely cyclonic (clockwise in the southern hemisphere) and anticyclonic (counter-clockwise in the southern hemisphere). Eddy currents can cause upwelling or downwelling in accordance with the direction of rotation (Martono 2009).

Eddy indirectly can affect the fertility of the water, so that eddy identification is needed to see which areas are fertile. Identification of Eddy is done by utilizing LANDSAT-8 because it has better capabilities where this satellite carries two sensors namely Operational Land Imager (OLI) with a spatial resolution of 15 meters and a Thermal Infrared Sensor (TIRS) sensor with a spatial resolution of 100m to produce thermal infrared channels (USGS, 2019). In addition, Landsat-8 can also reduce electromagnetic wavelengths so that it is more sensitive to differences in reflectance of seawater or aerosols in the atmosphere.

Research methods

Identification of Eddy was carried out by interpreting LANDSAT8 satellite data from July to October 2018 then processed using ENVI 5.1. To determine the position of eddy is done by looking at the temperature changes that occur where the area is different from the surrounding area. according to (Arraza et al, 2003; Castellani, 2006 and ChuanHua, 2015) areas that have a sea surface temperature that resembles a circle and experiences an increase in temperature from the center of the outgoing circle can be identified as eddy. Then the direction and speed data and sea surface temperature data are overlapped using ArcGIS 10.2 and seen in each eddy occurrence can be seen what day, month and how much eddy is formed.

RESULTS AND DISCUSSION

The results of the Landsat 8 data processing using Envi 5.1 which uses sea surface temperature data as an indicator of eddy formation as with the research conducted (Lehodey et al, 2006) that uses sea surface temperature as an indicator in determining upwelling and downwelling associated with potential fish areas. (Nontji, 2008) stated that upwelling and downwelling can be caused by eddy currents. Then the eddy obtained will be processed by using Arcgi so that there are four map images of eddy identification in each month from July to October 2018, as below

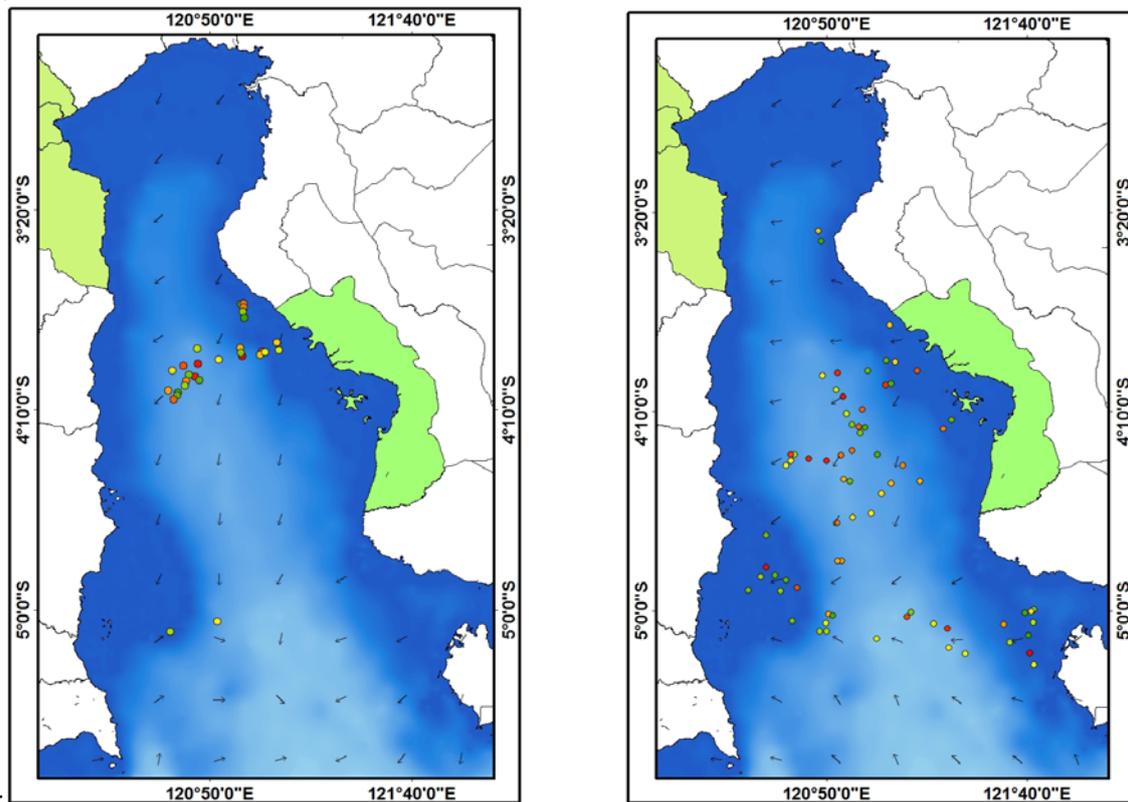


Figure 1. Eddy identification map based on LANDSAT imagery in July 2018 and b in August 2018

In figure 1, in July 2018 33 eddy can be identified with the lowest sea surface temperature obtained is 20.34°C while the highest temperature is 24.95°C. The temperature 20°C is three points, 21°C 9 points, 20°C 10 points, temperature 23°C as many as 8 points, and 24°C as many as 3 points. As for August 2018 the identified eddy was 74 points with the lowest sea surface temperature of 20.2°C and the highest sea surface temperature of 27.34°C. The temperatures of 20°C contained of 13 eddy points, 21°C as much as 17 eddy points, 22°C 18 eddy points, temperature of 23°C as much as 17 eddy points, temperature of 24°C as much as 6 eddy points, temperature of 25°C as much as 1 eddy tube.

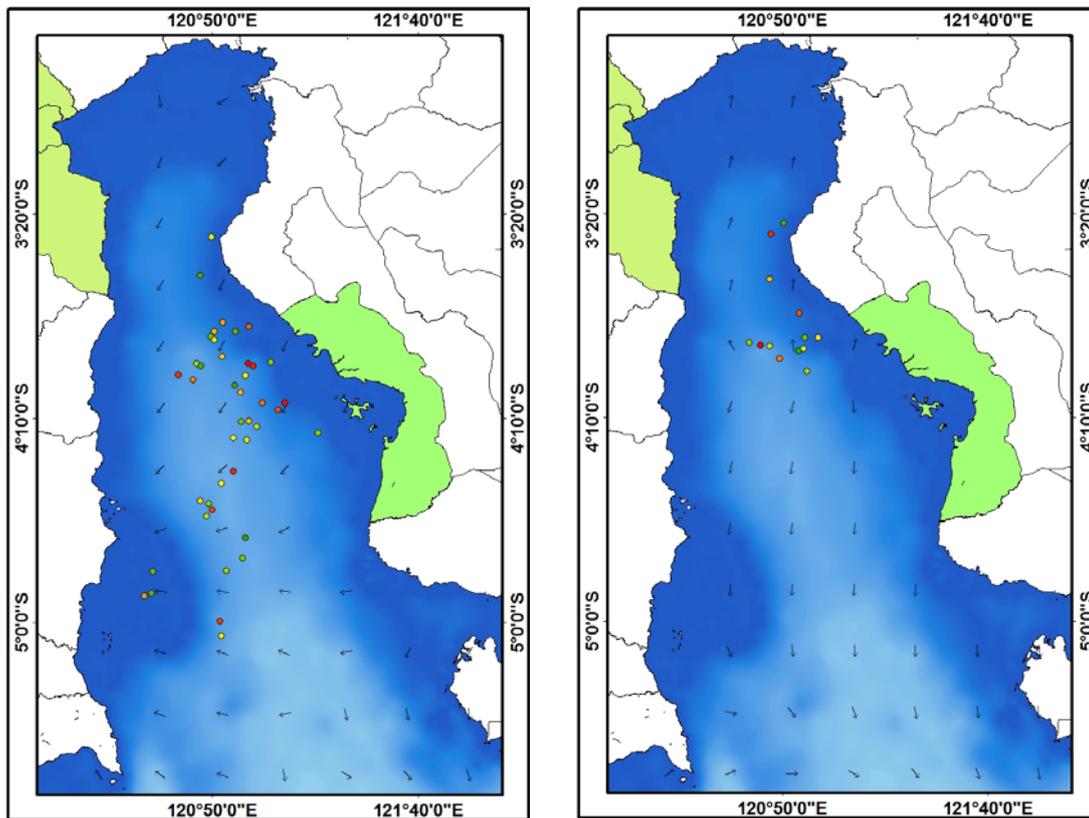


Figure 2. Eddy identification map based on LANDSAT imagery a September 2018 and b in October 2018

In Figure 2, we can see eddy identification in September and October 2018, wherein September 2018 there were 46 eddy points with the lowest temperature was 20.13°C and the highest was 24.6°C. The eddy point at temperature of 20°C was 9 points, 21°C as much as 8 points, temperature of 22°C as much as 12 points, temperature of 23°C as much as 13 points and temperature of 24°C as much as 3 points. Whereas in Figure 2b is the eddy identification map in October 2018 that had 15 eddy points which the lowest eddy temperature was 20.74°C and the highest temperature was 25.7°C. The eddy point of 20°C was 2 points, of 21°C 4 points, of a temperature of 22°C as much as 1 point, at temperature of 23°C as much as 2 points, at a temperature of 24°C as much as 2 points and at temperature of 25°C for 2 points.

In July it was found 33 eddy points. In August there were 206 points, September as many as 78 points and October as many as 15 points which range of sea surface temperature is of 20-25°C. The value of sea surface temperature was lower than the surrounding sea surface temperature identified as eddy. Eddy currents are oceanographic phenomena that have an important influence on atmospheric conditions and dynamics. This effect is through the formation of upwelling and downwelling due to eddy. Welling and downwelling currents will change the sea surface temperature. According to research done by (Martono, 2010), Changes in sea surface temperature will change air pressure, then the wind circulation will result in ocean waves and ocean currents. This chain process will continue.

Based on research done by (Kunarso et al, 2011) SPL distribution has different values in each season. In the East season, in general, the waters have a temperature range of 24-27°C with conditions in the eastern region cooler than the western region. The waters tend to be warm up in the western season with a range of values of 28-30°C and tend to be homongen each month. The intensity of upwelling increases with conditions of very low sea surface temperatures and higher chlorophyll-a content.

In June-August, when the sun is in the northern hemisphere, the continent of Asia has a higher temperature than the continent of Australia. This causes the air pressure in the Asian Continent to be lower than the air pressure on the Australian Continent so that the wind blows from the Australian Continent to the Asian Continent. This condition is called the East Season

and the wind that blows comes from the southeast (Southeast Muson Wind) for the Southern Hemisphere. In December-February, the position of the sun is in the southern hemisphere so that the continent of Asia has a higher pressure than the continent of Australia. This causes winds to blow from the Asian Continent to the Australian Continent. This condition is called West Season and the wind originating from the northwest (Wind of the North West Monsoon, in the Southern Hemisphere blowing (Wyrтки, 1961)

In July to August, the number of eddy has increased while from August to September and from September to October there have been decreases in the number of eddy points. This is in accordance to the study of (Alawiyah, 2018) which stated that June-August is the most potential month for triggering eddy currents that can cause upwelling. The upwelling phenomenon that occurs in the west is calculated to be weaker than the eastern season because overall upwelling is a response to the blowing of the southeast monsoon (Susanto, 2001). (Wyrтки, 1987) said that in normal circumstances, in the Pacific blows southeast easterly winds throughout the year. This wind friction power serves to push the mass of water in the Pacific towards the west. So that there is a buildup of water masses in the western Pacific which are close to Indonesia.

The upwelling phenomenon occurs when the wind blows from the east and the drag effect turns to the south because in the north there is a barrier (another land/beach/ dominant wind front, in the southern part of the earth), then causes a series of water masses to be dragged to the south away from the coast so that the mass of water from the deeper layers will fill the void in the surface layer. Downwelling is a process that occurs when the wind blows in the opposite direction. This pattern of upwelling and downwelling is very likely to affect the pattern of aquatic fertility in the region.

In figures 1 and 2, it can be seen that the eddy points converge in the middle due to the current located in the north of the Bone bay was towards the south of the bone bay and so the southward current moves towards the northern of Bone bay too. Based on research (Widodo, 2014) the Bone bay currents generally moved from the south to the northwest of Wulu and then moved along the east coast to Tanjung Tabako and turned west around Murante, then joined the west coast railroad which moved from the southern of Lakaloto Cape Bay to the North to go to the reefs and Palopo. In addition, some of the moving currents from Tanjung Tabako run along the East and North shores then turn towards Southwest to the coast of Palopo.

In coastal areas, upwelling can occur if a mass of surface water flows to leave the coast. Off the sea, upwelling occurs because of a spread surface pattern (divergence), so that the mass of water from the subsurface layer will flow up to fill the void that occurs due to the spread of the current. This process is characterized by a significant decrease in sea surface temperature (around 2°C for the tropics, and > 2°C for subtropical regions (Dahuri et al., 1996). Changes in sea surface temperature will affect the production and distribution of fish in the Sea (Nybakken.1988). Water temperature varies from time to time in accordance with natural conditions that affect these waters. According to Illahude (1997), the influence of strong land on water temperature causes coastal waters to have higher temperatures than offshore waters. According to (wicaksono, 2010) the temperature in the sea can be affected by the influence of the season on regional sea circulation processes such as the warm flow of water from the Pacific Ocean to the Indian Ocean through parts of Indonesia and also from the existence of the El Nino phenomenon.

Upwelling areas are generally characterized by high nutrient content and lower surface temperatures than surrounding areas. The condition of low sea surface temperatures and relatively higher surface wind speeds coincides with the abundance of chlorophyll-a concentrations as an indication of upwelling. And conversely the abundance of chlorophyll-a tends to decrease where sea surface temperatures experience a temporary increase as soon as the wind decreases. This indicates a downwelling in the region, the sea surface temperature is very heavy (Ratnawati, 2016). Sea surface temperature is very closely related to primary productivity and ocean currents (Arsjad, 2014). Sea surface temperature in June has decreased which is predicted to occur upwelling or removing of low-temperature water masses from deeper layers of water to the surface. The upwelling process that occurs in a waters is thought to affect the living conditions of phytoplankton, hydrology and nutrient enrichment in these waters

(Yoga, 2014; Rochmady, 2015) and in his research (Nontji, 2008) said that the decreases in surface temperature, the presence of upwelling is also characterized by rising levels nutrients or nutrients in that location. Nutrients, especially phosphate and silicate in the photic zone, have an effect on the productivity of phytoplankton, therefore phytoplankton in large numbers will be found at the location of upwelling.

CONCLUSION

The conclusions that can be taken in the study of identification of eddy in Bone bay by using Landsat is that the number of eddy in each month is different. The number of eddies identified in July is 33 points, in August are 74 points, in September are 46 points and months October is 15 points. The eddy points gather in the middle of the Gulf of Bone caused by current movements

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Productivity of Fishing Tuna Sirip Yellow (*Thunnus Alabacares*) Using Ulur Pances in Luwu Bay Water

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Abstract- Bay is a waters region that has high potential for yellowfin tuna (*Thunnus albacares*) because it is a migratory route. This encourages fishermen to install new FADs so that the number of FADs increases. So it is necessary to do research on "stretch fishing productivity for catching Midlun fish (*Thunnus albacares*) using FADs in the waters of the luwu bone district. Data used is data catch per fishing effort on each ship. The productivity of catching yellow fin tuna (*Thunnus albacares*) highestship 1 is in the range of 0.72-0.82 kg / minute with a total frequency of 216 times and the highest productivity of fishing in ship 2 is in the range 0.72-0.82 kg / minute with a total frequency of 154 times .

Index Terms- produktivitas, madidihang, handline

a fishing aid, as an effort to maximize their catch (Jumzurizal, 2012). Rumpon is a tool for fish collectors that uses various forms and types of binding / attractors from solid objects, which function to lure fish to gather, which is used to improve the efficiency and effectiveness of fishing operations (KKP 2014).

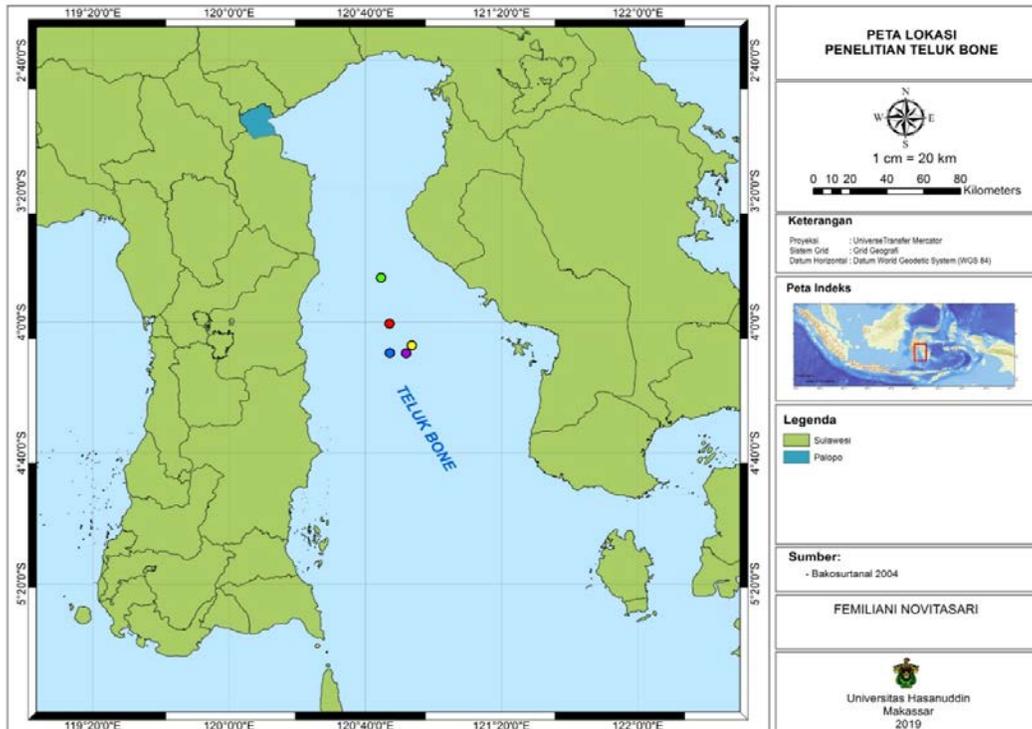
The increase in production is determined by the fishing effort and also by the technology used. The use of FADs as a tool for catching *Thunnus albacares* in bone bay the value can increase the productivity of the catch. This encourages fishermen to install new FADs so that the number of FADs increases. Seeing the role of FADs as a tool for catching stretch fishing rods. So it is necessary to do research on "the productivity of stretching fishing for catching Midlunfish (*Thunnus albacares*) by using FADs in the bay waters of Luwu District.

I. INTRODUCTION

Bone bay is a waters region that has a high potential for yellowfin tuna (*Thunnus albacares*) because it is a migratory pathway. Assets in the form of abundant natural wealth have the potential to become an economic source for the community. One of the efforts of the community to use it is by conducting capture fisheries. One of the dominant fishing gears that are operated on bone bay is stretch fishing rods. Retractable fishing is one of the people's fisheries business which has simple construction and simple and easy operation. This causes stretching rods to be one of the dominant fishing tools that are operated and uses FADs as

II. MATERIALS AND METHODS

Description of the location of the study. This research was carried out in the Bone Bay of Luwu District, Larompong Subdistrict South Bone Pute Village (Figure 1), from September to November 2018. Data was collected by following fishing operations in 2 units of fishing rods and conducting interviews with fishermen. The data taken is the amount of production (tail) of yellow fin tuna (*Thunnus albacares*) and the length of time the fishing is carried out in FADs.



Picture 1 . Location of capture area



Figure 2. Fishing location in FADs

Productivity catching area. The data of catch and fishing time obtained are then analyzed using the following equation:

$$Prd = \frac{C}{T}$$

Note:

Prd: capture productivity

C: Catch (Kg)

T: Effective time of processing (Minutes)

The kruskal-wallis test is conducted to determine the difference in productivity on each ship by following the hypothesis:

Determining the hypothesis:

H0: There is a productivity difference in each vessel

H1: there is no difference in productivity on every ship

decision:

Value significance > significance level ($\alpha = 0.05$), then H0 is accepted

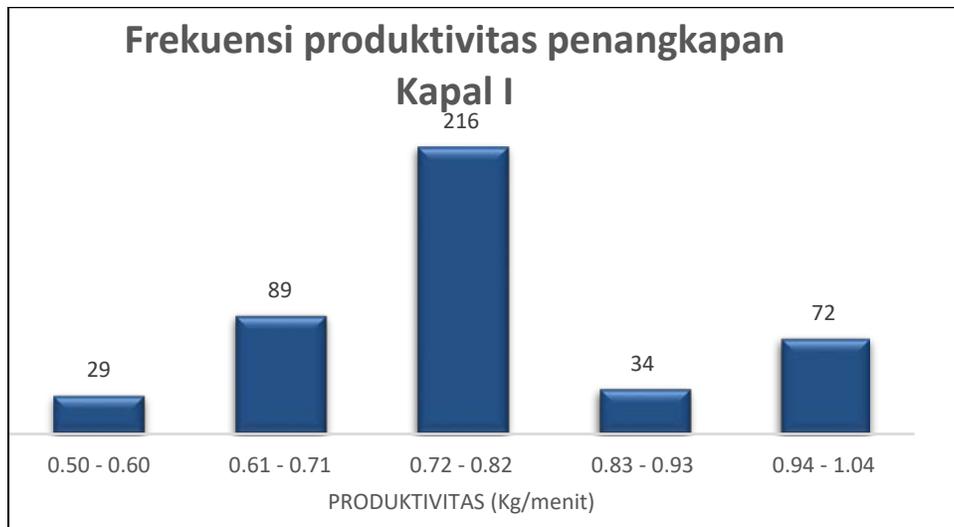
significance value < significance level ($\alpha = 0.05$), then H0 is not accepted

III. RESULTS

Productivity fishing vessel stretching first.

Catching productivity is a measure of the production capability of a type of fishing gear. The productivity of catching yellow fin tuna (*hunnus alabacares*) in FADs on ship I showed an uneven graph. The structure of the retaining productivity value

found in the first vessel is in the range of 0.50 - 1.04 kg / minute. With a total overall productivity of 342.8 kg / minute and a total frequency of 440 times. From the graph, it can be seen that the highest productivity is in the range of 0.72-0.82 kg / minute with the total frequency of 216 times the lowest productivity in the range of 0.50 - 0.60 kg / minute with a frequency of 29 times.



Picture 1 . Productivity of fishing rods on ships

Productivity fishing rods Ship II .

The productivity of catching yellow fin tuna (*hunnus alabacares*) in FADs on ship I showed an uneven graph. The structure of the retaining productivity value found in the first vessel is in the range of 0.50 - 1.04 kg / minute. With a total overall productivity of 202.43 kg / minute and a total frequency of 440

times. From the graph it can be seen that the highest productivity is in the range of 0.72-0.82 kg / minute with a total frequency of 154 times while the lowest productivity is in the range of 0.83-0.93 kg / minute with a frequency of 3 times.

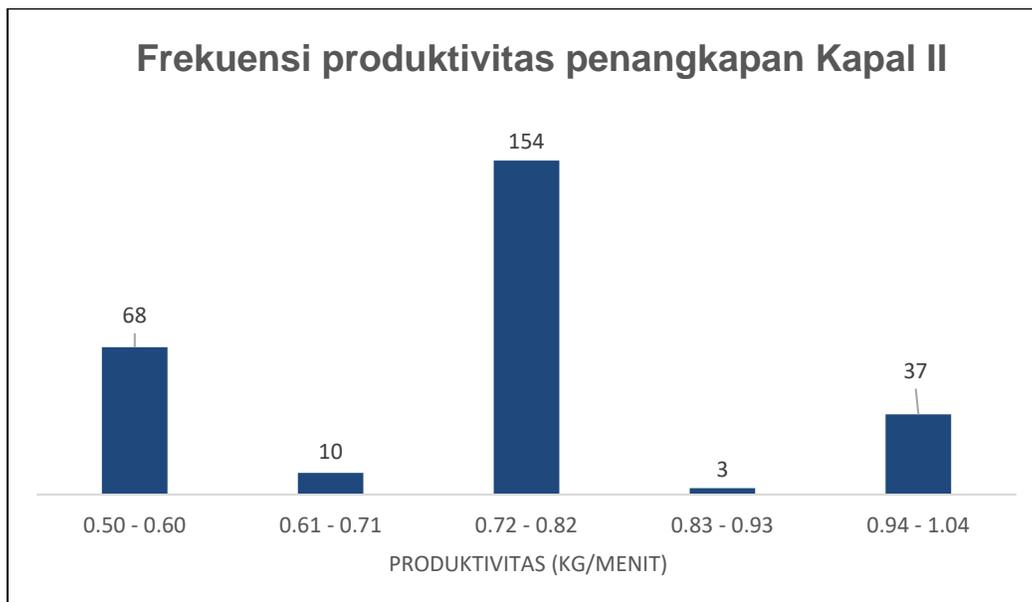


Figure 2. Productivity of stretched fishing vessels II

Analysis of different kruskal walis test results on productivity on 2 stretching fishing vessels The

value of productivity on both vessels was statistically significant between vessel 1, ship 2 (H = 16,564 df, p = 0,0001)

with average rank the first ship is 379.87 and the second ship 318.69 H is the *kruskal wallis* value where the *chi-square* value in the df table is freedom and p is the significant value p value is

0,0001 smaller than 0.05 then there are different values of productivity in each ship.

**Table 1. Results of analysis of different testwalis
 kruskalKruskal-Wallis Test**

| Ranks | | | |
|----------------|-----------|-----|--------------|
| | SHIP | N | Mean Rank of |
| PRDUCTIVITY of | ship 1 | 440 | 379.87 |
| | vessels 2 | 272 | 318.69 |
| | Total | 712 | |

| Test Statistics ^{a, b} | |
|---------------------------------|-------------|
| | PRDUCTIVITY |
| Chi-Square | 16,564 |
| df | 1 |
| Asymp. Sig. | ,000 |
| a. Kruskal Wallis Test | |
| b. Variable Grouping: SHIP | |

IV. DISCUSSION

Catching productivity is a measure of the production capability of a type of fishing gear. Fishing productivity is stated in the comparison between production and fishing efforts. The productivity of catching a fishing gear can be one indicator to determine the potential of a resource. Catching efforts based on the length of time the fishing gears lead to a tendency for productivity differences to occur between the two fishing boats (Nelwan et al., 2015). The fluctuations in the frequency of stretching fishing productivity on both vessels can be influenced by various factors, including the presence of tuna resources in FADs locations as the main function of using FADs to concentrate fish (Nelwan et al., 2015), seasonality factors which are related to food availability and suitability habitat (Mapstone et al., (2008); Saul et al., 2013; Nelwan et al., 2015) weather at the fishing location, meal time of yellow fin tuna (*Thunnus albacares*), fishing trip duration and supply of basic operational needs on board .

The productivity of catching yellowfin tuna (*Thunnus albacares*) between September-October can be said to tend to decrease, this is because in October and September it is not the season of yellowfin tuna fishing (*Thunnus albacares*). The catching season of Mididah (Yellowfin Tuna) occurs in the first transitional season of the beginning of the year, namely the west to east transition and the second transition season to the end of the year with the peak fishing season in the first transition season of the beginning of the year. The occurrence of fluctuations in the season pattern of catching Midnightfish (Yellowfin Tuna) is caused by monsoon and rainfall factors (Nontji 2002; Wijaya 2012; Putri 2015) so that fishermen do not carry out fishing

operations or move locations in safer waters. Apart from monsoon and rainfall factors, catching season fluctuations are caused by migratory tuna in the Flores Sea, Selayar Islands Regency. According to the research results of Safruddin et al (2015) In September, the most productive tuna DPPI was found in the waters west of Selayar Island and South Tarupa Island. This is due to other environmental factors that influence fish distribution patterns such as primary productivity, salinity, migration to spawning areas, dissolved oxygen content, seasonal fronts and others.

V. CONCLUSION.

The productivity of catching yellow fin tuna (*Thunnus albacares*) highestship 1 is in the range of 0.72-0.82 kg / minute with a total frequency of 216 times and the highest productivity of fishing in ship 2 is in the range 0.72-0.82 kg / minute with a total frequency of 154 times .

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The Effect Of Creative Leadership And Knowledge Sharing On Employee Performance

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ABSTRACT- This study aimed to analyze the influence of creative leadership and knowledge sharing on employee performance. The samples of this study were 73 employees at Badan Perencanaan Pembangunan Daerah (Bappeda) of Lahat Regency. carried out in a census. This study used indicators to measure each construct and the measurement model was structural, so the analysis of this study used the Partial Least Square (PLS) method. The result of the study showed that Creative Leadership and Knowledge Sharing had a positive and significant influence on Employee Performance in Bappeda of Lahat Regency and Creative Leadership had a greater influence than Knowledge Sharing on Employee Performance.

Index Terms- Creative Leadership, Knowledge Sharing, Performance

I. INTRODUCTION

Human resource management generally aims to obtain the highest level of employee development, to study the relationship and the role of humans in the organization. Emotion and strong identification of employees to the superiors can be done by instilling pride, respect and trust in leaders, (Hadiwijaya, 2015). Each leader can have a different leadership style from one another, and a leadership style does not have to be better or worse than the other leadership styles. Leadership style is a behavior pattern which is designed to integrate the organizational goals with the individual goals to achieve a certain goal, (Hadiwijaya, 2015; Heidjrachman and Husnan, 2002). Today the company is a structure which consists of interdependent units, therefore it requires a creative leader.

Creative leader is a leader who can give new ideas from all owned sources and able to analyze the problem well so that the organization will run well and smoothly. According to (Agboola, Alex & Tsai, 2012), Creative Leader is a leader who has the ability to think and act out of the box, autonomy, share new skills to solve problems, reconstruct new ideas into innovation. Creative is one of the important aspects which must be owned by a leader, because it becomes a tool so that the leader is able to formulate good organizational goals. Creative leadership does not only lead the leader to the success of leading the organization, but it can also make everyone achieve success.

Knowledge sharing can also open the opportunity to explore and obtain or create new knowledge. The knowledge sharing approach from the innovation perspective or the exploratory knowledge sharing is expected to become a trend of

knowledge sharing in the future. The knowledge sharing model will lead to the knowledge exchange between individuals through the formation of a knowledge network, the knowledge network function is to ensure the flow of knowledge (Memah et al., 2017). The knowledge sharing will lead to the maximum exploitation of knowledge. In addition. The knowledge sharing can also open the opportunity to explore knowledge in order to obtain or create new knowledge. Benefits of knowledge sharing are: (1) Creating equal opportunities for organizational members to access the knowledge and learn about it (2) Increasing learning opportunities or reduce the time needed to acquire and learn new knowledge (3) Speeding up the completion of a task or problem, because the settlement is no longer starting from the zero point (4) Resolving a problem by utilizing a method that has proven effective in the unit or elsewhere (5) Providing basic materials for innovation in the form of varied and multiperspective knowledge, (Memah et al., 2017; Tobing, 2011).

Performance is the result of work in quality and quantity which is achieved by an employee in carrying out his duties, in accordance with the responsibilities given to him, Mangkunegara (Hadiwijaya, 2017a; Hadiwijaya and Hanafi, 2016). Performance is basically "what is done or not done by the employees". Performance is the result or the level of a person's overall success rate over a certain period of time in carrying out tasks compared to various possibilities, such as the standard of work result, the target or criteria that have been determined in advance and agreed upon, (Hanafi and Hadiwijaya, 2017; Mathis and Jackson, 2006). Performance is the result of a process which is measured during a certain period of time based on a predetermined provision or agreement (Edison and Komariyah, 2016). Performance is the work result of an employee in carrying out the tasks which have been given by the organization to him.

This study aims to determine and analyze the influence of creative leadership and knowledge sharing on employee performance.

II. LITERATURE RIVIEW

2.1. Creative Leadership

Creative leader is a leader who has the ability to think and act out of the box, autonomy, share new skills to solve problems, reconstruct new ideas into innovations, (Agboola, Alex & Tsai, 2012). Effective leader has three characteristic aspects, namely: (1) ability, (2) personality, and (3) motivation,

(Gibson et al., 2009). (Hoy and Mskel, 2005) state that the research on traits often includes physical characteristics such as a leader must be large and high, and a number of personality factors, needs, values, energy and level of activities, tasks and interpersonal competencies, intelligence, and charisma. The characteristics of the most popular and the most up-to-date leader are: honest, foresight, competent, inspiring, intelligent, fair, insightful, encouraging, easy to understand, master, cooperative, decisive, imaginative, ambitious, courageous, caring, mature, loyal, self-control, and free, (Yaverbaum and Sherman, 2008). Leader behavior includes the implementation of planning, clarification of roles or objectives, monitoring performance, giving rewards, giving sanctions, supporting, admission, training, being role models, building teams, developing visions, the importance of change, and participating, (Yukl, 2010).

2.2. Knowledge sharing

Knowledge sharing is a basic facilities, employees can exchange knowledge and contribute to the application of knowledge, innovation, and ultimately to the competitive advantage of the organization (Wang and Noe, 2010). The effort of knowledge sharing is a central process of Knowledge management (KM), can improve the performance of innovation and reduce the excessive cost of learning (Calantonea et al., 2002; Matzler and Mueller, 2011). Knowledge sharing capability can be categorized into three dimensions: the willingness to share knowledge, the ability to learn, and the ability to transfer knowledge (Mathuramaytha, 2012). In the operational phase, organization needs to stimulate and enhance the knowledge capital and provide their workers with adequate facilities to communicate and share information, (Nonaka and Takeuchi, 1995). Knowledge sharing becomes two dimensions, namely 1). Knowledge donating is the process of contributing knowledge by leaders, employees, and others. The knowledge donating indicator is a process when leaders share their new knowledge to employees, as well as among fellow employees, willing to share knowledge and experience with other people outside the company. 2). collecting knowledge indicators that inform employees when asked, seeking help when they can not solve the problem, and actively collecting knowledge, by (Hooff and Weenen, 2004). The climate of openness and trust among members of the organization are the basic conditions of the tacit knowledge formation, which is divided and used in the process of innovation, (Alwis and Hartman, 2008).

2.3. Performance

Performance is basically "what is done or not done by employees". Performance is the result or the level of overall success of a person over a certain period in carrying out tasks compared to various possibilities, such as the standard of work result, the target or criteria that have been determined in advance and agreed upon, (Hanafi and Hadiwijaya, 2017; Mathis and

Jackson, 2006). Performance is the result of work achieved by someone in carrying out the tasks assigned to him based on skills, experience, sincerity and time, (Hadiwijaya, 2017b; Hasibuan, 2006). Performance can be assessed or measured by several indicators, namely: 1). Effectiveness, that is if group goals can be achieved with the planned needs. 2). Responsibility, is an inseparable part or as a result of ownership of authority. 3). Discipline, that is obeying the laws and rules that apply. Employee discipline is the obedience of employee concerned in respecting the employment agreement with the company where he works. 4). Initiative, related to thinking power, creativity in the form of an idea related to company goals. The nature of initiative should get the attention or response from the company and good boss. In other words, employee initiative is a driving force of progress that will ultimately affect the employee performance (Hadiwijaya, 2016; Prawirosentono, 2008).

III. RESEARCH METHODS

The samples of this study were 73 employees at Badan Perencanaan Pembangunan Daerah (Bappeda) in Lahat Regency carried out by census. This study uses indicators to measure each construct and also structural measurement model, so the that the analysis of this study uses the Partial Least Square (PLS) method.

IV. RESULT AND DISCUSSION

Respondents in this study were 73 employees of Badan Perencanaan Pembangunan Daerah (Bappeda) of Lahat Regency. From the distribution of the questionnaires conducted, there were 4 questionnaires which were not returned so that the questionnaires that could be processed were 69 samples.

4.1. Confirmatory Factor Analysis

Confirmatory factor analysis is designed to test the unidimensionality of a theoretical construct, or often called testing the validity and reliability of a theoretical construct. dimension validity test of the construct in this study is done by looking at the standard factor loading value of each indicator in the overall model (full model). Indicators are declared valid if the standard factor loading value is greater than 0.5. Reliability testing is done by looking at the value of Composite Reliability in the full model. Indicators are declared good if they have a value > 0.6.

4.1.1. Confirmatory Factor Analysis of Exogenous Constructs

The measurement model to test the validity and reliability of the indicators forming latent constructs is done by confirmatory factor analysis (CFA). In Model_1 CFA Exogenous Constructs

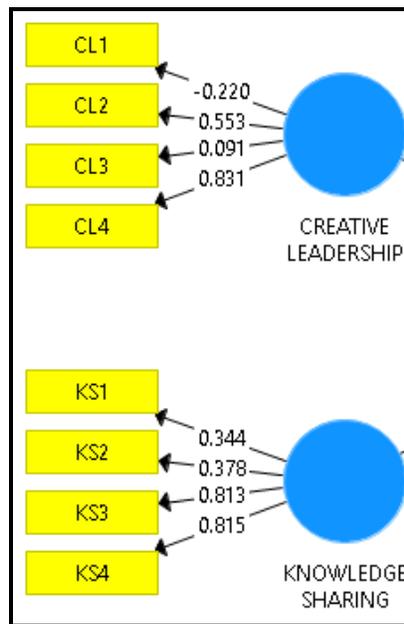


Figure 1. Model_1 CFA Exogenous Constructs

Based on Figure 1. Exogenous constructs still have a loading factor value of less than 0.5, in Creative Leadership variables namely CL1 and CL3, in Knowledge Sharing

variables, namely KS1 and KS2, this dimension is not valid and must be removed so that Model_2 CFA is obtained

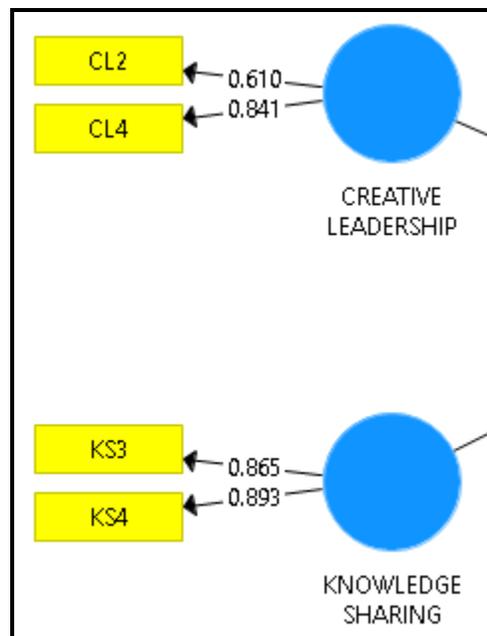


Figure 2. Model_2 CFA Exogenous Construct

In Figure 2. Model_2 CFA Exogenous constructs, all dimensions in the e loading exogenous variable, Creative Leadership variables and Knowledge Sharing variables have

shown to be valid. The calculation results of reliability with Composite Reliability from variables as in Table 1.

Table 1. Loading Factor Values and Exogenous Composite Reliability

| Variable | Construct | Loading factor (> 0,5) | Composite Reliability (> 0,7) | Description |
|--------------------------|-----------|------------------------|-------------------------------|------------------|
| Creative Leadership (CL) | CL2 | 0,610 | 0,796 | Valid & Reliable |
| | CL4 | 0,841 | | Valid & Reliable |
| Knowledge Sharing (KS) | KS3 | 0,865 | 0,872 | Valid & Reliable |
| | KS4 | 0,893 | | Valid & Reliable |

Source: Primary Data Processed, 2018

4.1.2. Confirmatory Factor Analysis (CFA) Endogenous Constructs

The measurement model to test the validity and reliability of the indicators forming latent constructs is done by confirmatory factor analysis (CFA).

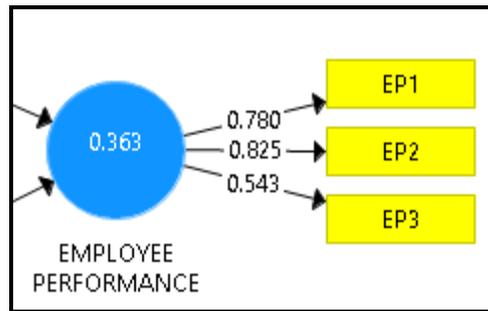


Figure 3. Model_1 CFA Endogenous Constructs

In Figure 3. Model_1 CFA Endogenous construct does not have a loading factor value of less than 0.5 in the Employee Performance variable, it means that the dimension is valid.

The calculation results of reliability with the Composite Reliability exogenous variables as in Table 2.

Table 2. Loading Factor Values and Composite Reliability Endogenous Constructs

| Variable | Construct | Loading factor (> 0,5) | Composite Reliability (> 0,7) | Description |
|---------------------------|-----------|------------------------|-------------------------------|------------------|
| Employee Performance (EP) | EP1 | 0,779 | 0,765 | Valid & Reliable |
| | EP2 | 0,815 | | Valid & Reliable |
| | EP3 | 0,564 | | Valid & Reliable |

Source: Primary Data Processed, 2018

Based on Table 2. It shows that all indicators in the Endogenous variable have shown valid. The calculation result of reliability with the Composite Reliability endogenous variable also shows that the Employee Performance (EP) variable in the full model has good reliability so that it can be analyzed further.

4.1.3. Compatibility Test of the Goodness of Fit Index

To validate the model as a whole, the goodness of fit (GoF) is used. The GoF index value is obtained from the average communalities index multiplied by the R² model.

$$GoF = \sqrt{Com \times R^2}$$

$$GoF = \sqrt{0,867 \times 0,753}$$

$$GoF = 0,808$$

The result of the calculation shows good value in the goodness of fit (GoF) which is equal to 0.808.

4.2. Analysis of Partial Least Square (PLS)

The next analysis is Partial Least Square (PLS) analysis as full model (without involving invalid indicators). The following in Figure 4.1 is the results of PLS.

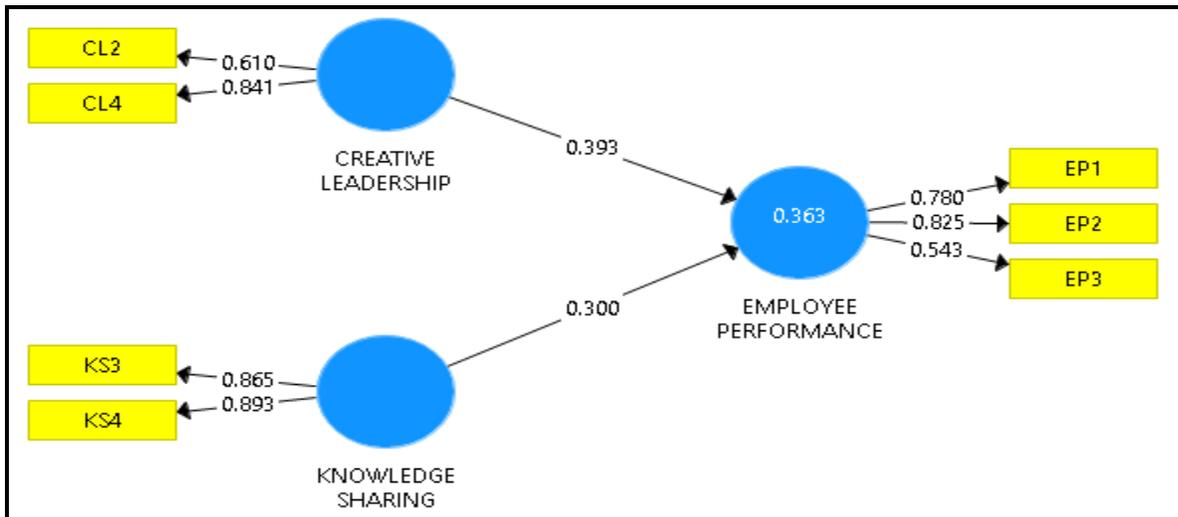


Figure 4. Path coefficient

Based on Figure 4, the structural equation is obtained as follows:

$$EP = 0,393*CL + 0,300*KS$$

Based on the structural model, it can be explained that Employee Performance (EP) is directly influenced by Creative Leadership (CL) and Knowledge Sharing (KS). It shows that Creative Leadership (CL) has a positive effect on Employee

Performance (EP) of 0.393 and Knowledge Sharing (KS) has a positive effect of 0.300 on Employee Performance (EP) in Bappeda of Lahat Regency.

4.3. Hypothesis testing

This analysis is used to test the research hypothesis that has been determined by PLS Analysis based on the t-value shown in Figure 5:

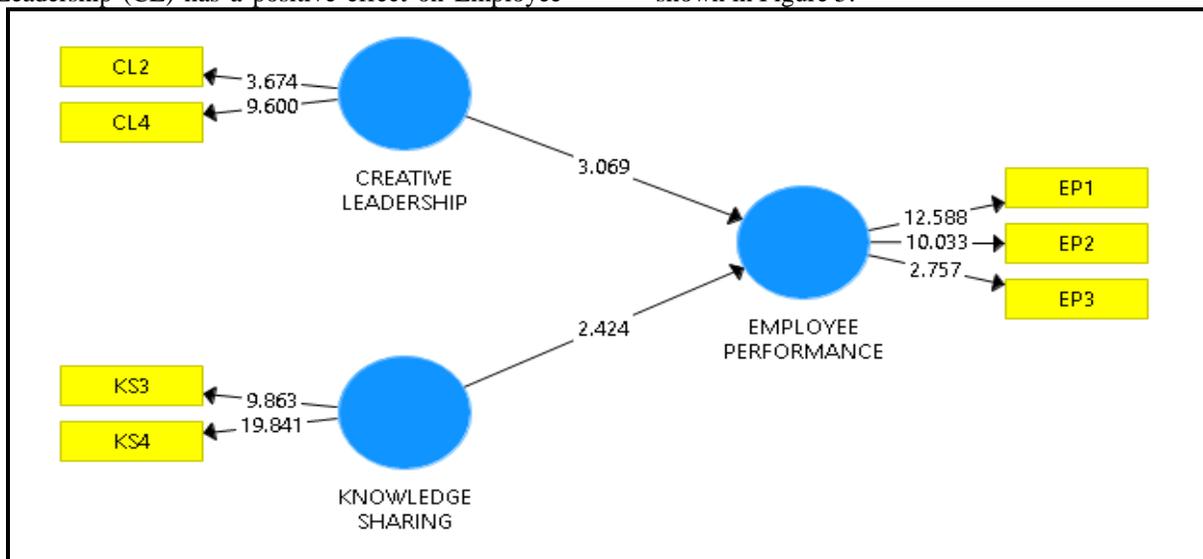


Figure 5. T-test on Employee Performance

Based on Figure 5. It can be seen that the effect of Creative Leadership (CL) on Employee Performance (EP) is 3.069. While the effect of Knowledge Sharing (KS) on

Employee Performance (EP) is 2,424. The level of confidence used is 95%, so that the level of precision or the limit of inaccuracy is $(\alpha) = 5\% = 0.05$ and the t-table value is 1.96.

Table 3. Coefficient and t-count value at level 5%

| Variable | Coefficient | t- count (>1,96) | P Values | Description |
|----------|-------------|------------------|----------|-------------|
|----------|-------------|------------------|----------|-------------|

| | | | | |
|---|-------|-------|-------|-------------|
| Creative Leadership -> Employee Performance | 0,393 | 3,069 | 0,002 | Significant |
| Knowledge Sharing -> Employee Performance | 0,300 | 2,424 | 0,016 | Significant |

Source: Research Data Results (2018)

Based on Table 3, the Effect of Creative Leadership (CL) on Employee Performance (EP) is $3.069 < 1.96$ and P-value $0.002 < 0.05$. It shows that Creative Leadership (CL) has a positive and significant influence on Employee Performance in Bappeda of Lahat Regency. The effect of Knowledge Sharing (KS) on Employee Performance (EP) is $2.424 > 1.96$ and P-value $0.016 < 0.05$. It shows that Knowledge Sharing (KS) has a positive and significant influence on Employee Performance in Bappeda of Lahat Regency.

4.4. Managerial Implications

From the results of this study, it is known that there are creative leadership variables and knowledge sharing on employee performance at Badan Perencanaan Pembangunan Daerah (Bappeda) in Lahat Regency. Thus the results of this study that creative leadership and knowledge sharing variables need to be considered by policy makers in Badan Perencanaan Pembangunan Daerah (Bappeda) of Lahat Regency. Because creative leadership is able to solve problems, reconstruct new ideas into innovation. Creative is one of the important aspects that must be owned by a leader, because it becomes a tool so that leaders are able to formulate good organizational goals. Knowledge sharing is as a facility for employees to be able to exchange knowledge and contribute to the knowledge, innovation, and ultimately improve the performance of employees at Badan Perencanaan Pembangunan Daerah (Bappeda) of Lahat Regency.

V. CONCLUSIONS

The conclusion which is obtained from this study is Creative Leadership (CL) and Knowledge Sharing (KS) have a positive and significant influence on Employee Performance in Bappeda of Lahat Regency. Creative Leadership (CL) has a greater influence than Knowledge Sharing (KS) on Employee Performance. Because Creative Leadership is a leader who can give new ideas from all sources owned and able to analyze problems that occur well so as to make the company run well and smoothly.

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A Phenomenological Study of the Experiences of the Seminarians During Formation

A Research Project Submitted to Martin Luther Christian University, Shillong
Submitted In Partial Fulfilment of the Requirements for the Master's Degree in Counselling Psychology

Fr. Jobin Joseph OSB, MScp

Sampurna Institute of Advanced Studies, Bengaluru

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Declaration: I, Jobin Joseph, hereby declare that this Research Project **A Phenomenological study of the Experiences of the Seminarians during Formation** was carried out by me under the guidance of Sritha Sandon, Associate Professor, Montfort College, Bengaluru.

This Research Project is submitted in candidacy for the award of M.Sc. in Counselling Psychology, to Martin Luther Christian University, in the month of May 2019. This research work or parts of it have not been submitted to any other University for any purpose so far. References borrowed from other sources have been duly acknowledged.

Abstract- This research is an attempt to study the experiences of the seminary students during the formation. A lot of students join the seminary where they teach Biblical themes, moral themes, and even secular themes. The student in the seminary stays for about 10 to 15 years under formation and finally becomes a priest. But it is to be noted that not all who enter the seminary becomes a priest. The number is very less. If a student is taught for so many years about religion, theology and philosophy then what makes them not to stay in the seminary? After a student completes the formation why there are scandals in the church. Why do they leave the seminary in the middle of formation? In this study I have used the Phenomenological method. To answer these questions, 10 boys aged between 16 to 25, in formation are interviewed and they said that they needed more of human concern rather than spiritual learning. There needs changes in the formation in accordance with the time. They also suggested psychological studies to be inculcated to the curriculum. And this study suggests that human and psychological studies together with the normal seminary curriculum will help the students to feel better and remain faithfully in the seminary.

Index Terms- seminary, formation, formater.

I. INTRODUCTION

Religion is one of the important factors in the society that makes the life of the people smooth and safe. Some of them experience God's presence in their life while others live peacefully in their religion. There are so many factors that make the life of the people, whether they believe in any religion or not, smooth and

happy. Some believe that Gods who are in the particular religion give them everything, their life, their job, money and all they need. And to facilitate this, are pastors, priests and several other people who contribute to the system.

Now in every religion there is a place for priest, pastor who is believed to be talking directly with God, who intercedes for the people and who pray on their behalf. These categories, as a rule, are set apart for this special purpose while taking care both of spiritual and material needs to a certain extend. And these are approached by the people at any time of need. Therefore, they are known to be infallible, sacred, powerful, knowledgeable and sometimes, function as judge over the society or the particular system.

Now to make such a great personality there are certain rules and regulations concerning their studies, life and wellbeing.

As in every religion, in Christianity also, there is a system set apart for the study of becoming a priest or pastor. The particular system is called Seminary. According to the Cambridge university dictionary the meaning of seminary is that "a college where people are trained to become priests, ministers, or rabbis".

To point out the example of a particular monastery established in 1987, though they used to recruit at least 15 candidates every year, there are only 7 priests remaining today.

According to a study done (Cassidy caption, 2018) in the year 2006 by the Vatican City News Fide, the total number of priests in the world decreased to 414.969 (- 687). The continent which registered a major decrease was again Europe (- 2.583). There was also a decrease in America (-589). Increase was registered in Africa (+ 1.181) and Asia (+ 1.304) Oceania remained unvaried. Diocesan priests increased by 317 units, reaching a total of 281.831 with a decrease only in Europe (- 1.611) and increase in Africa (+ 983); America (+ 180), Asia (+ 744) and Oceania (+ 21). The number of Religious priests decreased by 1.004 units to a total 133.138. Increase was registered in recent years in Africa (+ 198) and in Asia (+ 560), whereas numbers dropped in America (- 769), Europe (- 972), Oceania (- 21). This statistics shows that in Europe and in the US there is a big change in terms of less members becoming the priests. These are the proportionate studies made in the US. Considering all these studies done so far to find the reason in the decrease of the candidates becoming priests or the reason why they leave in between their particular way of life are many. Today

roughly there are 37000 Christian denominations in the world. The study also says that as many churches or denominations are there so the number of members in those churches abounds to the one third of the whole world population. But the interesting fact is that roughly around 6000 churches are being closed down every year while new ones are being built in different part of the world. The reason for the churches to close down is that either there are not enough priests; the priests don't live a life appealing to the people so they tend to join different churches or denominations or leave Christianity itself, or that newer denominations are being formed. Now, when we consider all these figures and facts together with the recent happenings in the Catholic Church especially – the so called scandalous life of the priests and looking at the priests and students leave the seminary – and the churches being closed down or the people joining other churches, we understand that the need for the study is important.

There are so many studies (Agenzia Fides ,2018) conducted in the Christian world regarding all the above mentioned issues, but to a limited realm either it is done in only one denomination- mostly in the protestant denomination-, among one sector or country –mainly in the US and the Europe .Therefore the need for other denominations as well, is important especially, in the Catholic world which is the largest among all the denominations and in India from where hails the most number of candidates to the priesthood. But I must also state that –it's in Asia the most number of students come for the studies and leave largely, to make it a figure -264 according to a recent study.

All these studies throw light on the need for psychological studies not only for the students but also for the teachers as well. The study in particular states that the teachers are to understand the needs – emotional and physical – of the students and in turn the students, their emotional as well as social needs apart from their faith and beliefs. Finally, faith and belief together with appropriate emotional and social relationship make the life of any student better and thus the life of society or the congregation or whatever denomination he or she lives in.

Here, in this, study I wish to concentrate on the emotional and mental status of the students in formation. I would like to also refer to those who left this particular of life during their studies and the reason why they did. I also wish to interview the teachers or the so called formators who is in charge of the students throughout regarding the pattern they follow in the life of the students and what are the changes they make when, if they found them inadequate.

II. REVIEW

In this chapter certain articles are reviewed studies done in different seminaries and institutions where the religious students study. These studies are conducted on the basis of the need for psychological education for the students in the seminary. These are done because of the certain incidents that took place in the church, among the students and their relationship, and their attitude towards their life and choice. Most of the studies show the necessity of psychological education to be included together with the theological or philosophical curriculum. After comparing the studies and research, they say that those with some knowledge of psychology of humanity do well in life and remain faithful to the life they have chosen, while others do not care for their life, do not

respect others nor understand the human values thus making the life of one and that of others miserable.

In the meeting that was conducted in the month of February, 2019 in the Vatican, regarding the misbehaviour of priests and religious. The topics to be discussed are gay life among the priests, sexual abuse, violence, immorality, and many other similar topics. Most of the experts say that all these happen because of the lack of proper education from the beginning of formation from the early years. The initial years are normally soon after High School or college.

Thus the need for psychological, moral studies, knowledge about the human mind in particular and about relationship, looking at the other person through the eyes being human is very important, the failure of which, will cause problems of all the kind.

The article “Life Satisfaction Of Seminary Final Year Students In Yangon ,Myanmar :A Path Analytic Study Of The Direct And Indirect Influences Of Coping Styles Being Mediated By Stress , Anxiety And Depression by Skeeter Win and Robert Ho (2017).This study was conducted to know the level of the stress, depression, anxiety among the final year seminary students in Myanmar. These being the primary variables the study was focused on employment of the method of coping mechanisms that is Emotion focused and Avoidance focused. The question was which of these two would help the students more in coping up with the primary variables. The study was conducted among 218 students aged between 20 and 45. The report was that as per the understanding that the Seminary study was to help the students to grow more in spiritual life. But, they also concluded that the Seminaries are meant to be centres' of not only spiritual learning but also of academic, social, and learning of every kind. But the learning is stressful for most of the students because of the change of style in life, ministry, assignments, strict timetable and disciplined life. While some students cope with these stressors others who would find it difficult. Therefore the researchers focused on the type of coping styles that each of them put in. Because these stressors would affect the quality of the seminary life positively and negatively. Therefore this study is to understand what style of coping would help the students to be successful in life amidst these stressful factors. It was a quantitative study. There were 218 students both male and female. The method was using questionnaire and there were three inventories: CISS – coping inventory for stressful situations. It contained 48 questions. The second was the DASS- depression anxiety and stress scale. The third one was SWLS – satisfaction with life scale. They used the convenient sampling method to choose the population. They also obtained proper permission from the authorities of the four seminaries from which they selected the students.

The results showed that the more the seminary students employed emotion focused coping to deal with the stressful situations, the higher the reported level of stress and the more they employed avoidance focused coping to deal with the stressful situations the lower the level of depression. The result also showed that the above mentioned two coping styles are below the problem focused coping styles in relation to the life satisfaction and stressful situations. The findings show that the students could employ problem focused coping style in stressful situations. These findings are in line with Lazarus and Folkmans theory that when people are aware that they are capable of solving a problem, they

would employ problem focused coping mechanism. The purpose is to enable the person to solve the issues very effectively. The study also found that the use of emotion focused coping strategy and avoidance focused coping strategy are used because of the various levels of life satisfaction they get and to get out of the stressful situation. Thus it negatively affected them in certain ways. This could be because of the spiritual aptitude or interest they showed in their life which they learned from the formation time.

Finally, the study says that the students should be made aware of the various coping strategies under different situations and help them to act accordingly so that the stress can be reduced and they become more effective.

According to the review by Peter Klpeonis on the book *Guidelines for the Use of Psychology in Seminary Admissions* by the United Conference of Catholic Bishops, Washington. This book was published so that all of the seminary rectors and bishops could make use of this. It was written in the light of psychology using and following psychological theories and terms. This article was written after studying the reports written by the rectors and in charges that had no background of psychological and learning. According to the author, the purpose of the psychological evaluation is to predict whether the candidate can live a healthy way of life and be effective in the future life as well. He says these evaluations are to be carried out seriously and with discretion. These assessments could help the rectors to know the intellectual, emotional, and psychological functioning of the particular student. The report suggests certain components how to make the assessments. They are:

1: psychosocial and psycho sexual interview which will tell about the student's unwanted sexual (orientation) attractions to both men and women, about the social relationship among the others, and social behaviours.

2: intelligent assessment which will tell about the student's current intelligent status.

3: Psychological Testing (structured written, visual, or verbal measures administered) to assess the cognitive and emotional functioning of the applicant.

4: Oral Feedback Session (a meeting of the psychologist with the applicant and some responsible person to discuss the results of the psychological evaluation. This is both for the student and the formater. This will help the formater to know more about the candidate and to form him or her well.

The report also suggests certain impediments to the formation that if the student is from an abusive family background and then he or she can become abusive of others and can be incorrigible. Students with addiction and disorders and students with learning disability can also make impediments to the correct formation. Therefore, the authors suggest that the formaters should be having enough knowledge in human formation, psychology and secular studies. So that he can understand the student well and form in a better way. It also suggests that the assessments and evaluations made should be kept secure and confidential both for future assessment and for the safety of the candidate. Finally, the goal of the psychological evaluation is to help to ensure that only the healthiest men become priests. If a man is accepted in the seminary, the information from the evaluation would be shared with the seminary rector and appropriate formation faculty. An abbreviated report should be shared with the

formation personnel that omit the most intimate details of the seminarian. It is also suggested that all these assessments and reports are to be checked by a professional psychologist. (USCCB, 2015)

The article namely, *Comparison of depression level and identity styles between students in Allameh University and Islamic Seminary* written by A Mahdavi, M Aghaei, MA Besharat, F Khaki Seddigh, SH Akbari, and Z Hamidifar (2015) tries to compare depression and identity styles to specify in which of these groups the level of depression is higher, in addition, which of the identity styles is more prevalent in both groups, thus predicting the depression level.

The study was based on the theory of Erick Erickson's identity v/s role confusion. To say that how depression affects the identity of the person. it was conducted among the youth of 18-25 years old both male and female. According to the study there are four styles of identity: identity gain, interval, identity record and identity dispersion. The individuals who have a dispersed identity present no specified direction, do not adhere to goals and values, and do not bother to reach them. The individuals, who have a recorded identity, have committed themselves to the goals and values without assessing other options. The individuals, who have an interval identity, did not create any definite obligation for themselves, looking for process, so that they were able to collect information and test various activities and hope that someday they will find some values and goals to direct their lives to. Finally, the individuals who have a gained identity have already assessed the options and they adhered to a series of values and goals that they have chosen. The result showed that students with informative life style are better in managing the issues in the life.

The number of samples collected from two universities and were about 100. They had to fill-in certain questions and then, the collected data were analysed by using ANOVA and Regression statistical methods by employment of SPSS statistical software. They used the ISI and BDI. The result showed certain differences in the depression level in between the two groups of the students but the level of avoidance and information were the same. Therefore according to the findings and the theory that the personality styles are formed during the childhood days and its effects is in full swing in the adult age and therefore, the parents and the educators are advised to prevent depression from the primary level itself.

The study article namely the *Christian Seminary Students Attitude Towards Psychology: Effects Of An Introductory Course On The Integration Of Psychology And Theology* by Scott W Woods (2010) as a part of his PhD studies. This study is meant to inculcate the study of psychology into spiritual studies as well because long since psychology was not thought about as a subject to be taught in the seminaries. The main purpose was to examine the effectiveness of introductory psychology course in the seminary curriculum and tests both before and after the assessments were done on the students and the author found significant changes in the attitude of the seminary students. The author begins the chapter by acknowledging the fact that there have been substantial rifts between the psychologists and the theologians in their specific fields of belief and practice and to be frank the theologians were unwilling to inculcate psychology into theological studies. but since 2002 after many studies in the field they are willing to accept psychology. That is to integrate science

with faith. They both –the clerics and the psychologists deal with issues of cognition but in different manner one in the light of faith and the other with the help of epistemology. This is because the Christians complain about the psychologists that they overlook the facts of sin and hell. They also hold that psychological principles are antithetical. This article is based on the theory of different psychologists that after the study of psychology many have agreed to change their way of life broadly or to look at situations with more understanding thus reducing risks in life. Therefore the hypothesis was that the attitude of the seminary students towards psychology would change after the psychological studies.

This study was to know about the seminary student's mentality towards psychological study as a part of the curriculum. There were 45 students both male and female aged between 18-54. These were from different parts of the world. The instruments used were the Religious Commitment Inventory-10 (RCI-10), the Brief Religious Coping Inventory (RCOPE), and the Attitudes toward Seeking Professional Psychological Help scale. In the first two tests they all showed high spirit and the attitude towards the third question was not as the author expected. But, all the same, he noticed a change in the student's attitude towards counselling and psychology. Therefore, this study intent to put forward a message that psychology is also to be a part of theological studies. It doesn't mean to make a comparative study but to change of attitude in seeking psychological help also. And therefore from the results the author intends to say that psychology is to be considered as a subject together with the theological studies.

The research article "Values As Predictors Of Religious Experience In The Lives Of Seminary Students Of Philosophy And Students Of Physics" was written by Stanislaw Glaz (2016). This study was to analyse the relation of values in the life of both religious students and physics students. Because it develops both personal and religious life. According to the social science, value has different meaning but psychologically it can be put into two different standpoints. One is the subjective standpoint i.e.: it is people who create values. Something becomes a value when it is preferred and accepted in the society. The other view is objective i.e.: values exist regardless of the subject. Therefore a person should realize and learn them. According to different psychologists values are desirable, trans-situational goals, varying in importance and serving as guiding principles in people's lives. Values, being socially approved verbal representations of basic motivations, play an important role in our functioning and are linked to motivational goals. Religious Experience, in the broad meaning of the word, is a fundamental form of human cognition, and it denotes a certain process, "movement" of consciousness, thanks to which a human being establishes contact with the reality, with a view to getting to know it. Some researchers also describe religious experience as profoundly spiritual. It is perceived as a type of genuine and immediate contact with a power recognized as divine presence or divine reality. It is most often accompanied by tension, inner conflicts about sin and the sacredness of God. Some psychologists say that it falsely assures of gods careful providence, which eventually leads to self-deception and neurotic disorders. In response to these features, the author of this paper, referring to Christian understanding of religious experience (Saint Jean de la Croix 1915; Tauler 1826)—created, on the basis of that concept, a tool for measuring experiences with a religious character: God's presence and God's absence. The scale will be

employed for the purpose of the article. It consists of statements referring to the Christian religion which takes into account all of the dimensions described above: the cognitive, emotional, and behavioural experiences of God's presence and God's absence. Two kinds of lifestyle are encountered in our culture: clerical and secular (lay). The clerical lifestyle is directed at self-realization with respect to God and another person, whereas the secular one is directed at self-realization with regard to another person and the surroundings. The former suggests that a human being's care about their own development, experiencing happiness, and solitude takes place in an institutional religious group where a person finds fulfilment individually and socially.

Some studies suggest that the seminary students seek more psychological help as they are taught and they believe more in human and religious aspects based on love, salvation and God experience. But the problem of values and religious experience: God's presence and God's absence—an aspect connected with self-realization as a person—is a popular research area. This paper focuses on an attempt to show the relation between terminal values and religious experience: God's presence and God's absence in the group of seminary students of philosophy, who live in a religious community, prepare for "being with others", live their lives in accordance with evangelical advice, and follow the Christ's footsteps, and in the group of students of physics, who are characterized by being open to external experience, belief in a rational world order, and fascination with material reality. In this context the following questions arise: To what extent does lifestyle—as a way of realization of students' individual traits—define and modify the corresponding world of terminal values, which perform an important regulatory function in their lives, as well as religious experience: God's presence and God's absence? To what extent do the most preferred values—as personal standards—imply religious experience: God's presence and God's absence in the seminary students of philosophy and student of physics? On the basis of the presented theoretical material and earlier studies, the following hypotheses were formulated: 1.

There is a difference in the level of religious experience: God's presence and God's absence, and in the hierarchy of terminal values between seminary students of philosophy and students of physics. 2. The most preferred terminal values contribute considerably to the occurrence of religious experience: God's presence and God's absence both in the group of seminary students of philosophy and in the group of students of physics.

The samples were collected from polish students of both theological and physics studies aged between 21-27. Both groups were 50 and 50. Both were asked to complete same questionnaire. The scales to measure these were The Scale of Religious Experience (SRE) by Glaz and Rokeach Value Survey (RVS). For the Statistical Analysis the analysis of variance (ANOVA) was applied. The results obtained in the Scale of Religious Experience (SRE) indicate two differences significant in terms of religious experiences; namely, seminary students of philosophy have a higher level of religious experience of God's presence and a higher level of experience of God's absence than those studying physics. For the interpretation of the preferences of terminal values, the top four values with the highest ranks were considered. The results obtained in the Rokeach Value Survey (RVS) concerning terminal values show that seminary students of philosophy respect most values like inner harmony, wisdom, salvation, and freedom,

whereas male students of physics prefer terminal values such as a world at peace, pleasure wisdom and family security. Now the author mean to say that there is a difference in selection of values in these two groups because of their different circumstances. Now, for the religious students it is entirely based on the existence of God and the feeling of sin and truth and thus they sometime fail to understand the full meaning of value as it really is and therefore suggesting the need for psychological and moral studies in the seminary curriculum as well.

The article "Training and education of north American masters of divinity students in relation to serious mental illness" written by Halle e. ross and Matthew s. Stanford (2014) department of psychology and neuroscience, Baylor university, waco, Texas, USA. This article tries to bring out the need for students to have certain knowledge in psychology as well, though they claim to have studied philosophy and theology. The reason to have this study is that they noticed those who had some knowledge of psychology were having less psychological issues or they were better equipped in dealing with the stressful situations. In the US more than 25 % of people suffer from psychological issues. Since most of the Americans claim to be religious they in their distress meet the clergy or the pastors who are not that equipped to deal with persons of this kind. Therefore, the study tries to make clear that the pastors also need training in psychology. The study also specify that the clergy though they are not well informed in the field of psychology do not often refer the people to professional psychologists and the reasons vary. it says that the clergy are not fully aware of the existence of the psychological help, to avoid stigma in the society, or to that they feel inferior and another reason is that sin and God aspect plays a big role in it. They connect everything with Bible, God and sin. Finally the study says most of the pastors have not received psychological education when they are in the seminary.

Another study revealed that despite the fact they feel inadequate to treat the clients they are also unable to recognize the symptoms of the patients due to the lack of prior knowledge. This is because in the seminaries they were afraid that if they come to know more psychology that would lessen the seminary aspect and God aspect. Therefore they are ready to treat the patients even though they are unaware of the sickness and treatment plan. The study was made among the university students over the phone. And of them 219 were contacted. Of that number, 70 directors agreed to be interviewed, two declined to be interviewed, and 147 did not respond to the request for an interview, resulting in a 32% response rate. Institutions that provided MDiv degrees on more than one campus were assessed one time through the main campus. They were from different part of the Latin America. Of the 219 seminaries contacted only 70 that responded and the study result show that no seminaries had enough access to the knowledge of psychology and so those who come out as pastors had no idea of any psychological issues. Thus the author suggests that those who enter the seminary should also have some knowledge of psychology integrated with bible studies.

The article "Self-Disclosure and Spiritual Well-Being in Pastors Seeking Professional Psychological Help" was written by Erik D. Salwen¹ & Lee A. Underwood² & Gabriel S. Dy-Liacco² & Kathleen R. Arveson.(2017). This topic was researched because the pastor's mental and physical health can have tremendous impact on the life and faith of the believers. Another reason for the

study was that the pastors were found to object to the findings of the psychology because of the faith that it is beyond and their personal benefits. They tend to focus more on traditional faith, belief systems and overlook the psychological aspects of life. But the fact is that they have issues in the family itself and they are unwilling to open up because of the faith, their position and high regard. And so they very often do not disclose the issues they face and therefore suffer. Certain studies in the 1990s proved that there are pastors who suffer but don't seek help because of the faith and belief. Further studies proved that there is a correlation between the spiritual struggle and psychological issues such as anxiety stress etc. Another study in the 2012 found that the pastors and the people believed that talking to psychologists would not help their issues as they believed this to be spiritual in nature. Thus, the purpose of this study is to state that in seminaries there is a need for study of psychology and pastors should disclose themselves if they are struggling with issues and are to approach the psychologists.

The samples were selected from the seminary students who are getting ready to go the parishes. The hypotheses was that There is a significant difference in willingness to seek professional psychological help as measured by the ATSPPH Scale by the level of self-disclosure flexibility as measured by the SDI Scale (non-directional). The data was collected through electronic gadgets, internet. The result however was neutral saying that the pastors' willingness to self-disclosure, spiritual wellbeing and willing ness to seek professional help are based on various other factors which are to be found out. However the implication is that the attitude of the person, necessity of the help and the situation all must be considered while seeking help. However this study also says that more spiritual maturity will make a pastor seek professional help and therefore, there should be study from the beginning regarding mental health issued together with the spiritual studies. Thus, they will be able to analyses and relate the mind with the spirit.

The article on "Sexual Minority Students in Non-Affirming Religious Higher Education: Mental Health, Outness, and Identity" by Joshua R. Wolff ,Heather L. Himes ,Sabrina D. Soares ,and Ellen Miller (2016) who are practicing psychologists and experts in the area of education. The authors wanted to conduct the survey on the sexual minority students in different college with Christian background and where the Seminarians also study. They wanted to know how the sexual minorities are treated in these colleges and universities. According to them the SM find it difficult to live in the society because they are a minority and that they are harassed for their being different in gender and other aspects of life. Because of these they are more prone to addiction and suicide. So the purpose was to study the psychological functioning of the SM students amidst all these difficulties. According to the study they said that the SM are more prone to be introvert without going out with the others and if they are in a religious situation they are not accepted in the society by the family or in the churches by the pastor because of their difference. Because they are labelled as punished by God and their same sex orientation is considered as sin.

Thus the study found out that in the US where the study is done in the colleges and universities with seminarians and religious background don't accept the SM students in the college. Thus, they don't divulge their identity and if they are found to be SM they are harassed. They also said to have regretted regarding

their selection of studies and career. Therefore, the hypothesis was that the SM students who join the universities and colleges with Christian attitudes will have trouble and psychological issues in their life. They selected 213 SM students from different colleges with Christian management or seminaries involved. The data was collected through questionnaires and they are selected through emails or advertisements without revealing the identity.

The results showed that these have suffered a lot, were bullied, mocked upon and were dismissed sometimes from the colleges and apart from that, they were psychologically suffering from anxiety both personal and social, stigmatized, and were depressed. Though they approached councillors from the same campus they were not allowed because of the restriction from the part of the management. So they were denied either ways. These results were applicable to both theist and atheist because of their religious beliefs and others beliefs. They also noted that those colleges who received psychological classes or information about the SM community or group were much tolerable than the others who believed so much in religious and theological aspects. Therefore, the author suggested that the Christian colleges and universities supposed to have psychological education, significant staff training is needed to be models of psychotherapy which are exceptionally focused on encouraging self-determination, sensitive to religious spirituality, embrace a developmental view of sexual and gender identity, and have safeguards to protect students from therapist bias and potentially harmful practices.

The title of the article is "A Study Of Psychological Assessment Practices In The Screening And Admission Process Of Candidates To The Priesthood In The Us Catholic Church" written by Gerard J McGlone, he received his PhD in psychology from California school of professional psychology San Diego. He is a Jesuit priest. Fernando A. Ortiz, is a PhD scholar in clinical psychology from the University of Memphis and is working closely with the seminarians and church. And Ronald J Karney is also a PhD scholar in clinical psychology from the University of Memphis and is working closely with the church and seminarians (2010).

This is a survey conducted among different seminary rectors who were psychology professionals themselves and it was to investigate the policies and procedures concerning the psychological assessments of candidates to the Catholic priesthood. The rationale of the study was that the church exerted the need of cooperating in different areas of study while recruiting the students to the Seminary, especially that of psychology. The basis was that there were sexual abuses happening. Therefore the church documents insisted on the need of psychological evaluation in this area. This was to ensure the suitability of the candidate to the particular way of life. They used the systematic method in exploring the different phases, exploration, consultation, commissioning and data collection. For data collection, they conducted a series of surveys both among the catholic rectors and mental health professionals. This was done under the supervision of a psychiatrist and licensed psychologist. The samples were religious rectors 86 of them, who were also mental health professionals. They were also both diocesan and religious rectors. Survey measures for each – diocesan, religious and psychologists were different. These surveys contained certain questions which rated the answers like, not at all, little, very little and somewhat and very much. The results showed that nearly all of them

suggested the need for psychological assessments during the admission of the students and this formed the basis for the admission or rejection of the candidate. The cost was to be taken care by the particular congregation or the diocese. The psychologists were also asked to look for the background of the candidates for the admission. This included the ethnicity, family history of illness, social relationships, employment history, spiritual aptitude, educational history etc. To assess the candidates they said to have used certain inventories like Minnesota multiphasic personality inventory, wide range achievement test, etc. These were to assess the areas of maturity, interpersonal skills, empathy and psychosexual development. While doing the survey, they also followed all the ethical concerns regarding the confidentiality, rights to privacy, and they were all given proper guidelines while having the survey. As a result they suggested that while having the survey among the students there should be professionalism, rights to privacy and confidentiality because they are dealing with issues of personal rights. And there should be consistency in what they are doing and there should be periodical or on-going assessments. While giving the candidates platform for growth, they also suggested that these reports should be given to the authorities or the in charges in each period of the studies.

The research article: "Seminary Formators And Psychologists: A Collaboration Model" written by Fernando A Ortiz (2010) having a PhD in psychology from the Washington state university. He is also an assistant director of counselling in Gonzaga University and his area of research and practice include personality assessment and multicultural psychology. This study was conducted to refer that evaluation of candidates, when it includes the multicultural and multiphase process it needs to include the psychologists together with the rector. This is to integrate the anthropological and formative realms together. The study shows that the vocational assessment is purely Catholic and pastoral. But once vocation is purely dynamic and developmental which also includes behavioural, humanistic, bio-psycho social, neuro- psychological and multicultural. And so is the need for psychologists in evaluating the student in to the religious institute, which calls for an integrative assessment. The author suggests different phases of psychological assessment. Pre-date collection, to get to know the student, initial data collection, where in the psychologist will collect the data's regarding the human aspects, behavioural aspects – HEXACO DIMENSIONS. Then the development of interference – where the psychologists begin to formulate hypothesis regarding the students cognitive, emotional and interpersonal functioning through a clinical interview. Then the interactive phase where in the psychologists will approve or disapprove the hypotheses. Then the integrative hypothesis where in the psychologist elaborates each interface of the behaviour of the candidate. Next is the situational variable that is to avoid the purely individualistic interpretation of the data. Then the completion and the submission of the report to the sources of reference. This report contains relevant, clear, explanation that meet the needs of the formation plan and the language used in it will be therapeutic and is to help the student in needs. Finally, the seminary formation will be using the most important, accurate specific interventions for the usage. There will be on going and regular communication and meetings. These data can be used for admission and assessments.

III. METHOD

Research question

What are the experiences of the seminarians that determine the following?

1. Their choice to remain in the seminary life
2. Their choice of and ability to cope with seminary life
3. Their general well being
4. Their attitude towards others in the seminary

Paradigms

This research is based on the lived experiences and the choice they – the seminary students make in their life. As research tool, **Phenomenology** (Croswell, John, 2007, 159-164) is based on the academic disciplines of philosophy and psychology and has become a widely accepted method for describing human experiences. It's a qualitative research method to describe how the human being experiences a certain phenomenon or life experience. It is beyond any biased feelings and preconceived ideas about human experiences, feelings and responses to a certain question. It allows the researcher to delve into the feelings, experience and perspective of the person who actually lived in a particular situation. Therefore, this method uses in-depth qualitative interview or direct investigation. When we consider the Phenomenological Analysis in research, we need to look into four aspects in order to analyse and represent the data. And they are the phenomenology that is to talk about the detailed experience of the participants personal world, which includes the description (drawing of meaning) of the personal details, events in life, through an interpretative process.

The next one is the grounded theory, similar to phenomenology, which uses detailed procedure for analysis. It provides a coding system that builds a story that makes the connection. These are different methods of interviews which will be coded and encoded to make meaning out of the session. With the help of this theory the researcher generates the proposition or the hypothesis.

The next is the ethnographic analysis and representation that is to study certain culture group. The ethnography and the chronological order will give the researcher more details. In this there are three aspects, description of the data, analysis and interpretation. The researcher with the help of the data collected makes inferences regarding the group of particular people.

And finally, case study analysis and representation that is as in ethnography, the particular situation is considered to study in detail and then analyse the data. The analysis is done in detail. Thus using these steps the data collection and analysis becomes easier and accurate.

Settings

The background of the settings for the interview study is the seminary. Seminary is where the students join to become priest and have their studies. Here they live together for some time. I have interviewed them from a closed room and have the sessions recorded with due permission. There were no obstacles they were free to speak to me.

Population and participants

Population is the seminary students who are doing their studies in philosophy and theology. They are boys aged from 16

to 20. The data is collected from 10 students. I also spoke to five Rectors so as to get more details regarding the study pattern and the ambience where these students are in.

Data sources and collection process

Data is collected through in- depth interview in which is used and prepared questions and followed by questions according to the situation. The interview will be recorded. The interview is meant to be one to one and will be conducted in an enclosed area. For more data and for validity of the data the superiors, rectors or the mistresses will be interviewed.

Data analysis strategy

For the analysis of the data the thematic analysis approach is used. Thematic analysis according to Virginia Braun and Victoria Clarke (2006) is a rarely used and less acknowledged but is the widely used method for analysis for the qualitative research. One of the benefits of thematic analysis is its flexibility. Qualitative analytic methods can be divided into two that this is in a particular theoretical position and secondly this is based on theories that are independent and based on epistemology. And it provides theoretical freedom; thematic analysis provides a flexible and useful research tool, which can potentially provide a rich and detailed, yet complex account of data. Thus thematic analysis is a method for identifying, analysing, and reporting patterns (themes) within data. It minimally organises and describes your data set in (rich) detail. However, it also often goes further than this, and interprets various aspects of the research topic. The range of different possible thematic analyses will further be highlighted in relation to a number of decisions regarding it as a method. It is different from analytic method. It is a method used to report reality and meaning from the interviewee, it can be constructionist, it draws meaning from the experiences of the person.

Ethics

All ethical considerations will be met – that of the agency where the interview is conducted and of the college from where I go for the interview. The permission will be sought in writing and the participant's permission will be taken in writing. The data collected will be confidential and is used only for the purpose of research.

IV. FINDINGS

Another word for Seminary is formation house. Therefore, in the seminary the students are formed to become priests or ministers of the Church, which is a system in the Christian religion. This system is managed by a hierarchical order which is formed within the system itself. The leaders are formed within the system itself. Thus a student to be a priest joins at the age of 16 or above. Then onwards the student who is called formees goes through certain studies of the church for about ten years or even more. Many students join with eagerness and interest but leave immediately after joining or after a few years. The teaching in the seminary is very systematic and is based on the biblical principles and certain secular aspects. But still, the students find it difficult to adjust or to continue within the system due to certain reason or because of lack of interest.

This research “A Phenomenological study of the Experiences of the Formees during the first few years of Formation” is an attempt to find out what are reasons for the students to join the seminary at a very younger age and what makes them remain while so many others leave and what s their coping mechanism while they have a lot of studies based on the scripture, philosophy and theology which are supposed to give them enough knowledge and understanding about the life they have chosen.

The participants

10 brothers (boys), students from five different seminaries were interviewed in the process of collecting the data. They are aged between 16 to 25. They are students of degree, philosophy or theology. They have not made the final commitment to the congregation. They are from different backgrounds, from different States of India speaking different languages. By now they will have lived five to seven years in the seminary under formation. They will have travelled and lived in several places. Therefore they are with rich experiences and knowledge. Some of them have left one seminary to join another seminary. Some of them have joined after some years of working outside. I also have interviewed some superiors for better understanding. I also have spoken to a few people who have already left the seminary and are into life of marriage.

Method of data collection and analysis

In the study, the phenomenological paradigm (Clarke Moustakas, 1994) for the interview and the data collection is used. It’s a 20th century philosophical movement based on the work of the philosopher Edmund Husserl. As research tool, phenomenology is based on the academic disciplines of philosophy and psychology and has become a widely accepted method for describing human experiences. It’s a qualitative research method to describe how the human being experiences a certain phenomenon or life experience. It is beyond or doesn’t hold any biased feelings and preconceived ideas about human experiences, feelings and responses to a certain question. It allows the researcher to delve into the feelings, experience and perspective of the person, who actually lives in a particular situation. Therefore, this method uses in-depth qualitative interview or direct investigation and I have also used the same in-depth interview of 10 participants. I have interviewed the participants, have studied their perspectives and have done the thematic analysis.

For the analysis of the data the thematic analysis approach prescribed by Braun and Clarke (2016) is used. After the collection of the data, through interview and recording, it is Tran-scripted. Then the data will be read completely – in an unbiased manner. Browse through the data, make notes and re read. Using the notes made while reading code them or label them according to different content, section or relevance. Then do the conceptualisation based on the questions and the hypothesis. Then bring them together put them under categories or themes after defining each headings proper. (Moirra Maguire & Brid Delahun, 2017) Special consideration a Blind Coder was used to verify the coding for thematic analysis.

Participant summary

| Name | Age | Level which the participant is | Remarks |
|----------------------|-----------|--------------------------------|---|
| Participant A | 23 | Completed Philosophy | Has taken a break for other secular studies. |
| Participant B | 22 | Studying Philosophy | |
| Participant C | 22 | Completed Philosophy | He joined the seminary because of pressure from home |
| Participant D | 25 | Completed Philosophy | Doing some secular studies. |
| Participant E | 23 | Doing theology | |
| Participant F | 22 | Completed Philosophy | |
| Participant G | 25 | doing Philosophy | Came out of one Seminary and joined another |
| Participant H | 23 | Doing Theology | |
| Participant I | 23 | Doing Philosophy | |
| Participant J | 24 | Completed Philosophy | Came out of one Seminary and is planning to join another |

In the research three major themes evolved from the analysis. The study sought to understand what the experiences of the seminarians are in the early stages of the formation. This is not a criticism of the church but an inquiry into the realities and its relation with the actual happenings in the seminary. The themes that emerged are related to the structure which is rigid in the seminary, the strict hierarchy and the meaningless emphasis on the Biblical meanings to the formation.

The unfulfilled promise and disillusionment

What is the reason why so many are joining and then leaving the seminary is a question asked by many. They also ask why a lot of scandals are in the church now and within the system, in spite of long time of formation – mostly spiritual. This was the idea long back but today the system has changed, people have changed. People have made immense technological progress, which actually generate the feeling of self-realisation and has helped the person to realise the need for healthy and wealthy

living, free thinking, and freedom in all strata of life. This is the idea which actually is against the old culture, morality and thinking within confines of seminary. After the student becomes a priest, his role in the society is to be expert in the ritual part of the religion and lead the faithful into religious activities. Later on he begins to manipulate the powers and begins using his powers for healing, witchcrafts etc. In the Middle East he was an incarnation of God. Thus he occupied a major role in the society somewhere near to the king. In the ancient Greece and Rome there was a clear hierarchy among the Priests. Then came the Judaistic religion from which originated priesthood of family succession. Then came Christianity with its hierarchy system. In the Vedic system the role of the priests were not different. Today we have the so-called priestly system in every religion after a long time of changes and reformation. (Encyclopaedia Britannica.2011).

Erik Erikson, (Saul McLeod, 2018) in his theory of Psycho Social Development, maintained that personality develops in a predetermined order through eight stages of psychosocial development from infancy to adulthood. During each stage, the person experiences a psychosocial crisis which could have a positive or negative outcome for personality development. According to him, the crises a person experience at these stages are psycho social in nature. And successful completion of each stage results in acquiring a virtue which according to him makes person a healthy personality. Whereas, failure to achieve this virtue will result in making the person less successful and can lead a person to an unhealthy personality. However the virtues that are lost at a period of time can be achieved at a later period of time. The life of a seminarian can be compared to the stage of development; each stages of development can be a step of formation that a person goes through in the Seminary, for 10 to 15 years. In the stages of formation a student is expected to acquire certain virtues based on the Christian principles and the orientation of the particular congregation he is going to be part of. As Erikson explained, a successful formation can result in forming the person in a better manner. And a not so a successful formation can lead the person to be a failure in life, which will lead the person to leave the congregation.

The seminary formation is to teach the students to learn the religious practices normally. And thus, there came the hierarchy to teach the students. The in charges, the superiors, and the mentors who were, most of the times, from different area of life and having different backgrounds. Some were rude while some were very gentle and encouraging. But basically the idea remains the same that the students are to be taught from the beginning itself, about what they are going to become in the future. The formees who are coming to join the seminary are at the infancy level but having some kind of ideas they have learned listening to the sermons, or listening to the priests and sisters, having studied in the Christian schools and colleges, having attended retreats. Thus well motivated, they are offered to God by the parents. They may also have joined with the intention of studying further, due to poverty at home. Today, they have no idea what is happening inside because seminary life is something quite different from all other kinds of life.

The interviewees were of the opinion with regard to their experiences in the seminary that certain priests and sisters are living a very holy way of life and very much accepted in the society because they work for the people selflessly. They are

respected and remembered by the people. This, they said remains in their mind when they were students and they always keep these as their role models. But the fact is that they don't know what is happening within the confines of the seminary or the monastery they live. So the students said they joined to be seen by others, to become like their heroes in mind. This of course is a very noble intention. One of them said that when he saw a new priest in his village for preaching he was attracted to the particular priest and so wanted to become like him in his style of preaching wanted to help people like him. While another one was of the opinion that he too had the same experience as the previous one that he had attended a retreat by a certain priest and was really influenced by him. There he had the desire to imitate his healing ministry and wanted to become a preacher. Another one said that he was so much familiar with the kind of certain congregation that he joined which did well among the people so many good works. He too was drawn to this way of living aiming at the same high ideal .most of them said the same thing.

They were also talking about the recruiting, as to how they were recruited and what they were told in the beginning and how things looked different in their experience later.

P.A: In my parish there used to come a father with nice hairstyle and look, he used to preach well and I was fascinated by his style. (Interviewed on 2nd April, 2019)

P.B: From childhood onward I used to see my father working with the sister's school, so I am so much used to be with the fathers and sisters. (Interviewed on 24th march 2019)

P.G: since our community is a minority and we don't have any one, priests talking our language I left the congregation and joined the diocese.(interviewed on 23rd march 2019)
The other scholars have given their views as well:

"Bill sees his work as more than simply getting students to the Seminary," says Dr. David R. Schmitt, the Gregg H. Benidt Memorial Professor of Homiletics and Literature. "His work is actually supporting the Seminary in preparing people for mission and ministry in the Church and world."(Melannie Ave 2015)

This is what supposed to be the way they are to be recruited. A seminary is a school in which priests are trained. A priest is the representative of Christ among men: his mission is to carry on Christ's work for the salvation of souls; in Christ's name and by His power, he teaches men what they ought to believe and what they ought to do: he forgives sins, and offers in sacrifice the Body and Blood of Christ. He is another Christ (sacerdos alter Christus). His training, therefore, must be in harmony with this high office and consequently different in many ways from the preparation for secular professions. He must possess not only a liberal education, but also professional knowledge, and moreover, like an army or navy officer, he needs to acquire the manners and personal habits becoming his calling. To teach candidates for the priesthood what a priest ought to know and to make them what a priest ought to be is the purpose of seminary education; to this twofold end everything in the form of studies and discipline must be directed.(Vieban A,2019)

This is actually what should happen and what they should have in mind while they recruit someone to the seminary. One person enters into a life completely different from that of the family life and into a new set up and in company with new, unknown people. There they experience the hierarchy, the different languages, places, and types of people with different

temperaments and of different age. This is actually a difficult situation for a new comer. And so he should be informed properly what he is into and who he is living with. He is into new different timetable which they didn't experience at home, they are into different work which some of the students may not have even experienced, they are into new studies, new language- as they have to study different languages. So there should be a family atmosphere where they can adjust until they are ready to face with maturity that these are part of the system they are into and they have to uphold. For this they need proper guidance, accompaniment and care.

While interviewing them they were of the opinion that they experienced the same kind of life they have heard of in the 6th century that is a very rigorous life which of course was the fashion then. Now, they said they are in the 21st century and so they wanted some kind of change. One of them said he expected a very loving atmosphere because that was what was told to him and then he had to live with lot of different people which gave him a very negative idea about the seminary life altogether. He said he expected some love, care and concern from the authorities. But it was not there. While another brother said that he had to literally fight with different language people as there were already biased on the basis of language and caste. This made him feel bad and even wanted to leave the seminary.

But against all this there were some other opinions as well that they joined because of the issues at home like poverty, sickness, and that they were offered to God from the early age, itself so that they were obliged to join against their will and wish. While, yet another said that he wanted to reform his community which is a minority in that area and that they are illiterate. So that he wanted to reform, to teach them about Christianity and about the other aspects of living outside their own world.

P.H: we are from a poor area in the north, I experienced a lot of poverty and I wanted to live a better life. (Interviewed on 8th April 2019)

P.J: we are a convert family and my father is very much involved with the sisters and fathers and I joined the seminary after a long time of thinking and prayer. I feel obliged to my life for god. (Interviewed on 30th march 2019)

These students joined the seminary from different background, with different expectations and because of different reasons. The basic fact they expressed was that they had the call of God, they wanted to become priests, and they also wanted to serve God and others. These students came to the seminary with these various ideas and expectations. When they see that most of the things are different from what they had expected they tend to go back. All the interviewees said that when they joined there were like 18 to 25 but after three or four years, there are only two or three students remaining. The main reason they said what made those who left was the insufficiency, inadequate love and care or personal respect according to the age that they had expected. At home they said, they experienced more love and affection than in the seminary. Lack of the attention and care from the part of the authorities made them feel unwanted.

So what they were saying was that there needs some kind of changes from the "6th to the 21st century, when people are looked up as they are and are given freedom with respect and responsibility. This they said will make the person and the community a heaven. These are the students who are going to be

priests in the future and in whom they are going to invest. You reap the fruit of what you sow, in with time, energy, good qualities, education and care. Therefore, if they experience the affection in the beginning of the formation and throughout the formation, then they can be formed well for the future. They can become good formators later on. They can lead the church or the parish or the institute where they are appointed. These are the human resources for the future. Therefore, it is the duty of the authorities to form them properly so that the students will believe what they only have heard about before they came in and they will feel that they are in the right place. On the other hand, if we don't create such an environment for growth then they are going to leave the seminary or they are going to be misled and frustrated. Thus they might distract themselves from the church and they might even talk against the church. As one said in the interview that, I won't bring anyone to the congregation nor will I go for vocation camp because they should not be deceived by my words. They are free to join but first let them see and believe and then make a decision.

P.A:- difficulties were there in the seminary. (Interviewed on 2 April 2019.)

P.B:- they (superiors) should understand where the person is from and what is his desire and interest. (On 24th march 2019)

P.C:- they should respect the individual decision and should be open. (On 24th march 2019)

P.G:- it is 21st century and not 6th century. (On 23rd march 2019)

Strict Hierarchy

"Most of the priests of my generation are undoubtedly good men, unsullied in their personal life. I hope they will speak loudly from the heart about this crisis and how it must be solved. I think they know what must be done — assuming the Church has the collective will — to absolutely prevent sexual abuse in the church and to vow that never again will becoming a priest end in tragedy for men like my friend Andy."(John Dinges, 2018)

These are words of a journalist, who also was a seminarian once and, whose friend was a priest for some years then left and got married. This person later on committed suicide because of complaint of what he had done in his ministerial life – child abuse. He goes on to say, to some extent, it may be a matter of wilful blindness. At a College, which had a dormitory exclusively for seminarians, I was confronted with the reality of gay priests comprising a small but significant portion of the faculty. Yet in our seminaries counselling sessions there were warnings only about avoiding intimate relationship with women.

These facts I think, in connection with what is happening in the church today, to the priests and the religious as a whole, contribute to the lack of proper seminary formation as most of my interviewees stated. They said if only they behaved with us as they told us when we were recruited or if only they had looked at us as feeble and weak human beings.

That is to say, that these when they join at a very young age of sixteen don't know probably what they are into. If one takes the theory of Erik Erickson devoid of the fact of life span, then the student who joins the seminary in the infancy stage and they are in the so called developmental stage in each step of their formation. It is in this 'each stage' that they learn to accept life, to live with many who are like them or more than them, the seniors

and juniors and the superiors. That is why this stage is called the stage of formation and once they become priests this term is not used anywhere.

Most of whom I interviewed said the moment they joined the seminary they lost the contact with parents, friends and all of a sudden they had to get into contact with another set of people who are completely new. Each of them had different painful experiences in the beginning and they said when they joined there were new people from different areas and they seemed showing partiality from the formators. Another said he had to learn a new language to compete with the others and he felt the authorities showed discrimination because he was from a poor background of life and he felt like challenging them for debate face to face. While another said he experienced very difficult situation altogether that there were partiality in food, room facilities and they were not even allowed to use fan in summer and so he had to keep himself aloof from all the others. He also said that the superiors showed no mercy but insisted on the rules and regulations to the minutest point and he added that this was the reason why many of his batch mates left. There was no empathy from the part of the superiors. He said that the brothers even named some of the masters and superiors 'Hitler'.

P.A: I used to be working with the political parties in the school days so I used to be little rebel in the seminary when things didn't go well with me. (2nd April)

P.D: the superiors should have certain human values and they should not be judge before they listen. (2nd march)

Most of them said their basic needs were not met which included food, no proper sleep hours and self-care. Thus they said if there was equality formation in terms of recognition everyone would be happy. One of them said that he was already from a low income family and he experienced lot of poverty in the family. When he joined the seminary, the situation was not different, that they gave him limited food and he, like others was pressed hard in every basic need.

There were also other different opinions that the superiors needs to spend time with the students and they are to treat the students with the same respect and empathy. Lack of family atmosphere, from which the students were coming, makes the students feel discouraged, tired and lost. Slowly they tend to do things that are not permitted, like stealing food items, watching pornography, spend more time when they are sent out on a picnic or walking and make friendship with outsiders. They also used to get out in the night without permission for which they would be punished of caught by chance.

While something interesting I found, different from all the others, is that some found happiness when the superiors gave them freedom, freedom to speak, to play to enjoy, though in a limited manner. And in such a situation they found happiness. They had meetings like common gatherings when they discussed about any issues how they should behave in the seminary. This gave them more understanding and they said it helped them to open up their mind and to be free of inner conflicts.

They said their coping system in times of difficulty was to speak to the person directly, to go for games where they expressed their anger and distress. They also said prayer and meditation, spiritual direction also helped them.

P.A:- difference in formators and friends (2nd April 2019)

P. G:- human attitude is important, there were lot of partiality by the superiors.(23rd march 2019)

P.E :- I experienced situation with lot of difficulty we even called the superiors by names – e.g. Hitler. (On 6th April 2019)

Biblical meaning contrasted with humanness

The decree of the Council of Trent imposes on every bishop the duty of having a seminary, that is, a school exclusively destined to prepare candidates for the priesthood. It says that the student should receive all the necessary education, ecclesiastical training, secular training and theological training which are most necessary for the formation. The student whether under a formator or living alone shall be under some rector for some time in the middle of the studies so as not to forget what he is called to be or into what he is formed to. The student must strictly observe the rules, regulations and timetable of the particular seminary even while in the college or university. The church demands that from each student. (The Catholic Encyclopaedia)

This is the basic decree by which formation is conducted but it differs from place to place and congregation to congregation. This is mostly based on the biblical aspects and the amendments happening in the governance of different congregation from time to time. Some of the students whom I interviewed said that the formation should be based on the biblical principles of love and care. Most of them said when they joined the intention was to follow Jesus. Some they said they found the preaching of the some of the priests very good and appealing and so they joined. Now if we bring together all these arguments we find that bible is the basis of the formation and the principles in the Bible are what is taught. The students said there were difficulties in life when they began their life in the seminary they were reminded of the call they received and so used to pray so hard that it gave them energy and power. When that didn't seem working they went for spiritual direction and they were just advised to read bible to find happiness and joy. But that was only for a while and thus most of them ended up in prohibited activities like making friends with girls whom they met in the school or colleges, watching pornographic videos and slipping out in the night for some enjoyment. Some said they smoked; they were into reading pornographic books and masturbating. They said some of these students remained while most of them left. The spiritual talks were mainly focused on bible and biblical aspects of life. Thus it didn't give them much of a personal touch which they really yearned for at that moment. Thus most of the time it was boring but they had to attend such session because it was compulsory for them.

I had a chance to interview three brothers who once left the seminary to join other congregation. They said they left because they didn't find the previous seminary better and so they searched for better one. Now when I asked further about what was their experience at home they said it was very sad and different. Because the moment when others heard that these have left the seminary it was a shock to their parents and relatives and they felt shame. Because they said, to enter the seminary was the call of god and it brings blessings to home. One of them said when he joined the seminary he was very poor, his parents were working as coolie, now after he joined the seminary his family became very rich, his father quite the habit of drinking and they built a new house. When they left the seminary they were given a tag of 'seminary jumper' or the cursed , or they all were afraid that the

neighbours would mock them for having a son who didn't bring blessing upon them or that he blocked the blessings from the god. These kinds of details are in the bible very much,

"And now, you priests, this warning is for you. If you do not listen, and if you do not resolve to honour my name," says the Lord Almighty, "I will send a curse on you, and I will curse your blessings. Yes, I have already cursed them, because you have not resolved to honour me. "Because of you I will rebuke your descendants (Malachi, 2:1-3).

These are the words from the Bible and these kinds are explained and misspelt at different occasions and so when anyone leaves the seminary. And according to a recent study the identity of a priest and a monk is identified with that of Christ which levies a lot of stress on the candidates and would be priests. Thus the goal of formation is to make the person like that of Christ.

Therefore there is a blessing if you continue to remain in the seminary and if you leave there is the curse. One of them said it was really distressing to see their friends leaving and to hear scandalous news in the TV and newspaper. It was shameful to leave and to face the people due to the latest scandals in the Church. This, the fear of curse and happiness of blessings to a certain extent made them remain inside the seminary in spite of any difficulties.

In 2015 there was a study conducted by Igor J. Pietkiewicz in Poland on ten former priests regarding their decision to leave priesthood and how they felt afterward. The study said he interviewed ten former priests and they said to have experienced needs and aspirations conflicting with their social role and the expectations by others in the society. They found the decisions they made and the life afterward very frustrating and stressful because of social stigma, fear of breaking community norms, and a kind of disbelief in them to cope with the life outside and they all found to be seeking help from counselling.

In the present study most of them said the teachings were of mostly biblical and less secular studies. Few of them said since they had sister siblings they never had any unwanted sexual feelings because they are familiar with girls. While I also heard few others say they are afraid to face the girls because they don't know how to talk to them and behave with them. When they informed about the difficulty in controlling the sexual passions the spiritual directors advised them to keep away from girls and women so that they won't have such feelings. They were of the opinion that it was the curiosity from the part of their friends' regarding sex and money that caused them to leave or that they are sent out. Most of who were sent out had illegal relationships with girls whom they contacted outside the seminary.

They were having such an idea or opinion that if they all were sent to co-education or if they were given such awareness and freedom to mingle with girls then they would not have left. They said since they had less sexual education and psycho social awareness they didn't know how to speak, how to mingle, and how to behave with others even with same sex. Today we hear a lot of homosexuality within the boundaries of seminary walls.

The students' altogether said if only they had proper studies and information then they would be happy. They said some of them since they had community meetings in which they shared issues of this kind they were helped by others and that since they are given freedom – freedom with responsibility- and awareness they were able to manage their life well and they are happy today.

And they added they experienced less drop outs from the seminary where they lived.

P.C:- after I joined my father quit the habit of drinking, we got nice house and we became wealthy.(24th march 2019)

P. H :- we are afraid to go back we are public figures and we are meant to be praying for others.(on 8th April 2019)

P. J:- my family and I believe that god chose me. (30th march 2019)

P.C :- I got a vision from the retreat place and I enquired to the priest and he said I was called by god (24th march 2019)

From the articles (Fr. Earl K. Fernandez, S.T.D., 2015) I have reviewed, there were some articles that spoke about gay sexuality, the seminarian's attitude towards the other students with them. It said that there were a lot of gay priests and some others who didn't care about the lay people or cared less about the lay people. The so called priest students had a kind of idea that they are near to god and that they are intermediaries of god to men and that they are high in the society because of their status. The reason for this, according to the author was that, these attitudes were mostly because of the lack of proper formation from the beginning itself i.e. Formation on psycho –social education.

In 2019 in the month of February the leaders of the church from all over the world joined at Vatican at the synod to talk about the sexual abuses that were happenings in the church, the meeting was convened by the Pope himself. They talked about child abuse, gay sex, pornography and other sexual problems among the clergy and the students in general. They also convicted some priests and they were dismissed from the offices. They also met the abused victims. The committee said that they would make a committee to study the matter and take necessary step to stop these sorts of scandals in the church. And the pope asked pardon to all the victims. (Common weal magazine 2019)

Rulla,L.M(1986) in his study explains, the identity of the priest is defined in his relationship with Christ .to become Christ like the priest in the throughout his life, especially in the period of formation goes through lot of studies which will prepare him to develop a profound identification with Jesus Christ. Thus, the role of priestly formation is to help to prepare to be like Christ in mind and body. The priest is also working for and with the people. Therefore, he should be trained in human aspects as well. For that he needs commitment to his vocation and knowledge of human being with whom he is working with. Human beings are fallible but can be trained and formed. There is a struggle in the life of priest as well. There can be lack of capacity and desire towards his vocation and it is at this situation he tends to fall away. As a result there can be reduced desire to spiritual activities, lack of enthusiasm, frustration, workload, ambiguity in living priestly celibacy, and other environmental factors. Therefore the role of the psychology is to make the person aware of his own ambiguities and problems with regard to the particular way of life. If the problems persists that can cause issues. Here the role of a good formater becomes important. The formater without losing the values of the church teachings needs to walk with the candidate. The formater needs to make oneself aware of the life per se. thus, helping the candidate by using pedagogical methods, formative methods, guiding personally and encouraging without biases. All this will help the candidate to cope up with situations and live responsibly. Thus the formation becomes healthy and meaningful and productive.

The insight and reflection

The difficulty encountered in internalizing and identifying one to the priestly vocation.

As in any society by the very fact that a person joins a system he or she has to or is forced to become part of it in order to get maximum output. This is common to all the form of system or organization. Thus the moment a person joins anywhere he or she is asked to put the heart and soul into it and hard work and sincerity is expected. It is the same in seminary where a person is moulded into becoming a priest or an important personality in the Christian society. So the life of a person in becoming a priest begins immediately after 10th, at the age of 16 or at later age. However he has to go through a period of 10 to 15 years of formation. This formation includes mostly spiritual and church related matters. Very often secular studies are overlooked.

Thus identity of a person to be priest is likened to that of Christ and thus he is formed. This for a student at the age of 15 is difficult internalize immediately even though he has some idea to he has come into. But the moment the person enters the seminary he is to act as and in the name of Christ, which requires a lot of difficulties. Therefore such is the identity of a person in the seminary and thus will be the formation he will receive.

One has to change his behaviour to such an extent that he tends to leave in certain situations and this is what happens to most of the students who join. Social psychologist Herbert C. Kelman cited by H.E Howe, (1980) says if a person is to change his personality or attitude he has to have three process of change that is compliance or self-interest, which is an attitude to change once idea in order to gain something or to avoid punishment. However compliance is not commitment. Secondly identification or self-gratification that is the change in the attitude of the person occurs because of the interest that he needs to be part of a system to maintain relationship with certain person or system. This, too, is not commitment. Thirdly internalisation occurs when a person really understands what he is into and why he has chosen a particular way of life. This is identification and commitment.

According to the new document on formation by the Catholic Church, *The Gift of Priestly Vocation* published in the year 2016, part 130, by the present Pope, a seminarian is a protagonist of his own formation in the area of spiritual, mental and pastoral fields taking into account of his own situation, family background and relation to the Gospel values being responsible for himself. Thus, it means to say that the formation is actually an integration of all the aspects of human life. That is true to certain extent or fully but still to internalise something and to change one's attitude he or she needs to understand, get convenient ambience and should be rightly motivated. The research here is to identify what are the issues in internalising the ideals of priesthood and religious life. Why do people leave? Why do they get hurt and wounded, why people become rigid and head strong, why there is failure in the religious life? The reason for it is, mainly, the contradiction between virtue and sin, normality and psychopathology. Thus psychology today speaks about understanding, creating awareness about ones needs and desires and thus, to create motivation by personal accompaniment and formal training with all the necessary discernment and knowledge, and I feel that the Church can benefit from this field.

V. SUMMARY AND CONCLUSIONS

Every field of psychology focuses on the development of the society and the organisation which is inhabited by human being. Therefore, by default human development is the important matter in any field of study of psychology because any society begins and ends with human beings. Thus, the study of Psychology is to improve the performance of any human being for the growth of the particular society or organisation.

This study on "what are the Experiences of the Formees During the first few years of Formation" focuses on the experience of the Seminary students. Experiences would mean their life in the Seminary which is an organisation. Their experiences includes, their desire to join such a particular institute, their ability to cope up with situations in life, their relationship with different personalities like superiors and inferiors, their ability to stay while some leave in the middle of the studies.

According to the Organizational Psychology (Kendra Chery, 2019), which is a branch of psychology that talks about the increase of workplace productivity and the related issues such as the physical and mental well-being of employees. Industrial-organizational psychologists perform a wide variety of tasks, including studying the worker attitudes and behaviour, evaluating companies, and conducting leadership training. The overall goal of this field is to study and understand human behaviour in the workplace. The organizational side of psychology is more focused on understanding how organizations affect individual behaviour. Organizational structures, social norms, management styles, and role expectations are all factors that can influence how people behave within an organization. By understanding such factors, I-O psychologists hope to improve individual performance and health, while, at the same time benefiting the organization as a whole. To increase the productivity and profit, the company management focus on the overall wellbeing of the employees and the atmosphere as a whole. This will include giving extra benefits apart from salary and extra effort to increase the physical and psychological wellbeing of the employee which will benefit in the profit, productivity and the strengthening of the employee.

To find out the details regarding the research question, the phenomenological paradigm guided study was done to collect the of data in-depth qualitative interview. Ten students, aged between 16 to 25 from different Seminaries and different language group were approached for the interview. From the interview three themes emerged and they are the unfulfilled promise and disillusionment, strict hierarchy and Biblical meaning contrasted with humaneness.

Thus, the first theme, the unfulfilled promise and disillusionment, reveals how the students felt when they joined the Seminary. They said it was all different from what they heard and what they were told. The Seminary is to be a place of holiness and piety where a person is formed to be a spiritual leader. And it is true. But the way it was handled was different. Everyone speaks about peace and harmony, brotherhood and forgiveness while it was all in theory and not in practice. Thus most of those who entered the seminary felt that there lacked human formation, with kindness and love. Some of the studies done among the seminary students in Europe, it was revealed that a number of the students felt that they lacked proper behaviour in society. This study also revealed that seminary life and formation lacked understanding and humanity.

The second theme strict hierarchy says that there seems to be very little understanding from the part of the hierarchy towards the students. The students also felt that there were partiality and discrimination from the part of the superiors. Thus, most of them were disheartened. The formators had less idea of human formation and they insisted on strict rules, regulations and timetable. The students said when they were not given enough free time they took refuge in illicit and activities that were not permitted within the seminary. Some of them got into troubles and some even left. The studies done elsewhere in the different seminaries showed that formation with respect and care, love and concern made a great impact on the minds of the students that they felt to remain faithful to their vocation.

The third theme about the Biblical theme contrasted with humaneness speaks about the formation and attitude that were mostly tied up with biblical teachings. Thus anything and everything was looked at through the eyes of the Biblical themes and misinterpreted, so as to make life less meaningful. The students felt that we are living in the 21st century and not in the 6th century. Therefore, making, necessary changes can make life more meaningful and happy.

All the themes focus on the fact that Seminary formation with humanness, and understanding can make the lives of the formees more meaningful and productive. This study shows the need for a formation with understanding the students personally and inculcating all the other aspects of the different kind of learning so that formation becomes a great experience. Apart from the proper Seminary study curriculum, psychological studies for the formater and students needs to be inculcated. This will help the widening of the knowledge of the human mind and personality so as to make the lives of everyone in the Seminary meaningful.

This study is not to criticise anyone or to find fault with any system, but, to look at the lives of the seminary students from a different point of view. The Seminaries are known to be places where the students are taught to be leaders of the churches. There they are taught the Bible, the word of God and values and morals. Still the statistics show that less and less students remain to complete the years of formation. In spite of all the knowledge and teaching still what is the reason why students quit the seminary? So the above research was a humble trial to look into some of these facts.

Since only one in-depth interview per participant was carried and time didn't permit respond validation, it is recommended that a deeper and wider study dedicating more time be carried out.

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The Roles Of Entrepreneurial Characteristics On Business Strategies And Performance Of Female Entrepreneurs

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ABSTRACT

This study aimed to consider the effect of entrepreneurial characteristics on business strategy and business performance of female entrepreneurs. This also investigated the indirect impact of entrepreneurial characteristics on female entrepreneurs' business performance through the mediator of business strategy. In this study, the populations were all female entrepreneurs in Surabaya. Fifty respondents as samples were taken with non-probability sampling. They were determined to meet the particular criteria of research purposes. Then, this research data were collected through questionnaires and interviews. Furthermore, the data were analyzed using Partial Least Square (PLS) as the equation model of Structural Equation Modeling (SEM) which was based on components or variants. As the results, this study indicated that entrepreneurial characteristics affected female entrepreneurs' business strategy and business performance. While business strategy affected female entrepreneurs' business performance. However, business strategy did not mediate the effect of entrepreneurial characteristics on the female entrepreneurs' business performance.

Keywords: Entrepreneurial characteristics, business strategy, business performance, female entrepreneurs

Introduction

The movements of medium-small scaled enterprises have been currently dominated by male entrepreneurs. Historically, business actors were males since trading and business have been generally controlled by men (Casson et al., 2006). In the past, women were rarely involved in business, except for small trades in the traditional market. The World Bank (2011) found that the involvement of women for productive business activities were lessened rather than men in most of countries worldwide. However, the increasing technology has led women to contribute their roles in developing UMKM (Small-Medium Scaled Enterprises). Nowadays, women have taken their position as equal as men to run a business without leaving their natural roles as wives and housewives.

In Surabaya, female entrepreneurs are acknowledged as *wanita pahlawan ekonomi* (female heroes for economics). Indonesian women are barely as wives and housewives, but the government is able to empower them as economical heroes. In other words, the government leads the woman as female entrepreneur who are perceived to be successful business women. They are required to be more attentive in exploring business creativities, capital management, time management, human's energy, natural resources, product application and production. Then, their business can be successful and accessible to compete against global competition. Accordingly, some studies found that the success of small-scaled enterprises were due to various factors. The successful business performance can be influenced by the owner's behaviour (Zoysa and Herath, 2007, Kotey and Meredith, 1997; Olson and Currie, 1992). The success can also affected from business strategy (Li et al, 2005, Dess et al, 1997). Therefore, this study intended to know the effect of entrepreneur characteristics on business strategy and entrepreneurial business performance.

Literature Review

Entrepreneurial Characteristics

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The characteristics of entrepreneurs can be viewed from physical or personal traits. A characteristic of which a businessman contributes to success is the result of achieving motivation. While, the personal characteristics include desire for free, locus of control, creativity, risk-taking tendency (Rauch & Frese, 2005), and accomplishment needs (Rauch & Frese, 2005). Industrial, managerial, and entrepreneurial experiences along with other external factors positively affect business owners' or managers' success in running business (Davidsson, 1991). In particular, Hashim, Wifa, and Suliman (1999) argued that entrepreneurial characteristic of the owner or manager is in relation to a company's success. O'regan et al (2006) empirically proved that ownership is a key factor in overall business performance. Otherwise, Attahir (1995) assumed that the successful performance of a small business is determined by individual factor and environmental factor. A person may apply entrepreneurial characteristics, such as self-esteem, task orientation and outcome, risk-taking, leadership, originality, and future orientation. Only those who have entrepreneurial characteristics are able to act the entrepreneurship in their work (Meredith et al., 2000). In brief, high entrepreneurial characteristics positively affect the success of a business (Ardichvili et al., 2003).

Business Strategy

Strategy is defined as the unified, broad, and integrated plans that relate a company's strategic superiority and environmental challenges. It is designed to ensure that the company's main objectives can be achieved through appropriate implementation within the organization. Referring to Strickland (in Winardi, 2004), organizational strategies involve business actions and approaches that are implemented by management in order to achieve a pre-defined organizational performance. However, McCarthy (2003) states that strategy is viewed less formal in small companies since the owners or managers are the key decision makers. Schindehutte and Morris (2001) prove that small companies usually have no written statements of business strategies. Theirs are concluded from the owner's or manager's behavior development patterns and the available resource allocation (Boohene, et al. 2008). The strategy implementation of small businesses obviously reflect to the individual purposes and desires of owners or managers who originally have personal values. The options to consider particular business strategies can be based on the owners' personal goals, wishes, and individual characters (Kotey & Meredith 1997; Olson & Currie, 1992 in Boohene, et al. 2008). Moreover, personal values that relate to proactive strategies are often referred to as entrepreneurial characteristics, including creativity, risk-taking, innovation, performance-oriented, mmbition, and independence (Hodgetts & Kuratko, 2001; Kickul & Gundry, 2002 in Boohene, et al. 2008). In contrast, the conservative strategies that refer to reactive types compromise values of equality, compassion, social protection and compassion (Kotey, 1994 in Boohene, et al. 2008).

Business Performance

Business performance is a concept to measure the market achievement of a product. Each company generally concerns to know the market attainment of its products as the mirror of its success within business competition. Voss and Voss (2000) define business performance as efforts to fulfil a particular level of accomplishment, including the number of sales, number of subscribers, profit and sales growth. The simpler and more practical concept is conveyed by Ferdinand (2002) that good marketing performance involves three major measurements, such as: customer growth, sales growth, and market share that overall address to business profits. Moreover, Vanessa (2008) argues that the success of female home-based entrepreneurs is based on quality relationships with consumers, personal satisfaction, self-fulfillment satisfaction, ability to balance, and responsibilities between work and family. Within small-scaled businesses, the managers including the owners, employers, and investors operate their company as well as take various decisions independently (Suryana, 2001). They should have adequate abilities to formulate and implement effective strategies that can influence the survival or failure of small businesses (Boohene et. al, 2008). Thus, a company's performance is primarily determined with the strategies that are adopted by the managers (Covin, et al., 1990 in Boohene, et al. 2008). Literatures about strategy plans and business performance

indicate the different degrees of companies' performance. The companies which have invested time proactively to develop good strategies tend to demonstrate their higher level of business performance rather than those which provide less proactive on environment in developing business strategies.

Conceptual Framework

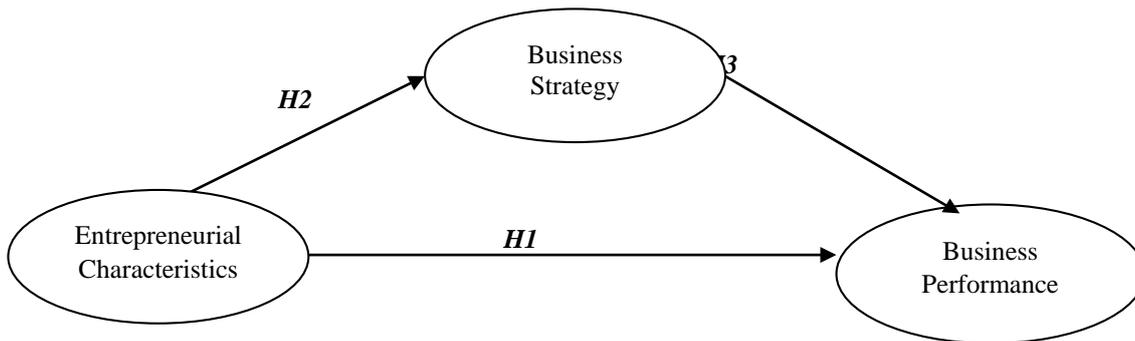


Figure 1: Conceptual Framework

Methodology

This research applied survey method. The research data involved primary and secondary data. The primary data was collected by distributing questionnaires to get detailed information and problems being researched. The population of this study were female entrepreneurs of SMEs in Surabaya. The number of samples were 50 respondents who were taken with non-probability sampling that provided different opportunities for each respondent and with purposive sampling technique that were taken with specified criteria. The samples were addressed to Small-Medium Enterprises (SMEs) that had an individual owned business with at least three employees and possessed legal or illegal entity. The SMEs had run for more than three years so their business performance could be indicated having particular degree of performance, business statuses, employees growth, and profit levels.

Research Variables

In this study, the first variable is entrepreneurial characteristic. This is the value that is inherited on SMES. Its indicators refer to the concept of Meredith et al. (2000), including confidence, task-orientation and results, risk-taking, leadership, originality, and future orientation.

The second variable is business strategy. This is the ability of a business owner or an entrepreneur in analyzing external and internal environments within a company, strategy formulation, implementation of business plans to achieve the objectives of a company as well as to conduct evaluation to obtain feedback in formulating further strategies. The indicators follow the concept of Boohene et.al (2008), i.e. planning strategies, financial strategies, human resource strategies, operational strategies, and marketing strategies.

The last variable is business performance. This refers to female entrepreneurs in the level of achievement within a certain period of time. The indicators refer to the framework of Ozer and Tinaztepe (2014), including the growth of customers, ability to dominate the market, ability to develop products, customer satisfaction, and company profits.

Analysis Technique

In this study, data were analyzed using Partial Least Square (PLS). This technique refers to Structural equation Modeling (SEM), the equation models that are based on components or variants. According to Ghozali (2005), the goal of PLS is to assist researchers for prediction. Its formal model addresses latent variable as the linear aggregate of its indicators. The Weight estimation is to create score component on the latent variables that are gained from inner and outer models. While the indirect impact was tested using Sobel test.

Results

In this study, analysis of data applied Structural Equation Modelling (SEM) with Smart PLS (Partial Least Square) software. In the PLS Path Modeling, there are 2 models, including outer model and inner model.

Evaluation of Outer Model

Convergent validity of a measurement model with reflexive indicator can be identified from the correlation between score of item/indicator with constructed score. Individual indicators are considered reliable if the correlation values are above 0.7. Nevertheless, the scale development phase, loading 0.50 to 0.60 is still acceptable (Ghozali, 2002:40). The results of correlation between indicators and their constructs can be concluded that the variable dimensions of entrepreneurial characteristics, business strategy, and business performance are considered valid as a measuring instrument since each value convergent validity is above 0.5. Moreover, the construction of estimated model has been considered as discriminant validity when the value of AVE of each construction is greater than the correlation value between constructions. The AVE value that equals or above 0.50 indicates a good convergent. As the test results, this study found that the AVE value of entrepreneurial characteristic variable (X) was 0.529; the business strategy variable (Z) was 0.558; and the business performance (Y) was 0.525. Obviously, the indicators of each construct converged with other items in one measurement at the critical limit of 0.5. While, the test results of composite reliability indicated that the value of the entrepreneurial characteristic variable (X) was 0.870; the value of business strategy variable (Z) was 0.862; and the business performance variable (Y) was 0.844. Furthermore, this study then concluded that the overall constructions that were examined had met the criteria of composite reliability so that each construct was able positioned as research variables. In turn, this indicated that composites of entire variables had an adequate internal consistency in measuring the latent variables that could be used for further analyses.

Evaluation of Inner Model

Inner models are often named as inner relation, structural model, and substantive theory that specify relationships between research variables (structural models). Testing inner model evaluates the relationships between latent constructions that were hypothesized in the study.

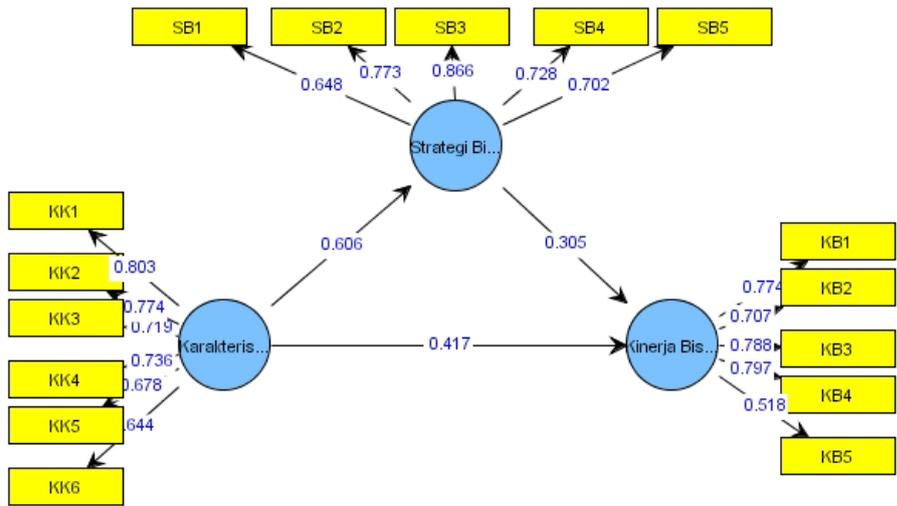


Figure 2. Model of PLS Research

Referring to the figure above, the value of inner weight demonstrated that the business strategy (Z) was influenced by the entrepreneurial characteristics (X). Otherwise, the business performance (Y) was influenced with the entrepreneurial characteristic (X) as well as the business strategy (Z) as proposed in the hypothesis testing.

Structural Model Testing (Inner Model)

Assessing a model with PLS is started by looking at R-Square for each dependent latent variable. The changes of R-Square value can be used to assess the effect of particular independent latent variables on the dependent latent variables that have substantive impact. Then, the endogenous latent variables of structural model with R2 yield of 0.67 was indicated as "good" model, R2 of 0.33 as the "moderate" model, R2 of 0.19 as "weak" model (Ghozali, 2009). The output PLS is described below:

Table 1. R-Square Value

| | R-square |
|------------------------------------|----------|
| Entrepreneur Characteristic | |
| Business Strategy | 0.368 |
| Business Performance | 0.421 |

Source: data primer diolah tahun 2018

The latent variable of characteristic of entrepreneur (X) that affected the business strategy variable (Z) in the structural model had a R2 value of 0.368. This indicated that the model was "moderate". The latent variables of characteristics of entrepreneurs and business strategies that affected the business performance variable in the structural model had a value of R2 of 0.421. This indicated that the model was also "moderate". Moreover, the conformity of structural models can be seen from Q2 below:

$$Q^2 = 1 - [(1 - R_1^2) (1 - R_2^2)]$$

$$\begin{aligned}
 &= 1 - [(1 - 0.368) (1 - 0.421)] \\
 &= 1 - [(0.865) (0.823)] \\
 &= 1 - [(0.711)] \\
 &= 0,289
 \end{aligned}$$

The Q2 result was 0289, so the value Q2 above zero was indicated as predictive relevance.

Hypothesis Testing

Table 2. Construction Table

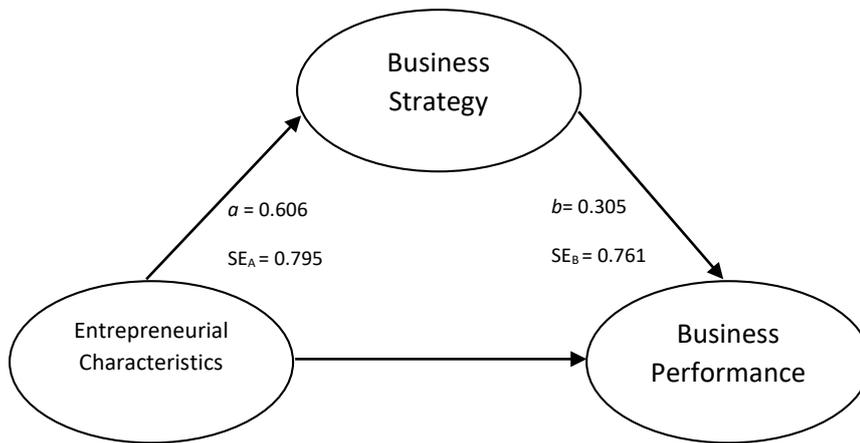
| | Original sample estimation | Mean of subsamples | Standard deviation | t-Statistic |
|---|----------------------------|--------------------|--------------------|-------------|
| Entrepreneurial Characteristics -> Business Strategy | 0.606 | 0.631 | 0.067 | 9.072 |
| Entrepreneurial Characteristics -> Business Performance | 0.417 | 0.456 | 0.138 | 3.031 |
| Business Strategy -> Business Performance | 0.305 | 0.303 | 0.113 | 2.700 |

Source: Primary Data, Processed in 2018

In this study, the hypothesis test evidenced four results:

1. The entrepreneurial characteristics (X) had a positive effect on business performance (Y) because the T-statistical value was 9, 072 that was indicated greater than 1.96. Therefore, the hypothesis result of H1 that entrepreneurial characteristics influenced business strategy was accepted.
2. The entrepreneurial characteristics (X) had a positive effect on business performance (Z) because the T-statistical value was resulted 3,031. This was greater than 1.96. Thus, the hypothesis result of H2 that entrepreneurial characteristics affected business performance was declared acceptable.
3. The business strategy (Z) had a positive effect on business performance (Y) because the T-statistical value was 2.700 that was meant greater than 1.96. Therefore, the result of H3 hypothesis that the business strategy affected business performance was accepted.
4. The indirect influence can acknowledged with Sobel test. This is to test whether the relationships between variables of mediation are significantly proficient to be a mediator within the connections.

| Path | b | | SE | |
|--------------|--------|-------|--------|-------|
| | Z<-- X | Y<--Z | Z<-- X | Y<--Z |
| Y <-- Z <--X | 0.606 | 0.305 | 0.795 | 0.761 |



$$Z = \frac{ab}{\sqrt{(b^2 SE_a^2) + (a^2 SE_b^2)}}$$

$$z = \frac{0.606 \times 0.305}{\sqrt{(0.305^2 \times 0.795^2) + (0.606^2 \times 0.761^2)}}$$

$$z = \frac{0.185}{\sqrt{(0.059) + (0.213)}}$$

$$z = \frac{0.185}{\sqrt{0.271}}$$

$$z = \frac{0.185}{0.521}$$

$$Z = 0.355$$

The value of T was $0.355 < 1.96$ indicating that the mediation parameter was not significant. Thus, the model of indirect effect of entrepreneurial characteristic on the business performance of female SMEs through business strategy was not accepted.

Discussion

Effect of Entrepreneurial Characteristics on Business Performance of Female SMEs

In this study, the first hypothesis test showed that there was an effect of entrepreneurial characteristics on female entrepreneurs' performance for about 0.417. This result proved that the entrepreneurs' characteristics directly influenced their business performance. Although the influence of entrepreneurial characteristics was not great, but it could be determined as the primary capital in doing a business, particularly with business competition. Instead, the business women's characters could be formed to plan their future business. Meanwhile, the stronger entrepreneurial characteristic of SME's owners also had an impact on business performance. The characteristics of entrepreneurship were identified as the traits of small and medium business owners, including: confident, task-oriented and outcome, risk-taking, leadership, originality, and future-oriented characters. This study argues when the female entrepreneurs have confidence, so their business will highly succeed. It is necessary to run the business with an effort to develop product innovation. Indeed, the female entrepreneurs realized that the current business world had challenges; therefore, they needed to bring about an idea authenticity as well as to manage their business compassionately to achieve higher level of business performance. Such findings reinforce previous researches by Zoysa and Herath (2007), Lee and Tsang (2001), Street and Cameron (2007), Blackman (2003), Nimalathasan (2008), and Solichin (2005) of which all argue that the owner or manager is essentially the key factor in business performance.

Effect of Entrepreneurial Characteristics on Business Strategy of Female SMEs

In the second hypothesis, the test indicated that there was an effect of entrepreneurial characteristics on business strategy for about 0.606. This result proved that entrepreneurial characteristics directly influenced business strategy. The female entrepreneurs had a strong belief that their executed business would have a good performance. The impact of good entrepreneurship characteristic lead for coherent business objectives to preserve customers. Then, the female entrepreneurs are able to improve their products quality as the market demands. Moreover, a marketing strategy of SMEs is generated to win a competition within target market. A competition can be won if an enterprise is able to create competitive strategies that address for competitive advantage (Porter, 1991). Competitive strategies involve combination of business objectives that include policies as a medium to achieve business goals as well as to maintain a profitable position within an industry as the place of competition. In brief, electing appropriate strategies may derive from two factors, i.e. industrial attraction that provides long-term profit rates and relative positioning within an industry.

Effect of Business Strategy on Business Performance

The hypothesis testing result presented that business strategies influenced business performance in the value of 0.303. This result indicated that business women intended to look for market opportunities by choosing a strategy that suited with their business objectives. Otherwise, SMEs businesses were not declared publicly and apparently. This study argued that the existing SME owners run their business with a flowing strategy that aimed to increase profits, growth of customer numbers, market control, capability on products development, and consumer satisfaction.

Indirect Effect of Entrepreneurial Characteristics on Business Performance through Business Strategy

The Sobel test results indicated that indirect effect of entrepreneurial characteristics on business performance through a business strategy was not accepted because of T statistical < t table. This result showed that the business strategy was incapable in processing entrepreneurial characteristics and business performance of female entrepreneurs in Surabaya. In this study, the business purposes of female entrepreneurs were identified unclear so that their business strategies simply followed the market

environment. As the argumentation of McCarthy (2003), business strategies of SMEs are mostly informal and generated by the owners as the decision makers. Instead, Schindehutte and Morris (2001) explain that a small enterprise usually has no written statements on business strategies. Their strategies are inferred from the development patterns of owners' behavior and resources. In summary, this study found that small companies usually have no written strategies, but theirs are maintained from the entrepreneurs' behavior and resources (Boohene, et al. 2008).

Conclusion

The study resulted three proposed hypotheses that were all accepted. First, the characteristic of entrepreneurs affected business strategy. Second, the characteristic of entrepreneurs affected business performance. Third, the business strategies affected the performance of female entrepreneurs. However, the business strategy was incapable to be the mediator to influence the characteristics of entrepreneurs on business performance. The results identified that entrepreneur's characters influenced the selection of women's business strategies even though the strategies were never written clearly. The business women simply run a business for only earning income and profit.

This study had several limitations that might affect interpretation of study findings. First, the samples of this study were limited to micro and small businesses located in one city. Second, this study applied only three variables being investigated. The future research is perceived to expand the coverage areas into many cities so that the research results can be generalized into larger population. The findings of this study also indicate that three variables only predict 30 percent of variances in performance. Therefore, the future studies should investigate the effects of uncertain factors to add comprehensive results gained from this study.

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A Study on the Adsorption Isotherms of Humic Acid and Modified Humic Acids

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Abstract- The present research aims the preparation of modified humic acids to be used as the effective sorbents for the removal of acid dye and basic dye. The sub-bituminous coal samples occurred at Tekyit mine (Tekyit village, Pin Laung Township, Shan State), were received from Department of mine, Ministry of Mining, Myanmar. Three types of sorbents such as extracted humic acid (HA), physically modified humic acid (MHA I) and chemically modified humic acid (MHA II) were prepared. Sorption studies of three sorbents (HA, MHA I, MHA II) were carried out spectrophotometrically. Two model dyes, methylene blue as basic dye and congo red as acid dye were used in sorption experiments. There are many kinds of sorption parameters such as concentration of dye solution, pH of medium, contact time and temperature. Based on the dosage method, the maximum removal percent of congo red was found to be 46% by HA, 70% by MHA I and 93% by MHA II at the specified conditions such as initial dye concentration (30 mg L^{-1}), dosage ($0.05 \text{ g} / 10 \text{ mL}$), pH (5) and contact time (1 h). In the case of methylene blue as sorbate, the maximum removal percent was detected as 38% by HA, 51% by MHA I and 83% by MHA II under the conditions which were the same as sorbate congo red. Sorption isotherm studies corresponded to Langmuir, Freundlich and Temkin isotherms and significant sorption parameters were evaluated. Based on the Langmuir parameters, monolayer sorption was achieved to indicate the favorable adsorptions of congo red and methylene blue on MHA II. Based on the manipulating data of isotherms, the sorption capacities of sorbents for the removal of congo red and methylene blue were observed as the order of $\text{MHA II} > \text{MHA I} > \text{HA}$.

Keywords : Modified humic acids, acid and basic dye, isotherm, Langmuir, Freundlich, Temkin

I. INTRODUCTION

Humic acid is one of the main component portions of the naturally occurring humic substances that occur in soil, compost, sludge, in various rank coal peat, lignite, sub bituminous, etc. and all aquatic sediments. Its colour can range from dark brown to black. It is a highly complex polymeric substance, comprising a mixture of aromatic groups and other different compounds including amino acids, amino sugar, peptides, aliphatic acids and other aliphatic compound. It is important in soil chemistry due to its buffering capacity. Humic acid and other derivatives can be used for removing toxic metals and their ions from waste water (Aiken et al., 1985). Extensive works in the nature of humic substances, their characterization and applications have been reported elsewhere (Stevenson, 1994). Humic substances are major constituents of soil chemical and physical quality and are precursor of some fossil fuels. They can also be found in peat, coal and ocean water. They function to give the soil structure, porosity, high adsorption capacity, high exchange capacity and are involved in the chelation of mineral elements. Humic substances are usually separated into three fractions: humic acids, fulvic acids and humins. These fractions are defined strictly on their solubility in their acid or alkali solutions (Aiken, 1985).

II. MATERIAL AND METHODS

The collected coal sample was prepared humic acid(HA) by extraction method. This research work is concerned with the preparation and modification of humic acid and modified humic acids. Physically modified humic acid (MHA I) was prepared by heating process of extracted humic acid and chemically modified humic acid (MHA II) was prepared by adding calcium chloride and by heating process of extracted humic acid. Two model dyes, methylene blue as basic dye and congo red as acid dye were used in sorption experiments. The colour removal of congo red and methylene blue (initial concentration 30 mgL^{-1}) by various dosage of humic acid (HA) and modified humic acids(MHA I and MHA II) in 10 mL dye solution for removal of dye were also determined by varying the adsorbent dosage from 0.01 g to 0.13 g under the same conditions. Based on the sorbent dose effect, sorption isotherm studies corresponded to Langmuir, Freundlich and Temkin isotherms and significant sorption parameters were evaluated.

III. RESULTS AND DISCUSSIONS

The effect of dosage was studied the color removal of congo red and methylene blue from a constant initial concentration of 30 mgL⁻¹ by the amount of sorbents HA, MHA I and MHA II in range from 0.01 g to 0.13 g in 10 mL congo red solution. For the sorbent of 0.05 g in 10 mL, it was found that after 60 min agitation time, the amount of dye being adsorbed were 45.78 % for HA, 70.04 % for MHA I and 92.51 % for MHA II. The percent removal of methylene blue increases with respect to increase in sorbent dosage. The percent removal were 37.67 % for HA, 50.61 % for MHA I and 82.91 % for MHA II with respect to 0.05 g in 10 mL of methylene blue solution after the equilibrium time. The higher percent removal capacity may be attributed to the greater quantity of sorbent dose being used. This is due to increased in sorbent dosage attributed to increase in surface area and availability of adsorption site. The dosage method involves the use of different masses of sorbent, but a fixed initial concentration of the sorbate at a certain temperature. Here, to reveal the significance of the removal of congo red and methylene blue, the well-known isotherms were applied such as Langmuir isotherm, Freundlich isotherm and Temkin isotherm. Table (1 - 6) represent the data and Figures (1- 18) showed the Langmuir, Freundlich and Temkin isotherms pertaining to sorption equations. The calculated results of the Langmuir, Freundlich and Temkin isotherm constants are presented in Table 7.

Table 1 Data Treatment of Langmuir, Freundlich and Temkin Isotherms for Sorption of Congo Red by HA (Dosage Method)

| Mass (g/10mL) | Ce (mgL ⁻¹) | x/m (mg g ⁻¹) | Ce/x/m (gL ⁻¹) | log Ce | log x/m |
|---------------|-------------------------|---------------------------|----------------------------|--------|---------|
| 0.01 | 25.918 | 4.082 | 6.349 | 1.414 | 0.611 |
| 0.03 | 20.063 | 3.312 | 6.057 | 1.302 | 0.520 |
| 0.05 | 16.266 | 2.747 | 5.922 | 1.211 | 0.439 |
| 0.07 | 13.576 | 2.346 | 5.786 | 1.133 | 0.370 |
| 0.09 | 11.677 | 2.036 | 5.736 | 1.067 | 0.309 |
| 0.11 | 10.253 | 1.795 | 5.711 | 1.011 | 0.254 |
| 0.13 | 9.082 | 1.609 | 5.644 | 0.958 | 0.207 |

Stirring

pH = 5
Contact time = 1 h
Initial Concentration = 30 mgL⁻¹
Temperature = 30°C
rate = 100 rpm

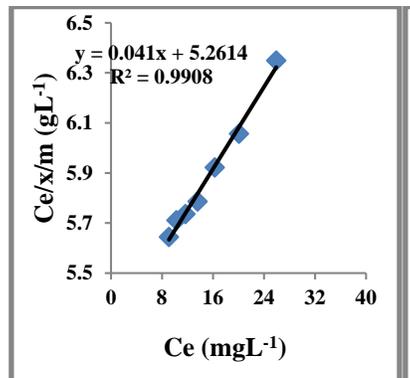


Figure 1 Langmuir isotherm for sorption of Congo Red on HA

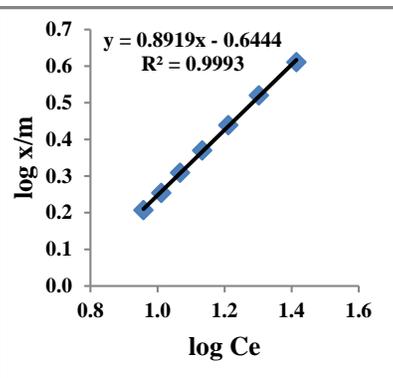


Figure 2 Freundlich isotherm for sorption of Congo Red on HA

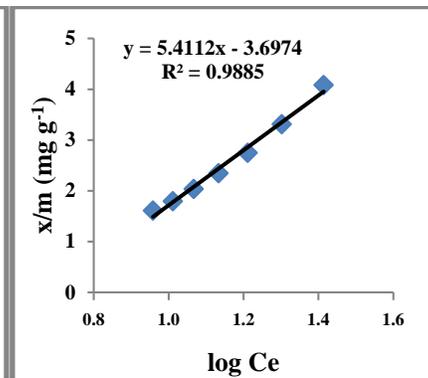


Figure 3 Temkin isotherm for sorption of Congo Red on HA

Isothe

Table 2 Data Treatment of Langmuir, Freundlich and TemIsotherms for Sorption of Methylene Blue by HA (Dosage Method

| Mass (g/10mL) | Ce (mgL ⁻¹) | x/m (mg g ⁻¹) | Ce/x/m (gL ⁻¹) | log Ce | log x/m |
|---------------|-------------------------|---------------------------|----------------------------|--------|---------|
| 0.01 | 26.911 | 3.089 | 8.712 | 1.430 | 0.490 |
| 0.03 | 22.134 | 2.622 | 8.442 | 1.345 | 0.419 |

pH = 5
Contact time = 1 h
Initial Concentration = 30 mgL⁻¹
Temperature = 30°C
Stirring rate = 100 rpm

| | | | | | |
|------|--------|-------|-------|-------|-------|
| 0.05 | 18.699 | 2.260 | 8.273 | 1.272 | 0.354 |
| 0.07 | 16.159 | 1.977 | 8.172 | 1.208 | 0.296 |
| 0.09 | 14.207 | 1.755 | 8.096 | 1.153 | 0.244 |
| 0.11 | 12.683 | 1.574 | 8.056 | 1.103 | 0.197 |
| 0.13 | 11.402 | 1.431 | 7.970 | 1.057 | 0.156 |

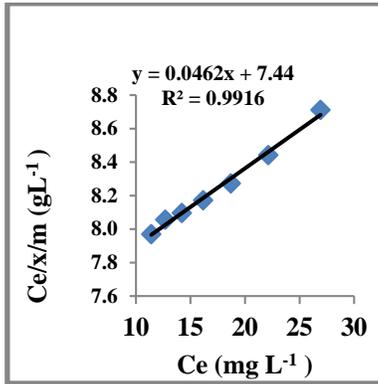


Figure 4 Langmuir isotherm for sorption of methylene blue on HA

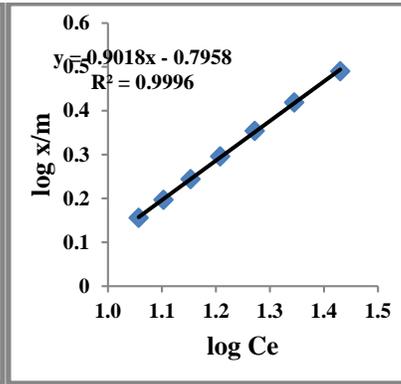


Figure 5 Freundlich isotherm for sorption of methylene blue on HA

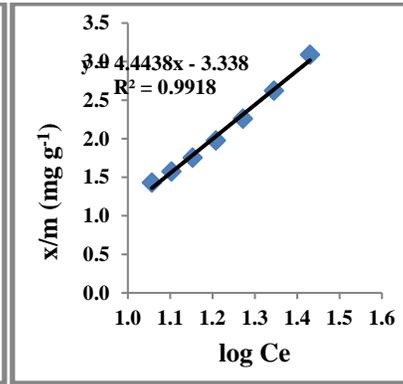


Figure 6 Temkin isotherm for sorption of methylene blue on HA

Table 3 Data Treatment of Langmuir, Freundlich and Temkin

Isotherms for Sorption of Congo Red by MHA I (Dosage Method)

| Mass (g/10mL) | Ce (mgL ⁻¹) | x/m (mg g ⁻¹) | Ce/x/m (g L ⁻¹) | log Ce | log x/m |
|---------------|-------------------------|---------------------------|-----------------------------|--------|---------|
| 0.01 | 21.234 | 8.766 | 2.422 | 1.327 | 0.943 |
| 0.03 | 12.785 | 5.738 | 2.228 | 1.107 | 0.759 |
| 0.05 | 8.987 | 4.203 | 2.138 | 0.954 | 0.624 |
| 0.07 | 6.772 | 3.318 | 2.041 | 0.831 | 0.521 |
| 0.09 | 5.475 | 2.725 | 2.009 | 0.738 | 0.435 |
| 0.11 | 4.557 | 2.313 | 1.970 | 0.659 | 0.364 |
| 0.13 | 3.861 | 2.011 | 1.920 | 0.587 | 0.303 |

pH = 5
Contact time = 1 h
Initial Concentration = 30 mg L⁻¹
Temperature = 30°C
Stirring rate = 100 rpm

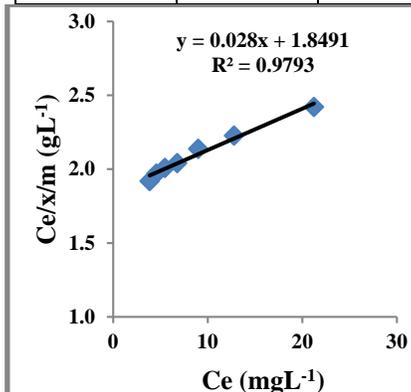


Figure 7 Langmuir isotherm for sorption of Congo red on MHA I

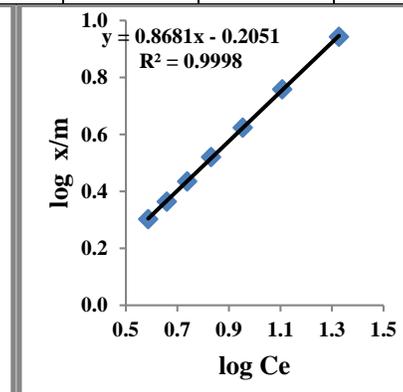


Figure 8 Freundlich isotherm for sorption of Congo red on MHA I

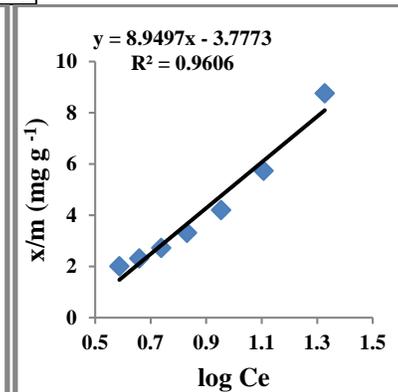


Figure 9 Temkin isotherm for sorption of Congo red on MHA I

Table 4 Data Treatment of Langmuir, Freundlich and Temkin Isotherms for Sorption of Methylene Blue by MHA I (Dosage Method

| Mass (g/10mL) | Ce (mgL ⁻¹) | x/m (mg g ⁻¹) | Ce/x/m (gL ⁻¹) | log Ce | log x/m |
|---------------|-------------------------|---------------------------|----------------------------|--------|---------|
| 0.01 | 25.264 | 4.736 | 5.334 | 1.403 | 0.675 |
| 0.03 | 18.821 | 3.726 | 5.051 | 1.275 | 0.571 |
| 0.05 | 14.817 | 3.037 | 4.879 | 1.171 | 0.482 |
| 0.07 | 12.012 | 2.57 | 4.674 | 1.080 | 0.410 |
| 0.09 | 10.244 | 2.195 | 4.667 | 1.010 | 0.341 |
| 0.11 | 8.902 | 1.918 | 4.641 | 0.949 | 0.283 |
| 0.13 | 7.866 | 1.703 | 4.620 | 0.896 | 0.231 |

pH = 5
Contact time = 1 h
Initial Concentration = 30 mgL⁻¹
Temperature = 30°C
Stirring rate = 100 rpm

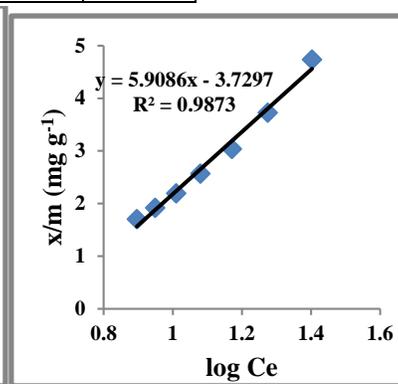
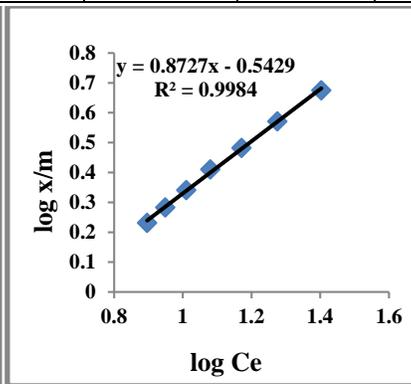
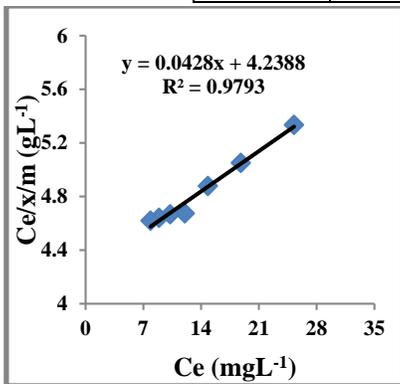


Figure 10 Langmuir isotherm for sorption of methylene blue on MHA I

Figure 11 Freundlich isotherm for sorption of methylene blue on MHA I

Figure 12 Temkin isotherm for sorption of methylene blue on MHA I

Table 5 Data Treatment of Langmuir, Freundlich and Temkin Isotherms for Sorption of Congo Red by MHA II (Dosage Method)

| Mass (g/10mL) | Ce (mgL ⁻¹) | x/m (mg g ⁻¹) | Ce/x/m (gL ⁻¹) | log Ce | log x/m |
|---------------|-------------------------|---------------------------|----------------------------|--------|---------|
| 0.01 | 10.918 | 19.082 | 0.572 | 1.038 | 1.281 |
| 0.03 | 4.146 | 0.618 | 0.481 | 0.618 | 0.935 |
| 0.05 | 2.247 | 5.540 | 0.406 | 0.352 | 0.744 |
| 0.07 | 1.614 | 4.055 | 0.398 | 0.208 | 0.608 |
| 0.09 | 1.234 | 3.196 | 0.386 | 0.091 | 0.505 |
| 0.11 | 1.013 | 2.635 | 0.384 | 0.006 | 0.421 |

pH = 5
Contact time = 1 h
Initial Concentration = 30 mgL⁻¹
Temperature = 30°C
Stirring rate = 100 rpm

Table 7 Langmuir, Freundlich and Temkin Parameters for the Adsorption of Dyes

| Sorbent s | Dyes | Langmuir model | | | | Freundlich model | | | Temkin model | | |
|-----------|----------------|-----------------------|----------|----------------|----------------|------------------|----------|----------------|--------------|----------|----------------|
| | | X _m (mg/g) | b (L/mg) | R ² | R _L | K (mg/g) | n (L/mg) | R ² | a (mg/g) | b (L/mg) | R ² |
| HA | Congo red | 24.390 | 0.008 | 0.990 | 0.806 | 0.226 | 1.122 | 0.999 | -3.697 | 2.350 | 0.988 |
| | Methylene blue | 21.739 | 0.006 | 0.991 | 0.847 | 0.160 | 1.109 | 0.999 | -3.338 | 1.929 | 0.991 |
| MHA I | Congo red | 35.714 | 0.015 | 0.979 | 0.690 | 0.624 | 1.152 | 0.999 | -3.777 | 3.886 | 0.960 |
| | Methylene blue | 23.809 | 0.009 | 0.979 | 0.787 | 0.287 | 1.147 | 0.998 | -3.729 | 2.565 | 0.987 |
| MHA II | Congo red | 58.824 | 0.044 | 0.855 | 0.395 | 2.564 | 1.169 | 0.990 | 1.447 | 6.604 | 0.942 |
| | Methylene blue | 25.641 | 0.048 | 0.979 | 0.409 | 1.393 | 1.321 | 0.998 | -1.230 | 4.266 | 0.957 |

HA = Humic acid

MHA I = Modified humic acid (physical modification)

MHA II = Modified humic acid (chemical modification)

4. CONCLUSION

Chemically modified humic acid (MHA II) as effective and low cost adsorbent for the removal of acid dye and basic dye were investigated. Physically modified humic acid (MHA I) was prepared by heating process of extracted humic acid and chemically modified humic acid (MHA II) was prepared by treating with calcium chloride. There are many kinds of sorption parameters such as concentration of dye solution, pH of medium, contact time, sorbent dose and temperature. Among these parameters, the effect of sorbent dose was studied in this paper. The maximum removal percent of congo red were found to be 46% of HA, 70% of MHA I and 93% of MHA II at 30 mgL⁻¹ of initial dye concentration, 0.05 g/10 mL of dosage, pH 5 and 1 h of contact time. The maximum removal percent of methylene blue by HA, MHA I and MHA II were found to be 38%, 51% and 83% respectively under the same conditions. Sorption isotherm studies using relevant isotherm equation corresponded Langmuir and Freundlich as well as Temkin were applied and significant sorption parameters were evaluated. According to these isotherms, the sorption capacities of congo red and methylene blue on sorbents in the order of MHA II > MHA I > HA were observed. MHA II was the most effective and efficient sorbent for acid dye, basic dye. HA, MHA I and MHA II could be applied in purifying the environmentally color polluted waste water bodies.

APPENDIX

Langmuir isotherm equation $\frac{C_e}{x/m} = \frac{1}{X_m b} + \frac{C_e}{X_m}$

Freundlich isotherm equation $\log \frac{x}{m} = \frac{1}{n} \log C_e + \log K$

Temkin isotherm equation $\frac{x}{m} = a + 2.303b \log C_e$

$\frac{x}{m}$ = the amount of sorbate (x) adsorbed per unit mass of sorbent

C_e = equilibrium concentration of the sorbate in solution

X_m = the maximum monolayer amount of sorbate per unit mass of sorbent

b = Langmuir constant related to the affinity between the sorbent and sorbate

n, K = constant

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Using the Sonification for Hardly Detectable Details in Medical Images

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Abstract- In this paper, the inverse sonification problem is analysed in order to capture hardly detectable details in a medical image. The direct sonification problem is converting the data points into audio specimens by a transformation which involves data, acoustics parameters and sound representations. The inverse problem is reversing back the audio specimens into data points. By using the current sonification operator, the inverse approach does not bring any improvement in the medical picture after sonification. The obtained image is the same with the original one and does not bring additional information for diagnosis and surgical operation. In order to discover new details in a medical image, a new operator is introduced in this paper, by using the Burgers equation of sound propagation. The improving of the medical image is useful in interpreting the medical details in the tumour surgery. The inverse approach is exercised on several medical images.

Index Terms- Sonification; Burgers equation; Visualization tools; Laparoscopic surgery.

I. INTRODUCTION

A major effort was devoted in the last years to enhance the quality of medical images used to surgery [1]. Since Roentgen's discovery of X-rays (1895) the medical imaging is constantly developing. The computed tomography, magnetic resonance imaging, nuclear imaging, and ultrasound-positioned medical imaging were implemented for medical purposes including to diagnoses and surgery.

To our knowledge, we are the first to apply the sonification theory to detect hidden details in medical images, such as vessels or tumors that cannot be directly seen with the eye.

The sonification theory was founded in 1952 by Pollack who applied the information theory to visualize the auditory displays [2, 3]. The first International Community for Auditory Display Conference (ICAD) organized by Kramer in 1992 discusses different issues ranging from the sciences and technology to the arts [4, 5]. Licht traces in 2007 the history of the sound art by highlighting the old art such as Sonic Youth and the contemporary art that led to interesting applications [6].

The nano-guitar built by Cornell University physicists from the crystalline silicon no larger than a single human blood cell, invites the bacteria inside a person to play and thus to be easily detected and tracked with a stethoscope [7]. The quantum whistle is a nano-scale sound which is able to discover vibrations in superfluid gases that are predicted by quantum theory [8].

The sonification theory introduces new insights into illnesses such as the Alzheimers's dementia [9] and trauma of the body motions such as walking, turning, rising arms or legs [10]. The sonification of images is less studied so far to our knowledge. This is because the applying of current sonification operator in the inverse approach does not bring any improvement in the medical image. The sonification operator is based on the linear theory of sound motion.

This paper introduces a new sonification operator based on the Burger nonlinear theory of the sound propagation. The new operator is capable to solve the inverse sonification problem and to improve the content of the medical image.

The paper is organized as follows: Section 2 is devoted to description of the direct problem of sonification. A description of the new sonification operator based on the Burgers equation of sound propagation is presented in Section 3. The applications are presented in Section 4, and Section 5 contains Conclusions.

II. DIRECT PROBLEM OF SONIFICATION

The direct problem of sonification is well known in the literature [11-14]. The sonification operator S^0 maps the point data D into audio samples Y^0 $S^0 : D \rightarrow Y^0$, $S^0 : x(t) \rightarrow y^0(t^0, x(t), p^0)$, with $x(t)$ the 1D point data to be transformed into audio samples, t is the data time, t^0 is the sonification time, and $p^0 \subseteq P^0$, $P^0 = \{k^0, \Delta^0, f_{ref}^0, \alpha^0, \beta^0, \phi^0, \varepsilon^0, g^0, \gamma^0, H^0\}$ are the sonification parameters: k^0 is the compression coefficient on the time interval $T^0 = T / k^0$, $\Delta^0 \geq 0$ is the dilation coefficient, f_{ref}^0 is the reference frequency, $\alpha^0, \beta^0 \geq 0$ are the pitch scaling parameters, $\phi^0 \geq 1$ is the power distortion coefficient, $\varepsilon^0 \geq 0$ is the amplitude's threshold, g^0 is the gain function, γ^0 is the decay coefficient and H^0 is the function of the timbral control.

The 1D data string $x(t)$ is divided into non-overlapping sections of different length. The variables of the data domain are t, t_i, T . The signal $x(t)$ is understood as a sequence $x(n)$ at the rate of sample f_s in T seconds. The $x(n)$ consists of $N = T \times f_s$ samples. The time points t_i separate $x_i(t)$. If $t_0 = 0$ and $t_M = T$ a division in M segments of $x_i(t)$ can be written as

$$x_i(t) = \begin{cases} x(t+t_{i-1}) & 0 \leq t \leq (t_i - t_{i-1}) \\ 0 & \text{else} \end{cases} \quad (1)$$

The duration of each segment is $T_i = t_i - t_{i-1}$. The segments $x_i(t)$ are sonified as a succession of events $y_i^0(t^0)$ which are longer or shorter than T_i

$$y^0(t^0) = \sum_{i=1}^M y_i^0(t^0 - t_{i-1}^0), \quad t_{i-1}^0 = \frac{t_{i-1}}{k^0} \quad (2)$$

The sonification signal $y^0(t^0)$ can be expressed as

$$y_i^0(t^0) = |x_i(\Delta^0 t^0)| \sin \left(2\pi \int_0^{t^0} f_{ref}^0 2^{(x_{trend}(t_{i-1}) + x_i(\Delta^0 t^0))} dt^0 \right), \quad (3)$$

where $x_i(\Delta^0 t^0)$ is the mean free segment, and $x_{trend}(t_{i-1})$ is the trend signal at the starting point for pitch modulation. Parameter Δ^0 gives the length of the acoustic event T_i^0 . If $\Delta^0 = k^0$ the adjacent events do not overlap but for $\Delta^0 \leq k^0$ they overlap.

The operator H^0 is a sine function and introduces the control of timbre

$$y_i^0(t^0) = a_i(t^0) H^0 < \sin \left(2\pi \int_0^{t^0} f_{ref}^0 2^{b_i(t^0)} dt^0 \right) >, \quad b_i(t^0) = (\alpha^0 x_{trend}(t_{i-1}) + \beta^0 x_i(\Delta^0 t^0)), \quad (4)$$

where $a_i(t^0)$ is the amplitude modulator, f_{ref}^0 is the base frequency for the pitch range of sonification and $b_i(t^0)$ is a pitch modulator. The amplitude modulator is

$$a_i(t^0) = |x_i(\Delta^0 t^0)|^{\phi^0}, \quad \phi^0 \geq 1, \quad (5)$$

where ϕ^0 is the amplitude modulator. A half-wave rectification is included for exceeding a threshold ε^0 around the mean of the amplitude

$$a_i(t^0) = g(|x_i(\Delta^0 t^0)|, \varepsilon^0), \quad g(x, \varepsilon^0) = \begin{cases} x - \varepsilon^0 & x \geq \varepsilon^0 \\ 0 & \text{else} \end{cases} \quad (6)$$

III. NEW SONIFICATION OPERATOR

The new sonification operator has the capability to bring gains in a medical image by discovering of hardly detectable details. We are looking for a new operator to replace (3) which is based on the linear theory of sound propagation. To introduce a new sonification operator, the Burgers equation of sound propagation is used.

Let us to consider a digital image B of area A , seen as a collection of N pixels $D = \{d_1, d_2, \dots, d_N\}, d_i \in R^N$. The B is subjected to external force $f(t)$ written as a sum of the excitation harmonic force $F_p(t)$ and the generation sound force $F_s(t)$. The last force is

introduced to build the sonification operator. The response of B to $f(t)$ is a new configuration b defined of all points $P \in B$ at the time t resulting by vibration of B . The vibration of B is described by Burgers equation [15]

$$\frac{\partial v}{\partial x} - \frac{\beta}{c_0^2} v \frac{\partial v}{\partial \tau} - \frac{b}{2\rho_0 c_0^3} v \frac{\partial^2 v}{\partial \tau^2} = 0, \tag{7}$$

where $x = (x_1, x_2, x_3)$, $v = (v_1, v_2, v_3)$ is the vector of acoustic velocity, $\tau = t - x/c_0$ is the retarded time, t is time, c_0 is the velocity of sound in the linear approximation, $b = (b_1, b_2, b_3)$ are the dissipation coefficients, ρ_0 is density of medium, $\beta = (\beta_1, \beta_2, \beta_3)$ is nonlinearity coefficient. Details on the propagation of waves in nonlinear 1D media can be found in [16-19]

Equation (7) admits the cnoidal solutions [20]. These solutions are expressed in terms of the Jacobi elliptic functions (cnoidal solutions) or the hyperbolic functions (solitons).

Given a known force F_p , we determine the unknown force F_s such that the acoustic power radiated from B to be minimum. The acoustic power radiated from B is

$$W = \frac{A}{2} v^T p, \tag{8}$$

where v is the velocity verifying (7) and p the acoustic pressure vector, A is the area of the rectangular photo, and the subscript T means the transpose [21].

We suppose that the solutions v_i , $i = 1, 2, 3$ of (7) are expressed as

$$v_i = \sum_{j=1}^l a_j \text{cn}^j(m_i, \eta_i) + \frac{\sum_{j=1}^l b_j \text{cn}^j(m_i, \eta_i)}{1 + \sum_{j=1}^l c_j \text{cn}^j(m_i, \eta_i)}, \quad i = 1, 2, 3, \tag{9}$$

where $\eta_i = k_{1i}x_1 + k_{2i}x_2 + k_{3i}x_3 - \omega t + \tilde{\phi}_i$, l is a finite number of degree of freedom of the cnoidal functions, $0 \leq m \leq 1$ is the moduli of the Jacobean elliptic function, ω is frequency and $\tilde{\phi}$ the phase, k_1, k_2, k_3 are components of the wave vector [20]. In the following we stop to $l = 2$, and we will see that there are no sensible improvements in solutions for $l > 2$. By setting

$$\frac{\partial W}{\partial F_s} = 0, \tag{10}$$

the function $F_s(t)$ is determined.

The unknown parameters $P_j = \{m_j, \omega_j, k_{1j}, k_{2j}, k_{3j}, \tilde{\phi}_j, a_1, b_1, c_1, a_2, b_2, c_2\}$, $j = 1, 2, 3$, are evaluated by a genetic algorithm. The objective function $\Upsilon(P_j)$ to be minimized is written with respect to residuals of (7) and (10)

$$\Upsilon(P_j) = 3^{-1} \sum_{j=1}^3 \delta_{1j}^2 + \delta_2^2, \tag{11}$$

with

$$\delta_{1j} = \frac{\partial v_j}{\partial x_j} - \frac{\beta_j}{c_0^2} v_j \frac{\partial v_j}{\partial \tau} - \frac{b_j}{2\rho_0 c_0^3} v_j \frac{\partial^2 v_j}{\partial \tau^2}, \quad \delta_2 = \frac{\partial W}{\partial F_s}. \tag{12}$$

The genetic algorithm is running until it is reached a non-trivial minimizer, which will be a point at which (11) admits a global minimum.

The quality of results depends on the values of Υ . The required precision is taken to be six places after the decimal point. The following parameters are considered: number of populations 200, the reproduction ratio 1.0, multi-point crossover number 1, probability of mutation 0.5, and maximum number of generations 500.

The sonification operator S is written with respect to F_s

$$S(D, t) = F_s(\tilde{D}, t) + \frac{F_s(\tilde{D}, t)}{1 + F_s(\tilde{D}, t)}, \tag{13}$$

with $D = \{d_1, d_2, \dots, d_N\}$, $d_i \in \mathbb{R}^N$ is the original image data domain, $\tilde{D} = \{\tilde{d}_1, \tilde{d}_2, \dots, \tilde{d}_N\}$, $\tilde{d}_i \in \mathbb{R}^N$ is the domain of point data in the sonified image, and t is the sonification time. Data D is arranged under a matrix with arbitrarily number of elements. This matrix is

shown in Fig.1a. The elements of the matrix contain interfaces or borders between the colors and nuances, lines and curved lines (Fig.1b).

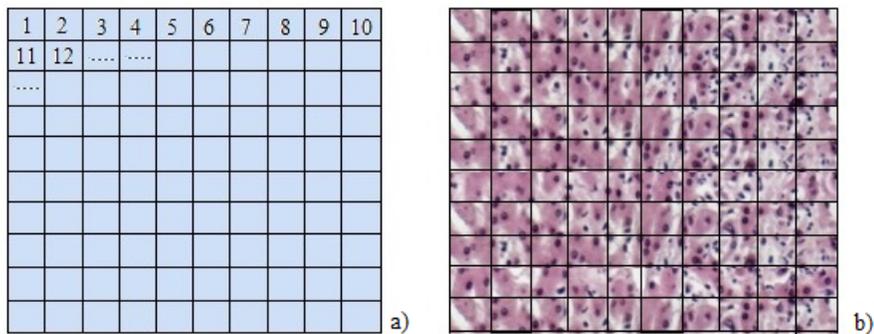


Fig.1. a) Matrix of data with arbitrarily number of elements. b) An image with borders separating the colors and nuances, lines and curved lines, etc.

The sharp interface conditions for which the matching of displacements and stresses at the image interfaces is imposed for (7). The reflections by the edges are removed by Dirichlet and Neumann boundary conditions. The reflection coefficient is [22]

$$r_j = \left(\frac{1 - \cos \theta}{1 + \cos \theta} \right)^j, \quad (14)$$

where j is the degree of approximation, and θ is the incidence angle. The reflections from boundaries are removed by coupling the Dirichlet fixed boundary conditions solution to the Neumann free boundary conditions solution. For more than one component of displacement, the Dirichlet and Neumann conditions alternate components at the boundaries. When more than one boundary is nonreflecting, more solutions are added to eliminate multiple reflections.

The blank spaces in the sonified image are filled through continuity by the solutions in the vicinity of interfaces and edges. The mapped data after sonification is typically containing the small blurred area, cavities and white dots due to the inaccuracies of the original medical images. These areas are filled with color and geometric lines, through continuity of the adjacent areas, so that the final image may contain new elements, new details that do not appear in the original image.

New inverse sonification technique was highlighted on some medical images used to surgical operations. In the next Section we present the applications.

IV. APPLICATIONS

The medical images chosen for sonification represent different tissue samples with abrupt changes in profile. A 3D sample of a fictive rat liver is shown in Fig. 2a, and the size of constituents are shown in Fig. 2b, respectively. The rat liver involves severe disturbances zones between 10 and 50 μm at the microscopic scale [23].

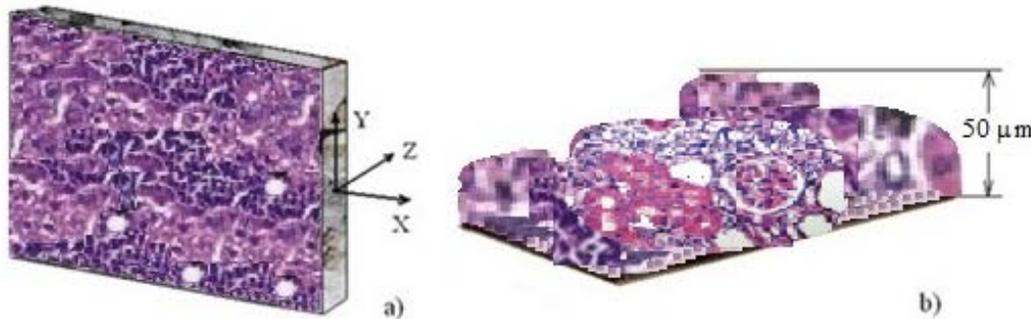


Fig. 2. a) A rat liver 3D sample; b) Size of constituents.

The sonification operator (14) is applied on different fictive images of fibrotic rat liver inspired from a study of effects of ginkgo biloba leaf extract against hepatic toxicity induced by methotrexate in rat [23, 24]. The images of cross-sections of the rat liver are

shown in Fig. 3. Fig. 4 visualizes the new images obtained by applying the sonification operator. A comparison of the images to the original ones leads to some differences observed in the last six images (yellow).

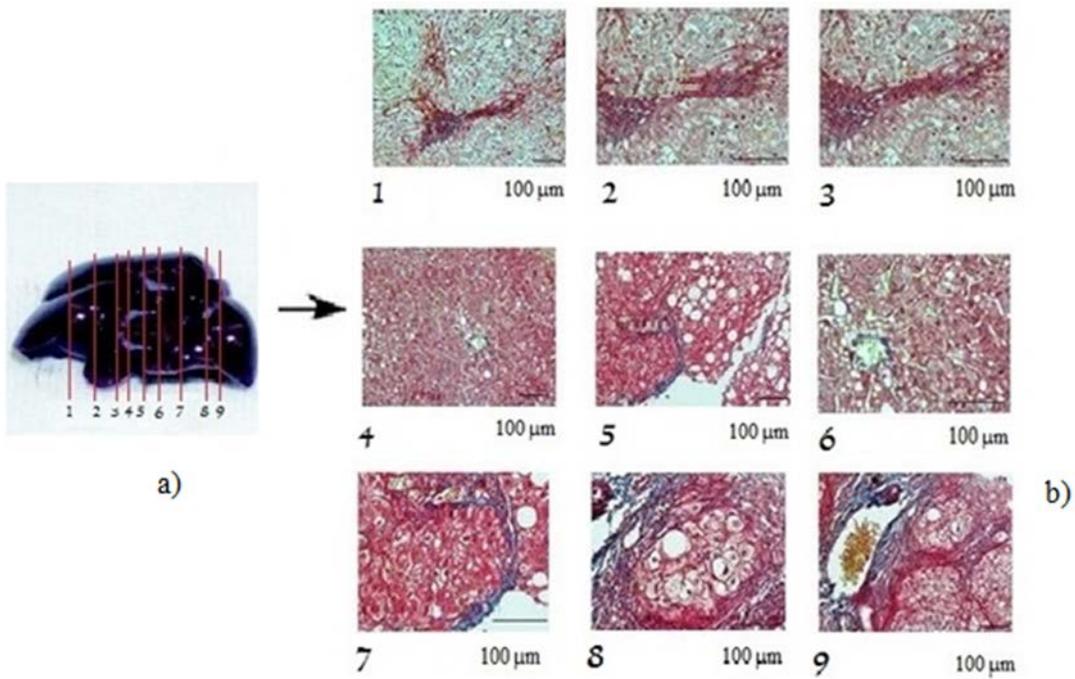


Fig. 3. Sectional slices of a rat liver sample; b) Cross-sectional slices of the sample.

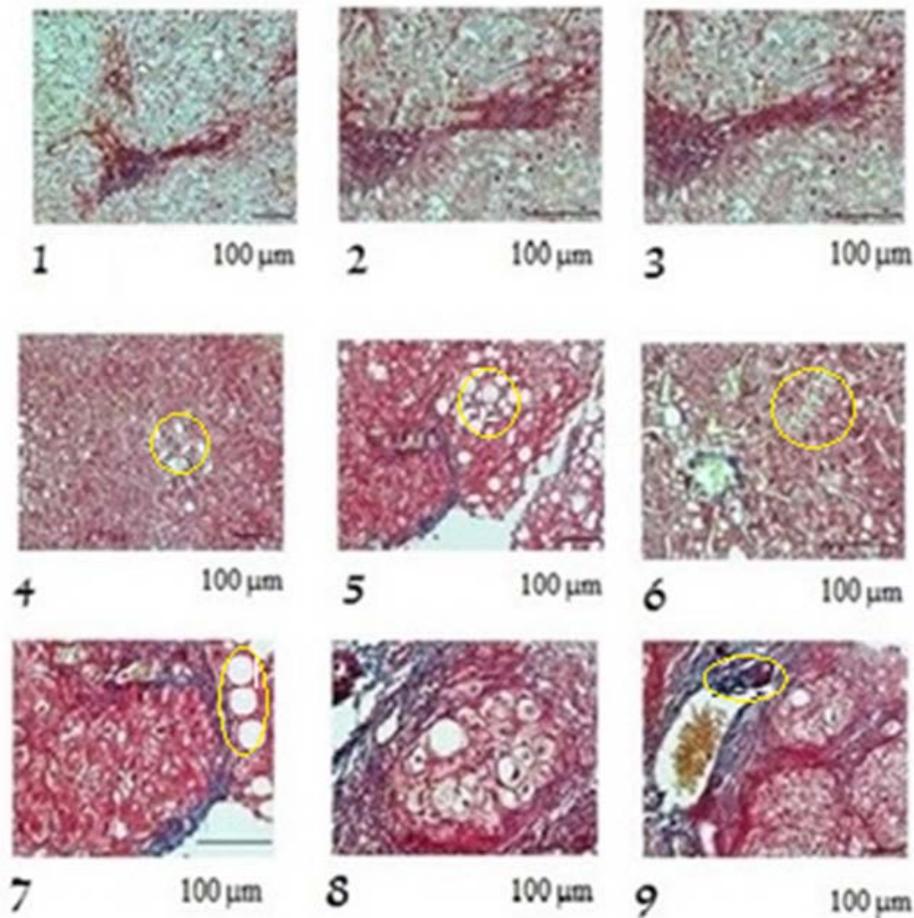


Fig. 4. Cross-sectional slices after sonification. Differences with original images are shown in yellow.

The work of Salameh [25] is considered next, related to the detection of nonalcoholic steatohepatitis in the fatty rat livers by magnetic resonance (MR) [26-28]. Fig. 5a shows the MR image of a liver rat with hepatocytes and strong hepatocellular. Details are purposefully hidden (red circles in Fig.5b). The inverse sonification operator recovered all initially hidden details (Fig.5c).

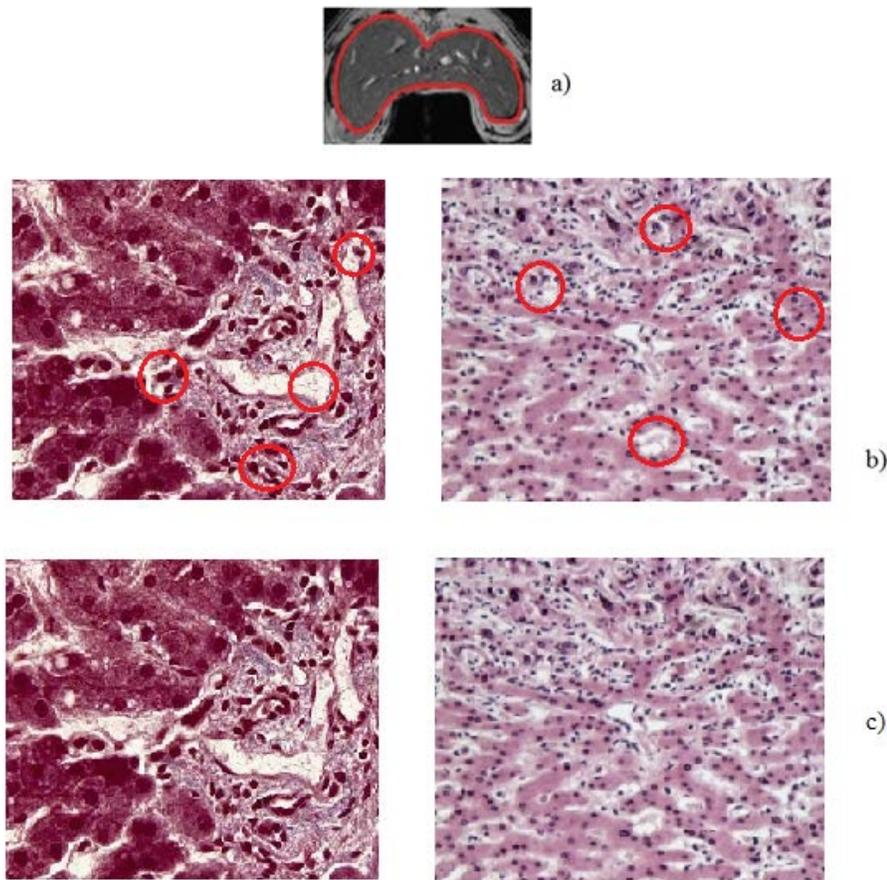


Fig. 5. a) A MR image of a rat liver; b) The initially hidden details were recovered by sonification technique.

Another exercise is related to the hepatic arterial chemotherapy [29-32], for which a catheter is inserted inside the gastroduodenal artery (GDA) to distribute the chemotherapy. A possible location of the hepatic arterial infusion catheter was discussed in [30]. Our exercise is to reobtain the CT image reported in this paper and presented in Fig.6. We intentionally spoil this image and apply to it apply the inverse sonification. The sonified image is shown in Fig.7d. This image is identically to the one of Fig.6.

Fig.7a shows the CT image of the hepatic artery (CHA- common hepatic artery, LHA - left hepatic artery, RHA - right hepatic artery, SA - splenic artery, Seg IV HA - segment IV hepatic artery) [30]. Fig. 7b shows the CT image of the left hepatic artery [30]. Fig. 7c shows the image we want to sonify.

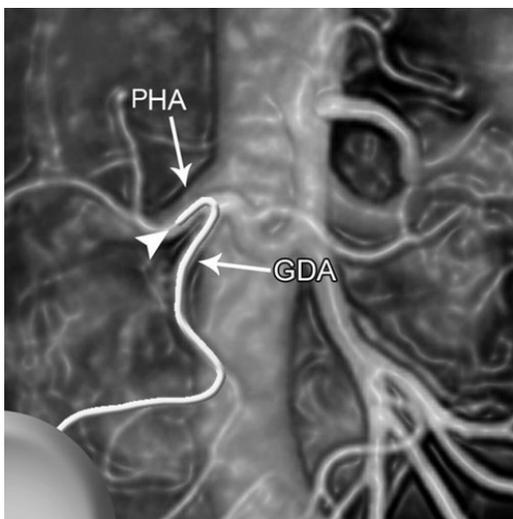


Fig. 6. A possible location of the hepatic arterial infusion catheter [30].

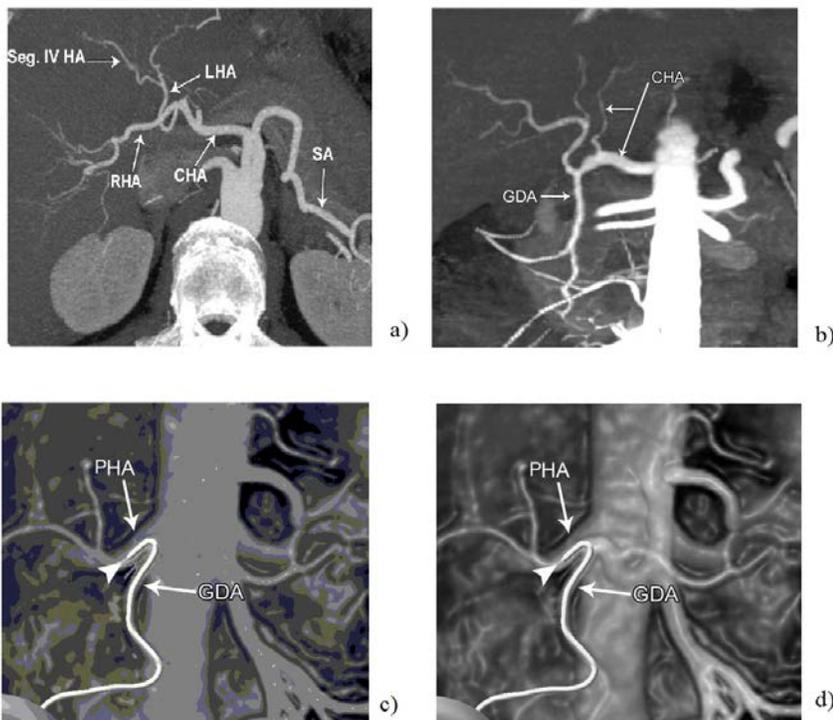


Fig. 7. a) CT image of the hepatic artery (CHA - common hepatic artery, LHA- left hepatic artery, RHA - right hepatic artery, SA - splenic artery, Seg IV HA - segment IV hepatic artery); b) CT image of the left hepatic artery; c) the image to be sonified; d) final sonified image.

The last exercise is the case of a tumor (pink color) located near the portal tree of the vascular branches (Fig. 8a) [33, 34]. The vascular territory (1) and the vessel branches in the vicinity of tumor (2) are shown in Fig. 8b. Three sonified images are obtained Fig. 9 for the frontal, caudal and cranial views. New details on the tumor are reported to surrounding area, and the shape and size of the tumor is better visualized.

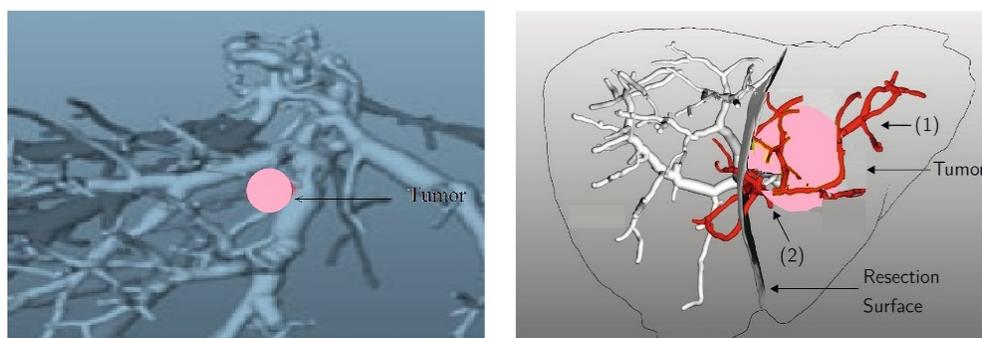


Fig. 8. a) The tumor location; b) Vascular map (1) and the vessel territory near the tumor (2).

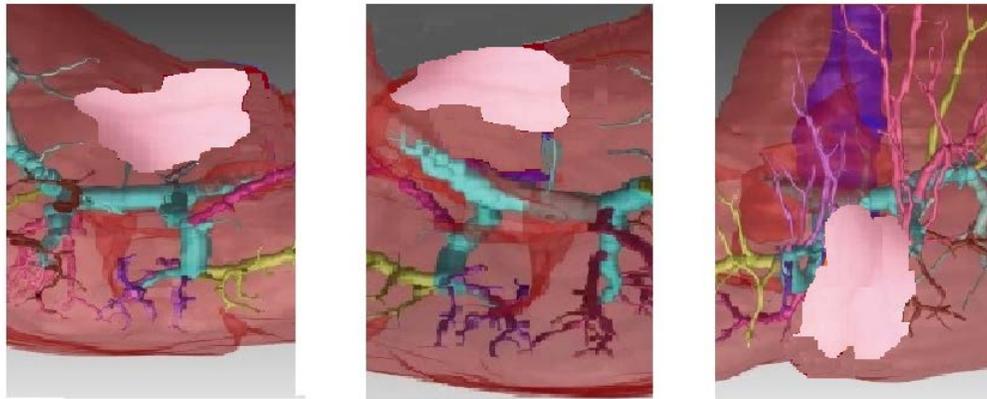


Fig. 9. New images in the vicinity of the tumor after sonification.

V. CONCLUSIONS

A new sonification operator is proposed in this paper in order to convert the digital data into sound by using the cnoidal vibrations as a set of basic functions. By inverting the sound into image, the result highlights hidden details in the image seen by the sound and not seen by the eyes. To show the efficiency of the sonification algorithm and to verify the correctness of the results, we intentionally hide some details into the images. The new sonification operator has discovered the hidden details.

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Determinants of Exclusive Breastfeeding: Analysis of 2017 Indonesian Demographic and Health Survey Data

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Abstract- Every mother is expected to be able to provide exclusive breastfeeding to her baby for 6 months, however, the coverage of exclusive breastfeeding in Indonesia in 2017 is only 52%, this is far from the National target of 80%. This study aims to determine the determinants of exclusive breastfeeding in Indonesia. This study uses secondary data, namely data on the Indonesian Demographic and Health Survey (IDHS) in 2017 with a cross sectional design. The sample in this study were infants born two years before the survey, born alive and the last child, and aged 0-6 months with a sample of 6,872. The analysis in this study used multiple logistic regression. The results showed that maternal age, socioeconomic, residence, parity, and behavior of initiation of early breastfeeding were determinants of exclusive breastfeeding. Mother's age affects exclusive breastfeeding but when viewed from the odds ratio, exclusive breastfeeding decreases with increasing age group of mothers. Likewise with the socio-economic level, mothers with lower socioeconomic levels are more likely to have exclusive breastfeeding than mothers with higher economic status. Mothers living in urban areas tend to provide exclusive breastfeeding compared to mothers living in cities. Mothers with parity 1 have a possibility of 1,436 times for exclusive breastfeeding compared to mothers with parity >1. The lower the mother's parity rate, the higher the chance to give exclusive breastfeeding to her baby. Early initiation of breastfeeding becomes a variable with the highest influence on exclusive breastfeeding (OR = 4,451).

Keywords : *Exclusive, breastfeeding, initiation, IDHS, determinants*

INTRODUCTION

Directly or indirectly, malnutrition is responsible for the deaths of children under five throughout the world. The amount is around 60% from 10.9 million each year. More than two-thirds of these deaths, which are often associated with improper feeding practices, occur during the first year of life[1]. Globally, no more than 35% of babies are exclusively breastfed during the first four months of life[1]. The results of a study conducted by Black, et al in 2008 showed that Exclusive Breastfeeding can reduce the risk of infant mortality by 12%[2]. The results of the Indonesian Demographic and Health Survey (IDHS) showed a decline in the coverage of exclusive breastfeeding in 1997 which was originally 40.2% to 39.5% in 2003 and then declined again in 2007 to 32.9%. In 2012 the coverage of exclusive breastfeeding increased to 42% then in 2017 it increased again to 52%. Although there was an increase in the two survey periods, this was still far from the Ministry of Health's target of 80% of the total coverage of Exclusive ASI prepared in 2014[3].

METHOD

This study uses secondary data, namely the Indonesian Demographic and Health Survey (IDHS) data for 2017. The 2017 IDHS is a national survey with 49,250 households as respondents with 59,100 female respondents of childbearing age (WUS) aged 15-49 years. The 2017 IDHS data can be downloaded freely on the Demographic and Health Survey (DHS) website at www.measuredhs.com. Before downloading the IDHS data, the author is asked to register to gain access to the database.

The population in this study were infants aged 0-6 months. The inclusion criteria are live-born children who are the last child, not twins and live with their mothers. Respondents who did not answer and answer did not know that they were included in the missing category and were not included in the analysis. The sample size obtained in this study was 6,723 babies.

The dependent variable in this study is exclusive breastfeeding obtained from information on feeding history in the last 24 hours and not given prelactals in children aged 0-6 months. Independent variables were socio-demographic factors (mother's age, child sex, mother's education, mother's occupation, socio-economic, and residence) as well as pre- and post-natal factors which consisted of parity, delivery method, place of delivery, pregnancy examination, and initiation of early breastfeeding.

The mother's age in this study was divided into 7 groups, namely 15-19 years, 20-24 years, 25-29 years, 30-34 years, 35-39 years, 40-44 years, and 45-49 years. The sex of children is divided into two groups, namely men and women. Mother's education was divided into six groups, they did not finish school, did not finish elementary school, graduated from elementary school, did not park high school,

graduated from high school, and had a college. Mother's work is divided into two groups: work and not work. Socio-economic is divided into five groups, namely Terbahawah, middle to lower, middle, middle to upper, and top. Whereas the residence is divided into two groups, namely rural and urban areas.

The parity in this study is the number of children practiced by the mother, in this study, parity was made into four groups, namely 1, 2, 3, and more than 3. The method of delivery is the method of giving birth, divided into two groups, namely normal delivery and caesarean delivery. The place of delivery category was divided into two groups, the first was the First Level Health Facility (FLHF) while the second was the Advanced Health Facility (AHF). Prenatal care is divided into three groups, first according to K4 if the prenatal check is done at least 4 times (K4 in the first trimester at least 1 time, trimester II at least 1 time, and trimester III at least 2 times), the second is not appropriate K4 if the examination is not appropriate with K4 requirements, and the last does not carry out a pregnancy checkup. Last Initiation of Early Breastfeeding (EBF), said EBF if the child is given ASI immediately, no more than one hour after birth.

All the above variables were analyzed using STATA version 14. The analysis carried out was Bivariate analysis using logistic regression with a significance of 5% and 95% confidence interval (C95% CI), so that the determinants of exclusive breastfeeding could be obtained.

RESULT AND FINDINGS

Bivariate analysis on socio-demographic factors showed that maternal age, maternal education, family socio-economic, and residence had a relationship (<0.05) to exclusive breastfeeding (table 1). In table 2, it can be seen that the pre / post-natal factors that have a relationship include parity, type of labor, place of birth, socio-economic, and residence.

Table 1. Bivariate analysis of the relationship between socio-demographic factors for exclusive breastfeeding in 0-6 months infants in Indonesia, IDHS 2017

| Variable | Exclusive Breastfeeding | | | | Odds Ratio | 95% CI | p-value |
|---------------------------------|-------------------------|-------|-------|-------|------------|-------------|---------|
| | No | % | Yes | % | | | |
| Mother's Age: | | | | | | | |
| 15 - 19 years | 100 | 34,72 | 188 | 65,28 | Reference | | |
| 20 - 24 years | 567 | 44,16 | 717 | 55,84 | 0,681 | 0,475-0,977 | 0,037 |
| 25 - 29 years | 758 | 42,39 | 1.030 | 57,61 | 0,745 | 0,520-1,067 | 0,109 |
| 30 - 34 years | 744 | 43,48 | 967 | 56,52 | 0,736 | 0,515-1,051 | 0,092 |
| 35 - 39 years | 505 | 43,13 | 666 | 56,87 | 0,747 | 0,519-1,075 | 0,117 |
| 40 - 44 years | 199 | 47,38 | 221 | 52,62 | 0,725 | 0,480-1,097 | 0,129 |
| 45 - 49 years | 29 | 47,54 | 32 | 52,46 | 0,924 | 0,466-1,832 | 0,822 |
| Ex of child : | | | | | | | |
| Male | 1.485 | 43,27 | 1.947 | 56,73 | Reference | | |
| Female | 1.417 | 43,06 | 1.874 | 56,94 | 1,003 | 0,889-1,131 | 0,959 |
| Mother's Education : | | | | | | | |
| Not school | 22 | 28,95 | 54 | 71,05 | Reference | | |
| Not Finished Elementary School | 155 | 39,04 | 242 | 60,96 | 0,485 | 0,243-0,966 | 0,040 |
| Finished Elementary School | 472 | 42,07 | 650 | 57,93 | 0,524 | 0,271-1,013 | 0,055 |
| Not Finished Junior High School | 736 | 41,49 | 1.038 | 58,51 | 0,554 | 0,288-1,067 | 0,078 |
| Finished Senior High School | 919 | 45,27 | 1.111 | 54,73 | 0,430 | 0,223-0,829 | 0,012 |
| College | 598 | 45,17 | 726 | 54,83 | 0,468 | 0,241-0,909 | 0,025 |
| Job status : | | | | | | | |
| Work | 1.654 | 42,57 | 2.231 | 57,43 | Reference | | |
| Ot work | 1,248 | 43,97 | 1.590 | 56,03 | 0,938 | 0,828-1,063 | 0,318 |
| Socio-economy : | | | | | | | |
| Poor | 694 | 39,14 | 1.079 | 60,86 | Reference | | |
| Middle to low | 598 | 44,49 | 746 | 55,51 | 0,858 | 0,715-1,029 | 0,100 |
| Middle | 567 | 45,36 | 683 | 54,64 | 0,783 | 0,643-0,955 | 0,016 |
| Middle to high | 540 | 44,93 | 662 | 55,07 | 0,827 | 0,683-1,002 | 0,503 |
| Rich | 503 | 43,59 | 651 | 56,41 | 0,902 | 0,736-1,105 | 0,320 |
| Residence : | | | | | | | |
| Rural | 1.479 | 43,73 | 1.903 | 56,27 | Reference | | |
| Urban | 1.423 | 42,59 | 1.918 | 57,41 | 1,13 | 0,991-1,296 | 0,067 |

Table 2. Bivariate analysis of the relationship of pre / post-natal factors to exclusive breastfeeding in children 0-6 months in Indonesia, IDHS 2017

| Variable | Exclusive Breastfeeding | | | | Odds Ratio | 95% CI | p-value |
|--------------------------------------|-------------------------|-------|-------|-------|------------|-------------|---------|
| | No | % | Yes | % | | | |
| Parity : | | | | | | | |
| 1 | 1.024 | 47,06 | 1.152 | 52,94 | Reference | | |
| 2 | 906 | 40,48 | 1.332 | 59,52 | 1,389 | 1,200-1,607 | 0,001 |
| 3 | 544 | 41,75 | 759 | 58,52 | 1,351 | 1,142-1,600 | 0,001 |
| >3 | 428 | 42,54 | 578 | 57,46 | 1,178 | 0,961-1,445 | 0,114 |
| Ype of Delivery : | | | | | | | |
| Normal | 2.228 | 40,41 | 3.286 | 59,59 | Reference | | |
| Caesar | 674 | 55,75 | 535 | 44,25 | 0,587 | 0,500-0,690 | 0,001 |
| Place of Delivery : | | | | | | | |
| First Level Health Facilities (FLHF) | 1.033 | 39,34 | 1.593 | 60,66 | Reference | | |
| Advanced Health Facilities (AHF) | 1.133 | 48,07 | 1.224 | 51,93 | 0,700 | 0,606-0,809 | 0,001 |
| Antenatal Care : | | | | | | | |
| According to K4 | 2.585 | 43,39 | 3.373 | 56,61 | Reference | | |
| Not according to K4 | 235 | 44,09 | 298 | 55,91 | 0,898 | 0,710-1,136 | 0,371 |
| No Antenatal Care | 82 | 35,34 | 150 | 64,66 | 1,446 | 0,993-2,106 | 0,993 |
| Initiation of early breastfeeding: | | | | | | | |
| No | 1.557 | 66,14 | 797 | 33,86 | Reference | | |
| Yes | 1.345 | 30,79 | 3.024 | 69,21 | 4,702 | 4,109-5,380 | 0,001 |

In the multivariate analysis process, all variables analyzed at bivariate were selected provided that the variables with p-value <0.25 will be included in multivariate analysis. The variables included in multivariate candidates are maternal age, maternal education, family socioeconomic status, place of residence, parity, type of delivery, place of birth, and IMD. The results of multiple logistic regression analysis indicate that the variables that influence exclusive breastfeeding are maternal age, socioeconomic, residence, and IMD Table 3). The results of the analysis showed that mothers with age groups under 45 years affected exclusive breastfeeding compared to the age group 45 years and over (OR = 0.571). Mothers with lower socio-economic groups are more likely to have exclusive breastfeeding compared to other economic groups (OR = reference). Mothers who live in urban areas may have 1,237 times for exclusive breastfeeding compared to mothers living in rural areas (OR = 1,237). Mothers with parity 1 had a possibility of 1,436 times for exclusive breastfeeding compared to mothers with parity > 1 (OR = 1,436). This means that the lower the parity, the higher the chance of exclusive breastfeeding. Finally, mothers who initiate early breastfeeding in their babies have a possible 4,451 times for exclusive breastfeeding compared to mothers who did not initiate early breastfeeding (OR = 4,451).

Table 3. Multivariate analysis of determinants of exclusive breastfeeding in children 0-6 months in Indonesia, IDHS 2017.

| Variabel | Odds Ratio | 95% CI | p-value |
|-----------------|------------|-------------|---------|
| Mother's Age: | | | |
| 15 - 19 years | Reference | | |
| 20 - 24 years | 0,571 | 0,388-0,841 | 0,005 |
| 25 - 29 years | 0,532 | 0,356-0,794 | 0,002 |
| 30 - 34 years | 0,470 | 0,312-0,710 | 0,001 |
| 35 - 39 years | 0,449 | 0,290-0,695 | 0,001 |
| 40 - 44 years | 0,476 | 0,289-0,783 | 0,004 |
| 45 - 49 years | 0,532 | 0,243-1,162 | 0,114 |
| Socio-economy : | | | |
| Poor | Reference | | |
| Middle to low | 0,780 | 0,634-0,961 | 0,020 |
| Middle | 0,722 | 0,573-0,910 | 0,006 |

| Variabel | Odds Ratio | 95% CI | p-value |
|------------------------------------|------------|-------------|---------|
| Middle to high | 0,795 | 0,626-1,010 | 0,061 |
| Rich | 0,846 | 0,649-1,104 | 0,220 |
| Residence : | | | |
| Rural | Reference | | |
| Urban | 1,237 | 1,055-1,452 | 0,009 |
| Parity : | | | |
| 1 | Reference | | |
| 2 | 1,436 | 1,193-1,730 | 0,001 |
| 3 | 1,395 | 1,104-1,763 | 0,005 |
| >3 | 1,251 | 0,945-1,654 | 0,116 |
| Initiation of early breastfeeding: | | | |
| No | Reference | | |
| Yes | 4,451 | 3,873-5,115 | 0,001 |

DISCUSSION

Mothers with age groups 44 years and under affected exclusive breastfeeding activities compared to the age group 45 years and over (OR = 0.571). This is in line with the research conducted by [4] where all age groups of mothers are related to exclusive breastfeeding. This is due to the fact that mothers gain experience in the management of children as they age. Mothers with lower socio-economic groups are more likely to have exclusive breastfeeding compared to other economic groups (OR = reference). This is in line with the research conducted by [5] where socioeconomic status influences exclusive breastfeeding. Mothers who live in cities are more likely to give exclusive breastfeeding compared to mothers who live in rural areas. This is contrary to the research conducted by [6] and [7] where there is no difference between the location of residence and both in rural and urban areas. The lower the parity number, the higher the chance to eat. This research was conducted by [8]. Parity levels have determined much attention in maternal and child health. This is said because there is a tendency for high-health maternal health to be better than for low-density mothers [9]. Early breastfeeding initiatives have a significant influence on exclusive breastfeeding, this is in line with the research conducted by [10].

CONCLUSIONS

Mother's age, socio-economic, place of residence, parity, and initiation of accepting early is a determining factor for exclusive breastfeeding. The age of the mother who supports exclusive breastfeeding when viewed from the odds ratio, exclusive breastfeeding is increasing according to the increase in the group of older mothers. Likewise with the socio-economic level, mothers with lower socio-economic levels are more likely to free exclusively mothers with higher economic status. Mothers living in urban areas must provide mothers who live in cities. The lower the mother's parity rate, the higher the chance to give exclusive breastfeeding to her baby. Early initiation of hunting becomes the variable with the highest ratio of exclusive breastfeeding.

SUGGESTION

The need for special efforts so that mothers can increase knowledge about the initiation of early breastfeeding so that the practice of early breastfeeding is expected to increase the rate of exclusive breastfeeding.

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Association for Percentage of DPT Immunization Against Incidence of Diphtheria in West Java province 2017 with spatial analysis

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Abstract - Diphtheria is one of the infectious diseases that can be prevented by immunization which was still suffered 954 people with a mortality rate of 4.61%. West Java Province is one of the provinces with the second largest number of sufferers in Indonesia. Many statistical tests but do not include spatial elements in the analysis. The purpose of this study was to find out the spatial relationship between diphtheria incidence and the relationship factors in DPT immunization coverage. This study was cross-sectional with spatial regression data analysis approach were used 2017 of West Java Province health profile's data and reports from the Central Statistics Agency of Indonesia. The results of analysis in the form of spatial patterns were interpreted. This study was Moran's Index of diphtheria in West Java Province was 0.255. Diphtheria in West Java Province was collecting pattern in west of the region and autocorrelation between district / cities. The low percentage of immunizations in Cianjur, Purwakarta, Karawang, and Bekasi were effect of increasing the incidence of diphtheria. Subang, West Bandung, Bekasi, Bogor City, Depok City, Sukabumi City have greatest risk of contracting diphtheria from neighboring districts / cities. It is recommendation to increase coverage and further research on risk factors for diphtheria in the West Java province spatially

Index term - Diphtheria; DPT; Spatial.

I. INTRODUCTION

Diphtheria was an infectious disease in Indonesia with 954 cases in 2017 with a CFR of 4.61%. People with diphtheria were suffering most from 5 until 9 years old. West Java Province was 167 cases of diphtheria and it was province with second largest number of cases in Indonesia

after East Java Province was dominated age range 5 until 9 years old[1].

Diphtheria is a disease that can be prevented by immunization but it is transmitting in West Java Province and dominated 5 - 9 year old of 29.71% in 2017[2].

Efforts that can be made to prevent transmission of diphtheria can be done in various ways, one of which is the assessment of risk factors to make prevention easy and effective. Assessment of risk factors can be through statistical analysis to find relationships statistically which contribute to increase cases of diphtheria. Statistical analysis that can be used spatial analysis because the statistical method is more accurate in making models to describe cases than other statistics (classical regression) because there have geographical factors that are also analyzed[3].

The lack researches on spatial autocorrelation in diphtheria in the West Java province made researcher want to find out whether the incidence of diphtheria in West Java Province and linking of percentage of DPT immunization as a risk factor for the spread of diphtheria.

II. METHOD

This study's design was cross-sectional and used data from West Java Province's Health Profile in 2018 which contains data number of diphtheria cases in 2017. Data was free and public domain, which can be downloaded in West Java Province's Health Office at <http://www.diskes.jabarprov.go.id>.

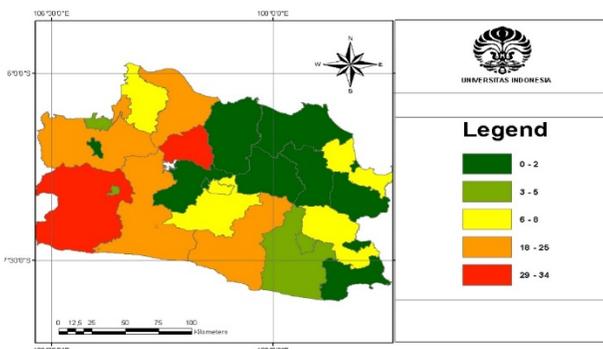
Analyzed Variable was Number of Diphtheria Events as dependent variable and Percentage of Toddlers who had Received DPT Immunization as independent variables.

Data analysis used Opengeoda software version 1.12 which can be downloaded for free. analysis used Moran's Index method with results in the form for distribution patterns of diphtheria in each district / city in West Java Province. Neighboring models used Queen Method with a sample was 27 districts / cities with study units was districts / city level. The purpose of this study was to identifying spatial relationship of diphtheria events in each districts / city in West Java Province in 2017.

III. RESULT

Value of Moran's Index for Number of Incidence Diphtheria on West Java Province in 2017 was 0.255. Initial moran value was -0.039 so Moran value for diphtheria was greater than initial Moran value so that conclusion of diphtheria in West Java Province in 2017 was autocorrelation and it was a group pattern according to the number of diphtheria events in which district / city. Pattern of diphtheria groups can be seen in figure 1

Figure 1. distribution of diphtheria in West Java Province



Districts that have high number of diphtheria were in Districts: Bogor, Sukabumi, Cianjur, Garut and Karawang. They were patterns that was close together so they have an attachment based on geographical location. This was according with the Moran's Index value. Results of the moran analysis were shown in table 1

Table 1 Results of Diphtheria Moran's Test on West Java Province in 2017

| Moran's Quadrant | District / City Name |
|--------------------------|---|
| Quadrant 1 (High - High) | Bogor, Garut, Purwakarta, Sukabumi, Karawang, Cianjur, Kota Bekasi |
| Quadrant 2 (Low - High) | Subang, Bandung Barat, Bekasi, Kota Bogor, Kota Depok, Kota Sukabumi |
| Quadrant 3 (Low - Low) | Bandung, Tasikmalaya, Ciamis, Kuningan, Cirebon, Majalengka, Sumedang, Indramayu, Subang, Pangandaran, Kota Bandung, Kota |

Cirebon, Kota Cimahi, Kota Tasikmalaya, Kota Banjar.

Quadrant 4 (High - Low)

Table 1 was shown there are 7 districts / cities were in quadrant 1 (high - high), which means that districts / cities were high number of diphtheria and they located around districts / cities that have high incidence of diphtheria. Quadrant 2 was 6 districts / cities so that districts have low diphtheria cases and they located in surrounding districts / cities that have high diphtheria incidences. 15 districts were in quadrant 3 (low-low), which means the districts have low cases of diphtheria and they located around districts / cities that have low cases of diphtheria.

Percentage of Children Under Five who have Received DPT Immunization's variable, were LISA bivariate test performed with dependent variable number of diphtheria events obtained in table 2.

Table 2 Cluster of Bivariate LISA analysis

| Cluster | Districts / Cities |
|-------------|---------------------------------------|
| High - High | Bogor, Kota Depok |
| Low - Low | Cirebon |
| Low - High | Cianjur, Purwakarta, Karawang, Bekasi |
| High - Low | Majalengka, Ciamis |

Bogor District and Depok City have high number of cases and they percentage of children under five years who were immunized DPT against high. Cirebon District was low diphtheria cases and percentage of under-immunized children low. Cianjur, Purwakarta, Karawang, and Bekasi have high number of diphtheria cases and have percentage of low immunized children. Majalengka and Ciamis have low diphtheria cases and have high percentage of immunized toddlers.

IV. DISCUSSION

Moran's Test results showed the incidence of diphtheria in West Java Province in 2017 has spatial significance. It is caused by diphtheria which can spread between surrounding areas and increase number of cases in quadrant region 2. There were 6 districts / cities in quadrant 2 so it is very risky contracting diphtheria originating from surrounding districts / cities, especially districts / cities that have higher incidence of diphtheria. In addition, results of the Moran Test can be used to find out areas that have high risk factors for contracted[4][5].

LISA Bivariate Test results Bogor District and Depok City numbers of diphtheria events remained high even though the percentage of DPT immunization was high. Previous research in Bogor District, were results of interviews 3 from 4 informants showed that there were still many children who weren't re-immunize when their toddlers were immunized against DPT because parents were worried about the effects after immunization[6]. Re-immunization were needed to maintaining antibody levels as you age higher[7].

Cianjur, Purwakarta, Karawang, and Bekasi Districts have high number of diphtheria cases but percentage of DPT immunization were low. Solutions were do mass vaccinations which include adult vaccinations, door to door vaccinations, building vaccination posts, or vaccinations in schools. Vaccination was needed to prevent transmission of disease to other areas around it as not to expand other area[8].

Cirebon District was small case of diphtheria and it was small percentage of immunization. This can be caused by other factors that affect small number of diphtheria events.

V. CONCLUSION

a. Conclusion

Incidence of diphtheria in West Java Province in 2017 has a geographical attachment. The proportion of diphtheria in the west is more than in other regions and close together. DPT immunization is not only factor reducing incidence of diphtheria but there are other factors that affect mainly portion of events in the west.

b. Recommendation

Further research is needed on additional factors in Bogor Regency and Depok City. Further research in Cirebon Regency about the small amount of diphtheria. Special attention is needed to increase immunization coverage in cianjur, Purwakarta, Karawang, and Bekasi.

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Measuring Consumer Interest in Sorghum Composite Flours in Western Kenya

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Abstract- In western Kenya, sorghum (*Sorghum bicolor*) remains an important crop for rural food and nutrition security. Sorghum is a rich source of various phytochemicals including tannins, phenolic acids, anthocyanins and phytosterols which have the potential to significantly impact on human health. On the other hand, sorghum producing areas still experience periodic food deficits due to environmental changes and limited knowledge on diversity in utilization. This study investigated consumer interest in fortified sorghum flours and sorghum composite products. Results of consumer affective tests showed that tannin levels affected sensory characteristics of sorghum products i.e. low and free tannin levels would be preferred in sorghum products. Additionally, quality attributes such colour of high tannin varieties were more acceptable to consumers. After taste showed highest correlation with flavour ($r=0.852$), texture ($r=0.692$) and acceptability ($r=0.774$) for MKT-Red sorghum flour. Seredo, a low tannin variety showed high correlation between after taste and aroma ($r=0.746$), in flavour ($r=0.747$), texture ($r=0.762$) and overall acceptability ($r=0.772$). Results for composite products showed an average score of above 60% which was an indication of high acceptability of the products. Based on the potential benefits of sorghum, production and utilization should be prioritized to enhance household food and nutrition diversity.

Index Terms- Composite flour | Sensory evaluation | Sorghum | Tannins.

I. INTRODUCTION

Sorghum (*Sorghum bicolor* L. Moench) is the fifth most important cereal crop in the world after rice (*Oryza sativa*), barley (*Hordeum vulgare* L.), wheat (*Triticum aestivum*) and maize (*Zea mays*) [1,2]. It is a staple food crop for millions of the poorest and most food and nutrition insecure people in the semi-arid tropics of Asia and Africa [3]. The crop is agronomically suited to hot and dry agroecologies where other crops do not grow easily [3,4]. Sorghum is also characterized by an extensive root system, waxy bloom that reduces water loss, ability to stop growth in periods of drought and resume it when water stress is relieved and C4 photosynthesis [1,4,5]. These characteristics have made the crop adaptable to most arid and semi-arid regions of Kenya and therefore, has been accepted as an important hunger crop [4,6]. The crop performs well in areas between 500 metres and 1700 metres above sea level, with seasonal rainfall of 300 mm and above. In Kenya, it is grown in the often drought-prone marginal

agricultural areas of Eastern region (1385m ASL, 76mm month⁻¹), Western region (1190m ASL, 130mm month⁻¹) and Coastal region (185m ASL, 87mm month⁻¹) [4].

In many parts of western Kenya, sorghum is an important food and feed crop and therefore, remains an important crop for rural food and nutrition security, income generation and food culture of the rural poor [5,7,8]. Amusala *et al.* (2012) [9] stated that grain yield of sorghum will decline by about 17% owing to climate change and this if not checked, environmental issues and drought in western Kenya may lead to decline in production and utilization of sorghum despite drought tolerant sorghum varieties having been developed and deployed. Since western Kenya still experiences food deficits, the production of the crop must be increased in order to ensure food and income security through the development of improved sorghum varieties and technologies [1,9].

Sorghum farming is mainly by small holder farmers who use low input levels and have limited access to new technologies. Farmers have always grown red sorghum varieties, but in small quantities and this has led to decline in sorghum yields to less than 1.0 t/ha, [5,7]. Decline in production, especially the popular landraces grown by farmers is attributed to perceptions of sorghum as a poor man's food of little nutritional value [10]. This negative perception has also frustrated governments effort to promote sorghum as a viable crop and commercially marketable food. As a result of low production, the market outlets for sorghum have stagnated [2]. Okuthe *et al.* (2013) [7] reported that prevalence of striga weeds, high soil acidity and competition from sugarcane and maize production also affects its farming and utilization. Since sorghum potential value is under-estimated and under-exploited, sorghum crop is in danger of continued decline in utilization as well as genetic erosion and disappearance. However, despite sorghum being neglected and regarded to be of low potential, it has one of the largest germ plasm collections, which could provide great opportunity for sustainable crop production, provide extra income for farmers, provide dietary diversity and enhance smallholder farm households nutritional wellbeing [10].

A wide variety of traditional fermented and non-fermented food products and recipes in western Kenya are based on sorghum namely and these include porridge, ugali, pilau and other traditional dishes where it is consumed with protein and vegetable sources [5,8,11]. Besides providing calories, sorghum has actual nutritional value in principle, due to its content of vitamins, both fat-soluble (D, E and K) and the B group, protein as well as

minerals, such as iron, phosphorus and zinc [11]. In composition, sorghum compares favourably with other renowned cereals: its protein content is similar to wheat but higher than maize and rice, while its essential amino acid profile is comparable to maize or wheat due to the limited content of threonine, arginine and lysine [4,11]. In particular, sorghum's main storage proteins kafirins (aqueous alcohol-soluble prolamins) are devoid of lysine amino acid, thus, the abundance of kafirins in a given sorghum variety has a direct negative impact on its nutritional value [11,12]. In contrast, sorghum proteins contain a relatively high proportion of leucine, in particular compared to isoleucine, which determines an unfavourable leucine/isoleucine balance [13]. Due to its lack of gluten, sorghum whole grains could be considered a suitable complementary diet for people with coeliac disease [14]. Iron content of sorghum is lower than millet but is higher than wheat, maize and rice [12]. Duncan et al. (2013) [4] stated that sorghum has high levels of iron (>70 ppm) and zinc (> 50 ppm) hence may be used to reduce micronutrient malnutrition.

Despite sorghum having some vital nutrients, its nutritional value is compromised to a certain extent by its contents i.e. low protein digestibility and activity of antinutrients: phenolic compounds, mainly condensed tannins, and phytic acid. The low digestibility of sorghum in comparison to other cereals is presumably due to the proteins high cross linking and kafirins location primarily on the periphery of the protein bodies [11,15]. Close packing of starch granules and protein bodies in the endosperm also lowers protein digestibility. The implication of such a close association between starch and protein may be that the starch, especially when gelatinised after cooking, could reduce the accessibility of proteolytic enzymes to the protein bodies and therefore reduce protein digestibility [13]. The antinutrients groups of tannins and phytates interact negatively with the bio-accessibility of essential nutrients in the digestive tract, particularly iron and zinc; moreover, tannins further reduce the digestibility of sorghum's proteins. Tannins are also able to bind human gut enzymes involved in cereal digestion. The general mechanism involves formation of insoluble complexes at physiological pH, due to the ability of phytic acid and tannins to bind proteins and divalent cations [1,13,15]. Consequently, the anti-nutrients elicit an unbalanced intake of essential elements as well as reduce the availability of amino acids and metabolized energy. In contrast, these antinutrients may also have potential positive impacts; tannins may act as antioxidant scavengers of free radicals, thus contributing to the prevention of chronic pathologies such as cancer and cardiovascular diseases. Similarly, phytates acts as anti-oxidants by binding iron ions in solution, and thereby prevent ferric irons from participating to the generation of the hydroxyl radical as well as reduction in bioavailability of heavy

metals like cadmium and lead [11]. Sorghum has also gained industrial relevance where the grains are used to manufacture wax, starch, syrup, alcohol, dextrose agar, edible oils and gluten feed [8] while sorghum stalks are used as dry season fodder and fencing materials [7].

Although more attention should be devoted to the beneficial effects of antinutrients, however, in western Kenya, the high intake of tannins in traditional cultivars grown and the consequent impaired bioavailability of essential elements and proteins may cause health disorders especially in pregnancy and early childhood. Consequently, enhancing nutritional value of sorghum through food to food fortification to enhance absorption and acceptability may improve the nutritional status of vulnerable groups of a population. Therefore, this study sought to measure consumer interest in sorghum fortified products through affective tests.

II. METHODS AND MATERIALS

Sorghum selection

Five types of sorghum that are popularly used to make porridge were procured from both research centre Kenya Agricultural and Livestock Research Organization (KALRO) and smallholder farmers from western Kenya and these represented grains with a wide range of tannins. Characterization of the sorghum varieties according to their tannin levels was done using the bleach test as described in Khoddami et al. (2017) [16]. Quantification of tannin levels in the sorghum grain varieties was based on standards described by Awika & Rooney (2004) whereby tannin contents in dry weights ranged between 10.0-68.0 mg/g and 0.5-3.8 mg/g for high and low tannin varieties respectively. The sorghum grain varieties were milled to produce sorghum flour and thereafter coded as follows, E1-High tannin sorghum, E97-Low tannin sorghum, MKT-RED-high tannin sorghum, SEREDO-low tannin sorghum, T30b-1 No tannin sorghum.

Product categories for evaluation

In this study, two categories of products were evaluated i.e. porridge made from the 5-types of sorghum characterized by their tannin levels and 6-bakery products made from sorghum composite flour (T30b-1-free tannin variety). Porridges were evaluated by 110 consumers drawn from both urban and rural areas of the study site while composite flour products were evaluated by thirty (30) trained panelists comprising of students and staff in the school of Agriculture, University of Eldoret but were from western Kenya region as shown in Figure 1.

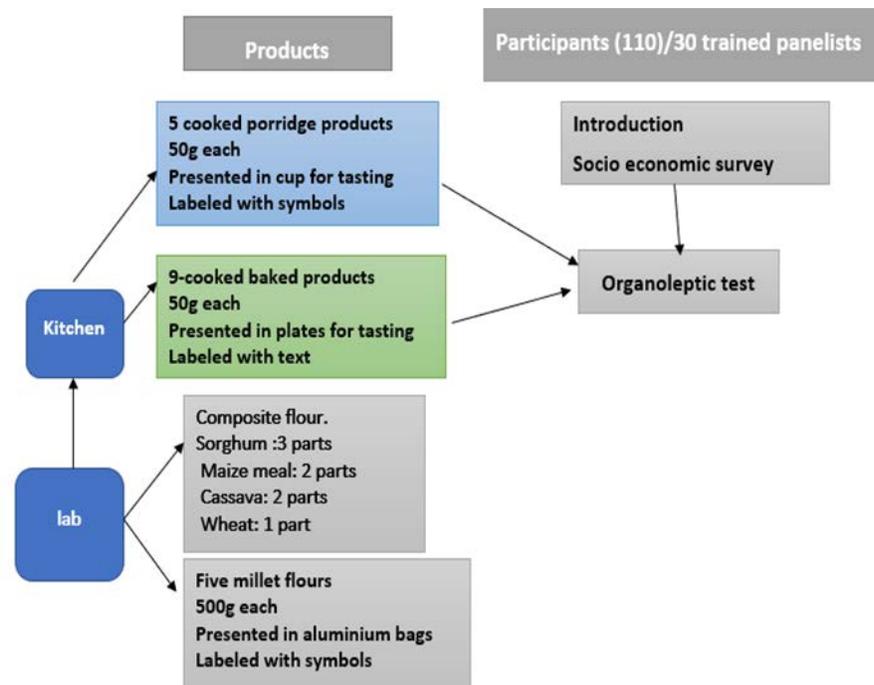


Figure 1. Study design

Preparation of sorghum flour

Each sorghum grain type was milled in a laboratory grinding mill to make sorghum flour that was immediately packed in batches of 1kg in aluminium laminated packages and stored in plastic buckets at room temperature ($25 \pm 5^\circ\text{C}$) until use.

Composite flour

A composite flour was made out of sorghum (T30b-1-free tannin variety) comprising of sorghum: maize meal: cassava: wheat in the ratio of 3:2:2:1. This composite flour was utilized in the preparation of six bakery products namely; sorghum cakes, scones, chapati, biscuits, doughnuts and zimbare. Minimal ingredients were added for purposes of cost effectiveness. Sugar and fat levels were lower than for conventional recipes. They had higher ratios of sorghum than other cereal grains since it is the staple cereal of small holder farmers in the regions.

Preparation of sorghum porridge

The conventional porridges were prepared for sensory evaluation based on the selected sorghum grain varieties. The cooking process entailed mixing 350 mL ambient temperature water with flour to form slurry. The slurry was then poured to 850 mL of boiling water in a small (2 L) saucepan with stirring to avoid lump formation. The mixture was then brought to boil with vigorous stirring and then simmered at low heat (hot plate) for 30 min with occasional stirring. For each tasting, 5- porridge samples were cooked in a batch, allowing for a 5-min interval between cooking cycles (between samples). The porridge. Once ready, the porridge was held in coded thermos vacuum flask and then served to consumers within 10 min interval. Four batches of porridges (20 porridges) were prepared and evaluated each day.

Selection of site and participants for sorghum porridge evaluation

The study was conducted at western Kenya which extends between $0^\circ 30'N$ and $34^\circ 30'E$. The study covered two regions namely; Matayos, an urban zone and Koyonzo, a rural zone. Western region forms part of the extensive basin around Lake Victoria. It consists of mainly of faulted plateaus marked by escarpments that descend gently from the Kenya Highlands to the lakeshore. The target population were consumers of sorghum from both the rural and urban zones within the two regions. The inclusion criteria included men and women who consume or use sorghum products in their homes or places of work and at least 18 years of age. And for evaluation of sorghum porridges, 110 consumers men and women were used. In collaboration with the relevant administration, a list of adult women and men was drawn, and 55 names were randomly drawn from each zone with an extra ten (10) as reserve. The selected participants were contacted and invited to participate in the study on specific dates. Actual evaluation and experiment took place in a large hall with enumerators seated at individual tables to conduct sensory evaluation with one consumer at a time. Porridge was prepared on a separate kitchen and participants were invited into the hall, in small groups or individually. They were registered, and the procedure briefly explained to them, they were then asked to give their informed consent. Invited participants who did not show up were replaced by those in the reserve list in the order they were drawn.

Sensory evaluation of sorghum porridge

The widely used 5-point hedonic scale for evaluating sensory characteristics such as colour, taste, flavour and texture was used to evaluate sorghum porridge [17]. The prepared porridge was kept in coded thermos vacuum flask. Each participant was provided with hot porridge samples (50 g) in a 100 ml coded disposable cup. The 5-porridges were provided simultaneously on tray in systematic random order and each

participant was asked to taste and evaluate each product in the established order on the 5-point scale (1-dislike very much, 2-dislike, 3-neither like or dislike, 4-like, 5-like very much). Water was also availed to each participant to rinse the palates before testing the next sample. The sensory attributes used were after taste, appearance, flavour, overall acceptability, aroma and texture. The tests were conducted double blind; neither the participants nor the enumerators knew the tannin levels in the porridges. Evaluation was done over a 2-day period (1-day per site).

Sensory evaluation of composite products

Sensory evaluation of products made from composite flour was done by a trained panelists of 12-people of western Kenya origin in the food processing laboratory, University of Eldoret. The trained panelists evaluated the food on a 9-point hedonic scale (1= very extremely disliked and 9= very extremely highly) scale based on sensory attributes of colour, texture, taste, flavour and acceptability. Two evaluation sessions were conducted per day over a 2-day period involving 6 panelists per day. A randomized complete block design was used whereby during each session, all six samples were randomly presented to each panelist. To avoid fatigue, panelists first evaluated a set of 3-samples, followed by a ten (10) minutes break before evaluating a second set of 3 samples. Each sample was presented as pieces on a transparent plastic plate, identified with three-digit codes. Panelists assessed the samples while seated in individual sensory booths under red light. Red light in the tasting area was used to mask the colour of the porridges for the panellists in order to concentrate on aroma, texture and flavour properties. Each panelist was also provided with a glass of water to rinse the palate before and between tasting of samples.

Data Analysis

Data were analyzed using Microsoft Excel 2010 and SPSS software (v. 16, SPSS Inc., Chicago, IL, USA) to derive mean differences and standard deviation of the quality attributes. ANOVA test was used to determine the differences between means of rural and urban respondents. Differences were significant for the sensory evaluation of porridge when the p-value < 0.05. Pearson correlation coefficients were generated to quantify the level of association between sensory attributes and characterized sorghum varieties. Results for composite products evaluation were reported as means and standard deviations.

III. RESULTS AND DISCUSSION

Consumer characteristics

Both men and women were represented well in the sample. More than half of the participants (53.6%) were women and the average age was 35.7 years ranging from 19 to 57 years. Two thirds of the participants had received formal education however,

socio economic indicators like family size and income level were not asked during the study.

Sensory evaluation of sorghum flour porridges.

Table 1 presents results from the mean sensory scores of porridges from sorghum flour with different tannin levels. The ANOVA test of differences between means showed that rural respondents scored higher means for after taste in high tannin and free tannin varieties of sorghum while urban respondents showed no preference between low/free and high tannin varieties even though the means scores were high in the range of 3.4-4.0 respectively. A similar trend was also observed in scores for flavour in both categories of respondents thus an indication that taste influences flavour and overall acceptability. A similar result was obtained by Timu et al. (2014) [18] on the role of varietal attributes on adoption of improved sorghum seed varieties whereby consumption attributes like taste was scored high by rural farmers in Kenya upon consumption of local sorghum varieties (reddish in colour). A review by Drewnowski and Gomez-Carneros (2000) [19] on possible causes of bitterness (after taste) in cereal grains revealed that bitterness may be due to trace quantities of low molecular weight phenolic compounds such as flavonoids, microbial metabolites, rancid oils, and hydrolysed proteins. The sorghum flour which had high tannin contents (>10.0mg/g dry weight) presumably had higher amounts of flavonoids (condensed tannins), hence leading to high scores in after taste. However, high scores by both urban and rural respondents for after taste in free tannin sorghum porridge suggests the presence of other phenolic compounds in sorghum flour. Kebakile et al. (2008) [20] reported that bran infusion from tannin free sorghum with variable phenolic compounds after milling were slightly bitter and astringent and this was attributed to catechin and procyanidin B1, the common monomer and dimer, respectively, in sorghum.

With regard to appearance, both rural and urban consumers showed no preference between high and low/free tannin sorghums suggesting that the reddish colour of high tannin sorghum varieties is not a discriminating factor in selection. With regard to aroma, rural respondents scored highly for porridge made from low/free tannin (with mean score value of 4.5) thus, an indication of high preference while the score for high/low tannin variety porridges ranged between 3.5-4.0, thus an indication of no preference. On the other hand, urban respondents with a higher mean score value (>4.0) for all the sorghum varieties showed no preference for aroma. The differences between means indicate that for both rural and urban respondents, low tannin and no tannin varieties scored higher means in acceptability, an indication that during further food processing, low and free-tannin sorghum varieties will be suitable in the development of composite flours as well as adoption by the community members.

| | ANOVA | E1 High tannin Sorghum | E97 Low tannin Sorghum | MKT-RED High tannin Sorghum | SEREDO Low tannin Sorghum | T30b-1 No tannin Sorghum |
|---------------|-------|------------------------------|------------------------------|-----------------------------------|---------------------------------|--------------------------------|
| Rural | | | | | | |
| After taste | *** | 3.5 ^{ab} ± 0.2 | 3.0 ^b ± 0.2 | 3.7 ^a ± 0.2 | 3.1 ^b ± 0.1 | 4.1 ^b ± 0.1 |
| Appearance | NS | 4.1 ^c ± 0.1 | 4.0 ^{bc} ± 0.2 | 3.7 ^c ± 0.2 | 4.0 ^b ± 0.1 | 4.6 ^a ± 0.1 |
| Flavour | NS | 2.9 ^a ± 0.2 | 3.4 ^b ± 0.1 | 3.7 ^a ± 0.1 | 4.3 ^b ± 0.1 | 4.5 ^b ± 0.1 |
| Aroma | *** | 3.5 ^{ab} ± 0.1 | 3.6 ^b ± 0.1 | 3.6 ^b ± 0.1 | 4.0 ^{ab} ± 0.1 | 4.5 ^a ± 0.1 |
| Acceptability | *** | 3.5 ^{ab} ± 0.1 | 3.6 ^{ab} ± 0.1 | 3.4 ^a ± 0.2 | 4.1 ^{ab} ± 0.1 | 4.4 ^b ± 0.1 |
| Urban | | | | | | |
| After taste | * | 3.7 ^{ab} ± 0.1 | 3.9 ^b ± 0.1 | 3.4 ^a ± 0.1 | 4.0 ^b ± 0.1 | 4.0 ^b ± 0.1 |
| Appearance | *** | 4.4 ^c ± 0.1 | 4.2 ^{bc} ± 0.1 | 4.4 ^c ± 0.1 | 4.0 ^b ± 0.1 | 3.5 ^a ± 0.1 |
| Flavour | *** | 3.4 ^a ± 0.1 | 3.9 ^b ± 0.1 | 3.2 ^a ± 0.2 | 4.1 ^b ± 0.1 | 4.1 ^b ± 0.1 |
| Aroma | NS | 4.2 ^{ab} ± 0.1 | 4.3 ^b ± 0.1 | 4.4 ^b ± 0.1 | 4.1 ^{ab} ± 0.1 | 4.0 ^a ± 0.0 |
| Acceptability | NS | 3.8 ^{ab} ± 0.1 | 4.0 ^b ± 0.1 | 3.6 ^a ± 0.1 | 4.0 ^{ab} ± 0.1 | 4.1 ^b ± 0.1 |

Table 1. Sensory profiling of sorghum flours with different tannin levels used for porridge.

*** P-value < 0.001, * P-value < 0.05, NS=not significant, Mean values with different superscript in the same column are significant.

Correlation between sensory attributes of sorghum porridges and demographic data.

Table 2 shows the correlation between sensory attributes of porridge made from the different sorghum varieties and demographic data (age and gender). Gender and age did not show any significant relationship with consumer rating of other sensory attributes. This is in agreement with Aboubacar et al. (1999) [21] study conducted in Niger on important sensory attributes affecting consumer acceptance of sorghum porridge which indicated that appearance and colour were less important in affecting consumer acceptance. Phenolics in sorghum grain contribute to the bitterness and astringency of sorghum, therefore, it is noteworthy that all the

sorghum cultivars (tannin and tannin-free) are perceived as bitter and astringent at least to some extent thereby contributing to after taste upon consumption. Correlation coefficients for after taste was significant for overall acceptability of E1 (r = 0.552, p<0.0001) and flavour (r = 0.648, p<0.0001), texture (r = 0.603, p <0.0001) and overall accessibility (r = 0.768, p <0.0001) for E97. Significant correlation was also observed between after taste and flavour (r=0.648, p <0.0001) and texture (r=0.603, p<0.0001) of E97. After taste was positively correlated with overall acceptability of all the sorghum varieties indicating that it was a vital parameter in consumer selection and adoption of the sorghum varieties.

Table 2: Pearson correlation coefficient between sensory attributes of sorghum porridge and demographics

Numbers in parenthesis represent p-values for correlations made.
Significant differences ($p < 0.05$) are designated by bold text.

| Products | Variables | Appearance | Aroma | Flavour | Texture | Overall acceptability | After taste |
|----------|-------------|---------------|--------------------------|--------------------------|--------------------------|--------------------------|---------------|
| E1 | Age | 0.171(0.211) | -0.091(0.510) | -0.135(0.323) | 0.062(0.653) | -0.003(0.998) | 0.135(0.327) |
| | Gender | 0.061(0.657) | 0.167(0.223) | 0.029(0.835) | -0.066(0.632) | -0.136(0.323) | 0.227(0.040) |
| | After taste | 0.188(0.169) | 0.220(0.106) | 0.423(0.001) | 0.472(0.003) | 0.552(<0.0001) | 1 |
| E97 | Age | -0.072(0.603) | -0.045(0.742) | 0.120(0.383) | 0.036(0.791) | -0.015(0.915) | -0.016(0.231) |
| | Gender | 0.3464(0.802) | -0.162(0.235) | -0.142(0.030) | -0.230(0.030) | -0.187(0.172) | -0.218(0.110) |
| | After taste | 0.161(0.241) | 0.255(0.060) | 0.648(<0.0001) | 0.603(<0.0001) | 0.768(<0.0001) | 1 |
| T30b-1 | Age | -0.188(0.173) | -0.153(0.269) | -0.171(0.215) | -0.039(0.778) | 0.736(<0.0001) | -0.277(0.043) |
| | Gender | 0.063(0.653) | 0.1635(0.238) | 0.172(0.216) | -0.037(0.791) | 0.453(0.006) | 0.117(0.399) |
| | After taste | 0.336(0.013) | 0.596(<0.0001) | 0.691(<0.0001) | 0.697(<0.0001) | 0.263(0.055) | 1 |
| Seredo | Age | 0.194(0.159) | 0.085(0.543) | 0.010(0.937) | 0.141(0.309) | 0.007(0.959) | 0.095(0.517) |
| | Gender | -0.032(0.818) | -0.027(0.845) | -0.134(0.339) | -0.026(0.055) | -0.243(0.076) | -0.243(0.07) |
| | After taste | 0.482(0.002) | 0.746(<0.0001) | 0.747(<0.0001) | 0.762(<0.0001) | 0.772(<0.0001) | 1 |
| MKT-Red | Age | 0.034(0.806) | -0.188(0.173) | 0.006(0.963) | -0.022(0.087) | -0.094(0.049) | 0.035(0.799) |
| | Gender | -0.111(0.422) | 0.171(0.216) | -0.232(0.009) | -0.193(0.162) | -0.158(0.254) | -0.308(0.024) |
| | After taste | 0.306(0.002) | 0.306(0.007) | 0.852(<0.0001) | 0.692(<0.0001) | 0.774(<0.0001) | 1 |

E1=High tannin sorghum, E97=low tannin, MKT=Red-high tannin, Seredo=low tannin, T30b-1=free tannin sorghum.

Porridge made from T30b-1 recorded a significant correlation for after taste with aroma ($r = 0.596$, $p < 0.0001$), flavour (0.691 , $p < 0.0001$) and texture ($r=0.697$, $p < 0.0001$) however, there was a weak correlation between after taste and overall acceptability ($r=0.263$, $p=0.055$) therefore, after taste is not a sensory parameter in determining its adoption for utilization. Age and overall acceptability recorded a negative correlation ($r=-0.736$, $p<0.0001$) for the same product. It was however, not possible to determine the rationale behind the negative correlation for this low tannin sorghum because it was not specific to a particular age group. Significant and positive correlation were observed between after taste and aroma ($r=0.746$, $p<0.0001$), flavour ($r=0.747$, $p<0.0001$), texture ($r=0.762$, $p<0.0001$) and overall acceptability ($r=0.772$, $p<0.0001$) for Seredo variety while MKT-Red recorded high and significant correlation between after taste and flavour ($r=0.852$, $p<0.0001$), texture ($r=0.692$, $p<0.0001$) and overall acceptability ($r=0.774$, $p<0.0001$).

The difference in texture of the sorghum varieties (Seredo and MKT-Red) was attributed to the characteristics of the endosperm i.e. MKT_Red, a high tannin variety, had a soft endosperm texture hence were bitter, chewy while Seredo, a low/free tannin variety had relatively hard endosperm hence were perceived to be soft and sweet [22]. Chiremba et al. (2009) [23] also observed a soft floury texture on high tannin variety sorghum Significant correlation of flavour and after tastes

($r=0.852$, $p<0.0001$) for MKT-Red variety is an indicator of consumer preference for the traditional red cultivar. Positive correlation between after taste and aroma profile of T30b-1 and Seredo were attributed to distinctive aroma of raw seeds which is dominant in common cereal search [24]. For high tannin varieties of sorghum porridge E1 and MKT_Red, the positive correlation observed between after taste and overall acceptability as well as high sensory mean scores of above 3.5 (Table 1) was attributed familiarity and regular consumption of local varieties hence consumers. Several studies have linked consumer preference to familiarity. Stallberg-White and Pliner (1999) [25] found that most familiar flavours are usually also the most preferred by consumers.

Sensory evaluation of composite products

Table 3 presents results from the mean sensory scores from sorghum flour composites. Most of the panelist rated the colour of the six products between 6 and 7 on the hedonic scale ('Like moderately' and 'Like very much') resulting in a mean score of above 6. The degree of liking for the colour of sorghum composites products decreased from 7.33 in sorghum cake to 6.15 in sorghum doughnuts. Colour as an attribute during sensory evaluation is an important parameter in judging whether a composite is properly baked. It also provides information about the formulation and quality of the product. High preference for

colour by the panelists on these products may be due to Maillard reaction between reducing sugars and proteins resulting into appealing brown colour [24,26]. The degree of liking texture was high for sorghum zimbare (mean score of 7.42) and sorghum cake (mean score of 7.28) with lowest preference recorded for

sorghum chapati and doughnuts at a mean score of 6.16 and 6.17 respectively. The panelists preference for texture could be caused by high gluten content in the composite flour. Added gluten provides a stronger network in the dough, increasing gas volume and retention thus resulting in more firmness [27].

Table 3. Sensory acceptability of composite products

| Product | Colour | Texture | Taste | Flavour | General acceptability |
|-------------------|------------|------------|------------|------------|-----------------------|
| Sorghum cake | 7.33±1.4 | 7.28±1.2 | 6.80±1.9 | 6.50±1.8 | 6.94±0.3 |
| Sorghum scones | 6.18±1.7 | 6.19±1.8 | 5.75±2.1 | 4.78±1.9 | 6.10±1.5 |
| Sorghum chapati | 6.15±1.7 | 6.16±1.6 | 5.70±2.0 | 4.76±1.8 | 6.15±1.7 |
| Sorghum biscuits | 6.53±2.0 | 7.20±0.8 | 6.40±2.1 | 6.80±2.0 | 6.70±1.2 |
| Sorghum doughnuts | 6.15±1.7 | 6.17±1.8 | 5.74±2.1 | 4.76±1.9 | 5.60±1.6 |
| Sorghum zimbare | 6.97 ± 1.0 | 7.42 ± 0.5 | 7.11 ± 0.1 | 6.65 ± 0.7 | 7.28 ± 0.9 |

N.B. Mean and standard deviations from duplicate analysis are reported

Taste/ flavour of sorghum chapati and sorghum doughnuts were generally accepted with a mid-mean ranking, and this was attributed to their perception as compared to the commonly consumed wheat products. Generally, the scores for flavour and taste attributes were lower than for the scores for the other attributes and therefore this may mean that taste and flavour had a greater influence on the quality and acceptability of the products than other sensory attributes. The overall score for taste was above average and this probably influenced overall acceptability as taste is an essential parameter related to acceptability. Sugar and fat was used in the preparation of some of the products and the changes in taste and flavour is attributed to the added ingredients which gelatinized starch upon heating as well as the Maillard browning end reaction product melanoidin [24]. Sorghum zimbare, which is a fermented traditional food had the highest acceptability mean score of 7.28 indicating consumer preference of fermented culinary characteristics while sorghum doughnuts had the lowest score on 5.60 due to preference of the commonly eaten breads. The high scores for the overall acceptability of sorghum composite products could be due to the familiarity of taste, aroma and colour as the panelists were regular consumers of sorghum.

IV. CONCLUSION

Sorghum characterization on tannin levels have great effects on sensory characteristics of the porridge. The study showed that low tannin or tannin-free sorghum types would be preferred in sorghum foods, however, quality attributes such as colour of high tannin varieties were acceptable to consumers. Rural and urban consumers showed some differences in preferences due to the differences that they place in food and its contextual significance. For urban consumers, accepting a new variation of a product may take a longer time whereas the rural consumer may be excited about product that is likely being introduced for the first time. Sorghum products are highly likely to be accepted and should be popularized and adapted by smallholder sorghum farm households as well as urban consumers to enhance food, nutrition and dietary diversity.

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Study and Analysis of Manual Gear Transmission System for Automobile

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Abstract

This paper is studied about the five speed manual gear transmission system for Ford Ranger automobile. Power transmission system for automobile is composing with transmission gear box, universal joint, propeller shaft, final drive and drive axle. The transmission consists of a train of gears with different sizes. The main aim of this study is about the investigation of how the five speed manual gear transmission influence on the vehicle's performance. The purpose of this investigation is for the driver's safety and comfort by ensuring good vehicle drive ability. This study is including the gear transmission, torque, wheel torque, tractive effort and vehicle speed.

Index term: *manual gear transmission, torque, tractive effort, vehicle speed*

I. INTRODUCTION

Power transmission system is the next and final stage of the engine generated power before it hits the wheels. The whole system is responsible to couple engine and wheels, driving and adapting the output shaft rotation to a desired speed, torque ratio, a wider range of speed and better as the engine has its own RPM limit and maximum performance value. Power Transmission Systems are divided in three major blocks. They are: clutch, gearbox (Transmission) and differential. Each of them has a specific role transmitting power from the engine to the wheels ensuring correct rotation speed and torque. There are four big types of transmission. They are manual gear box, dual-clutch transmission (DCT), continuous variable transmission (CVT) and automatic transmission.

The manual transmission or manual gearbox contains gearing arrangement to get different speeds. Gears are used to get more than one speed ratios. When both mating gears have same number of teeth, both will rotate at same number of speed. In a typical car, there may be six gear including one reverse gear. Higher gears give progressively increasing speeds. Gears are engaged and disengaged by a shift lever. Manual transmission in cars is usually controlled by an "H" pattern lever. Figure 1 shows the "H" pattern allows to move the shift rod between the control rods for the three forks and move the rods back and forth.

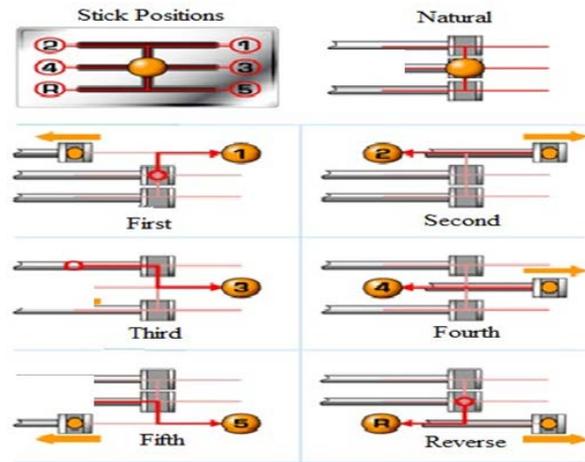


Figure 1 'H' Pattern Gear Transmission

II. MANUAL TRANSMISSION POWER FLOW

The following sections describe the path of power through a typical five-speed transmission. Multiple gear sets within the transmission provide gear ratios to best utilize the engine's torque. A gear ratio of about 4:1 in first gear provides high torque to begin moving the vehicle. In contrast, a higher gear ratio of about 1:1 reduces engine speed at higher vehicle speeds when less torque is required to maintain momentum [2].

A. First Gear

First gear power flow is illustrated in Figure 2. Power or torque flows through the input shaft and clutch gear to the countergear.

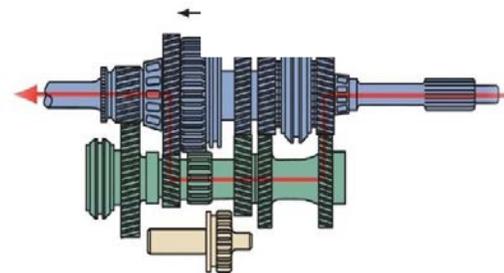


Figure 2. Power Flow in First Gear

The countergear rotates. The first gear on the cluster drives the first speed gear on the main shaft. When the driver selects first gear, the first/second synchronizer moves to the rear to engage the first speed gear and lock it to the main shaft. The first speed gear drives the main (output) shaft, which transfers power to the driveline.

B. Second Gear

When the shift from first to second gear is made, the shift fork disengages the first/second synchronizer from the first speed gear and moves it until it locks the second speed gear to the main shaft. Power flow is still through the input shaft and clutch gear to the countergear. However, now the second countergear on the cluster transfers power to the second speed gear locked on the main shaft. Power flows from the second speed gear through the synchronizer to the main shaft (output shaft) and driveline Figure 3.

In second gear, the need for vehicle speed and acceleration is greater than the need for maximum torque multiplication. To meet these needs, the second speed gear on the main shaft is designed slightly smaller than the first speed gear.

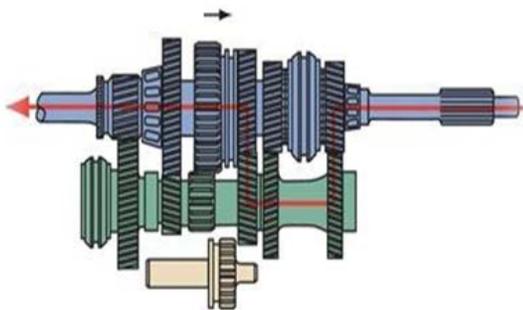


Figure 3. Power Flow in Second Gear

C. Third Gear

When the shift from second to third gear is made, the shift fork returns the first/second synchronizer to its neutral position. A second shift fork slides the third/ fourth synchronizer until it locks the third speed gear to the main shaft. Power flow now goes through the third gear of the countergear to the third speed gear, through the synchronizer to the main shaft, and driveline Figure 4. Third gear permits a further decrease in torque and increase in speed.

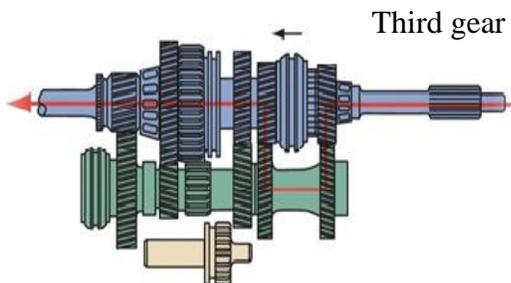


Figure 4. Power Flow in Third Gear

D. Fourth Gear

In fourth gear, the third/fourth synchronizer is moved to lock the clutch gear on the input shaft to the main shaft. This means power flow is directly from the input shaft to the main shaft (output shaft) at a gear ratio of 1:1 Figure 5. This ratio results in maximum speed output and no torque multiplication.

Fourth gear has no torque multiplication because it is used at cruising speeds to promote maximum fuel economy. The vehicle is normally downshifted to lower gears to take advantage of torque multiplication and acceleration when passing slower vehicles or climbing grades.

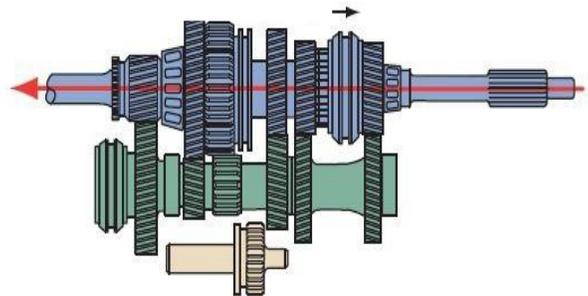


Figure 5. Power Flow in Fourth Gear

E. Fifth Gear

When fifth gear is selected, the fifth gear synchronizer engages fifth gear to the main shaft Figure 6. This causes a large gear on the countershaft to drive smaller gear on the main shaft, which results in an overdrive condition. Overdrive permits an engine speed reduction at higher vehicle speeds

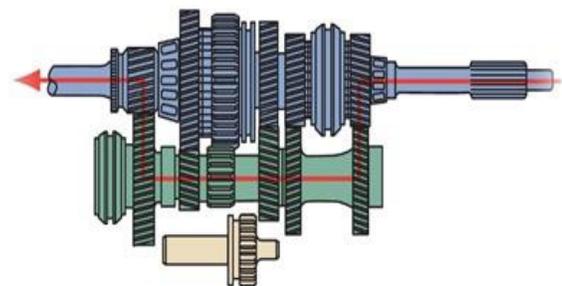


Figure 6. Power Flow in Fifth Gear

F. Reverse Gear

In reverse gear, it is necessary to reverse the direction of the main shaft or output shaft. This is done by introducing a reverse idler gear into the power flow path. The idler gear is located between the countershaft reverse gear and the reverse speed gear on the main shaft. The idler assembly is made of a short drive shaft independently mounted in the transmission case parallel to the countershaft. The idler gear may be mounted near the

midpoint of the shaft. The reverse speed gear is actually the externaltooth sleeve of the first/second synchronizer.

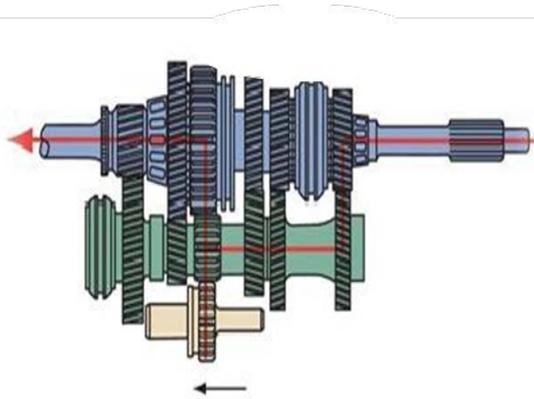


Figure 7. Power Flow in Reverse Gear

When reverse gear is selected, both synchronizers are disengaged and in the neutral position. In the transmission shown in Figure 7, the shifting linkage moves the reverse idler gear into mesh with the first/second synchronizer sleeve. Power flows through the input shaft and clutch gear to the countershaft. From the countershaft, it passes to the reverse idler gear, where it changes rotational direction. It then passes to the first/second synchronizer sleeve. Rotational direction is again reversed. From the sleeve, power passes to the main shaft and driveline.

Not all transmissions use speed and idler gears for reverse. For example, reverse gears in most Ford transmissions are helical gears that are in constant mesh with the first gear.

III.DESIGN SPECIFICATION OF FIVE SPEED MANUAL TRANSMISSION

The following specifications are rear wheel drive Ford Ranger F-150 five speed (MT).

Table 1: Specifications of Vehicles Engine and Transmission.

| Model | Ford Ranger |
|------------------------------------|-------------|
| Engine | Gasoling |
| Transmission and Final Drive Gears | Gear Ratio |
| i1 | 4:1 |
| i2 | 2.29:1 |
| i3 | 1.5:1 |
| i4 | 1:1 |
| i5 | 0.8:1 |
| i0 | 3.55:1 |
| Reverse Gears | 3.43:1 |
| Overall Gear Ratio | 14.2:1 |

P_{max} = 153 kW
N_{max} = 4750 r.p.m
T_{max} = 353 Nm
N_{max} = 3000 r.p.m
Tyre size P235/70/R/17
Width of Tyre = 235 mm

IV.RESULT DATA FOR FIVE SPEED MANUAL TRANSMISSION

$$\begin{aligned} \text{Height of tyre} &= 0.7 \times 235 \\ &= 164.5 \text{ mm} \end{aligned}$$

$$\begin{aligned} \text{Radius of rim} &= 0.5 \times 17 \times 254 \\ &= 215.9 \text{ mm} \end{aligned}$$

$$\begin{aligned} \text{Outer radius, } r &= 164.5 + 215.9 \\ &= 380.4 \text{ mm} \end{aligned}$$

$$\begin{aligned} \text{Loaded radius of tyre, } r_d &= 0.96 \times r \\ &= 365.184 \text{ mm} = 0.365 \text{ m} \end{aligned}$$

$$\begin{aligned} \text{Rolling circumference} &= 2 \times \pi \times 0.96 \times r \\ &= 2 \times \pi \times 0.96 \times 0.3804 = 2.3 \text{ m} \end{aligned}$$

The rear wheels drive in a version of the F-150 manual transmission. This was used in the Ford Ranger and number of other vehicles in both two-wheel-drive and four-wheel-drive versions. The following Table 2, shows number of teeth for each gear. Calculation gear ratio for compound gear train of each gear set,

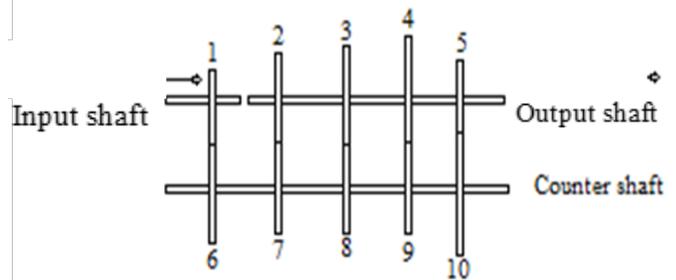


Table 2. In (MT) Number of Teeth for Each Gear

| Ge ar | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------|----|----|----|----|----|----|----|----|----|----|
| Z | 16 | 27 | 39 | 52 | 12 | 16 | 18 | 17 | 13 | 15 |

For Direct gear

16 teeth on the input shaft is divided by 16 on the counter shaft constant gear (driven gear). Ratio 1:1, counter gear rotates at the same of the input shaft. In direct gear is input speed and torque are at the same of the output speed and torque, can be calculated gear ratio by Equation.

$$i_4 = \frac{N_1}{N_6} = \frac{Z_6}{Z_1}$$

$$\frac{16}{16} = 1$$

$$T_6 = 353 \text{ Nm}$$

For third gear ratio,

$$i_3 = \frac{N_7}{N_2} = \frac{3000}{N_2}$$

$$N_2 = 2000 \text{ rpm}$$

$$T_2 = 529.5 \text{ Nm}$$

For second gear ratio,

$$i_2 = \frac{N_8}{N_3} = \frac{3000}{N_3}$$

$$N_3 = 1310 \text{ rpm}$$

$$T_3 = 808.37 \text{ Nm}$$

For first gear ratio,

$$i_5 = \frac{N_{10}}{N_5} = \frac{3000}{N_5}$$

$$N_5 = 3750 \text{ rpm}$$

$$T_4 = 282.4 \text{ Nm}$$

For reverse gear ratio,

$$i_r = \frac{N_{in}}{N_{out}} = \frac{3000}{N_5}$$

$$N_{out} = 875 \text{ rpm}$$

$$T_{out} = 1210.79 \text{ Nm}$$

Calculation of Power Transmitted by Torque

$$P = T \omega = 353 \times \frac{2\pi \times 3000}{60} = 110 \text{ kW}$$

Calculation of Efficiency

$$\eta = \frac{N_{out} T_{out}}{N_{in} T_{in}}$$

Calculation of Torque on Driven Wheel (T_w)

$$T_w = i_g i_o \eta T_p$$

Table 3. Results for Five Speed Manual Transmission Gear Ratio

| Gear | Gear Train of Number | Formula | Ratio |
|----------------|----------------------|---|---------|
| i ₁ | 1, 6, 4, 9 | $\frac{Z_6}{Z_1} \times \frac{Z_4}{Z_9}$ | 4:1 |
| i ₂ | 1, 6, 3, 8 | $\frac{Z_6}{Z_1} \times \frac{Z_3}{Z_8}$ | 2.29:1 |
| i ₃ | 1, 6, 2, 7 | $\frac{Z_6}{Z_1} \times \frac{Z_2}{Z_7}$ | 1.5:1 |
| i ₄ | 1 lock with 2 | None | 1:1 |
| i ₅ | 1, 6, 5, 10 | $\frac{Z_6}{Z_1} \times \frac{Z_{10}}{Z_5}$ | 0.8:1 |
| i _r | | $\frac{Z_6}{Z_1} \times \frac{15}{14} \times \frac{48}{15}$ | -3.43:1 |

Table 4. Result Table for Five Speed Manual Transmission Output Torque and Speed

| Gear | Engine Torque, T _{in} (Nm) | Engine Speed, N _{in} (r.p.m) | Ratio | Transmission Output Torque, T _{out} (Nm) | Transmission Output Speed, N _{out} (r.p.m) |
|----------------|-------------------------------------|---------------------------------------|-------|---|---|
| i ₁ | 353 | 3000 | 4 | 1412 | 750 |
| i ₂ | 353 | 3000 | 2.29 | 808.37 | 1310 |
| i ₃ | 353 | 3000 | 1.5 | 529.5 | 2000 |
| i ₄ | 353 | 3000 | 1 | 353 | 3000 |
| i ₅ | 353 | 3000 | 0.8 | 282.4 | 3750 |
| i _r | 353 | 3000 | 3.43 | 1210.79 | 875 |

Table 6 Results for Five Speed Manual Transmission Tractive Effort and Vehicle Speed

| Gear | Ratio | Rotational Speed of Driven Wheel | Torque on Driven Wheel | Tractive Effort | Vehicle Speed |
|----------------|-------|----------------------------------|------------------------|-----------------|---------------|
| i ₁ | 4 | 211.27 | 4260.71 | 11673 | 8.08 |
| i ₂ | 2.29 | 369.08 | 2439.26 | 6683 | 14.11 |
| i ₃ | 1.5 | 563.38 | 1597.77 | 4120 | 21.53 |
| i ₄ | 1 | 485.07 | 1127 | 2918 | 32.3 |
| i ₅ | 0.8 | 1056.34 | 852 | 2335 | 40.38 |
| i _r | 3.43 | 246.38 | 3653.56 | 10010 | 9.42 |

Table 7 Results for Gear Changing Upshift and Downshift

| Gear | Ratio | Rotational speed of Driven Wheel | Vehicle speed |
|----------------|-------|----------------------------------|---------------|
| i ₁ | 4 | | 8.08 |
| i ₂ | 2.29 | 1717.52 | 14.11 |
| i ₃ | 1.5 | 1965.08 | 21.53 |
| i ₄ | 1 | 2000 | 32.3 |
| i ₅ | 0.8 | 2400 | 40.38 |

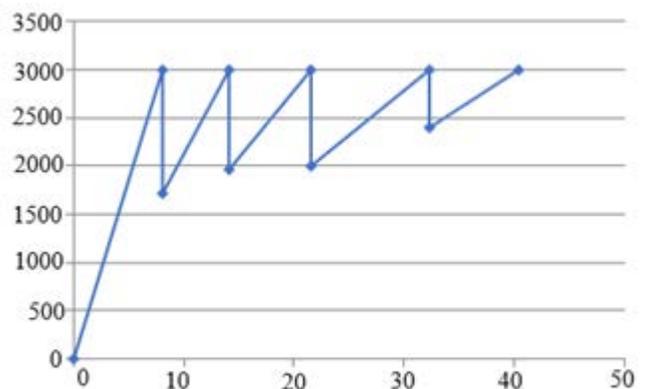


Figure 8 Graph for gear changing between upshift and downshift

V.CONCLUSION

In the design of manual gear box for power transmission system of Ford Ranger engine, transmission gear ratio, vehicle speed and rotational speed for each of gear shifting are considered. More gear ratios are required as the range of required speed and torque from low to high increased. Helical gear is used more widely as they run more silently than spur gear. In reverse gear of transmission gear box in F-150 engine, spur gear drive is used because it needed to transmit the maximum torque.

After knowing the gear ratio of the gear box, the number of teeth of gears are specified. And then, calculation of vehicle speed and transmission torque and gear ratio are carried out. Based on the result of design calculation, fifth gear (over drive gear) is the maximum speed 40.38 m/s and the minimum torque is 852 Nm. The first gear (lower gear) is the minimum speed about 8.08 m/s and the maximum torque is 4260.71 Nm. According to the result, the vehicle speed and torque reversely proportional. The tractive effort is also considered for each gear shift. The tractive force is the highest at first gear and the smallest at fifth gear.

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Prototype of Application to Predict the Pregnancy Complication In Rumah Sakit Mitra Bangsa Pati

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Abstract- Maternal mortality is a challenge for public health field in the world and developing countries account for 99% of maternal deaths globally. It is estimated that 15% to 20% of all pregnant women will experience a high risk state and obstetric complication. The evidence based midwifery comprehensive guideline provided by the midwife is expected to detect early risk factors for pregnancy before complication occurs. Pregnancy complications prediction system through assessment of gestational age, gravida, parity, abortion, complaints, blood pressure, pulse, temperature, presentation, height of fundus uterus, fetal heart rate, hemoglobin and proteinurin using manual recording and reporting takes time to make decisions. The purpose of this study was to build a prototype application for predicting pregnancy complications at Rumah Sakit Mitra Bangsa Pati in order to predict pregnancy complications, and design a pregnancy database and make reports electronically. The system development design uses a prototyping approach. The prediction method for the application of machine learning maternal complications uses the Naïve Bayes Classifier (NBC) algorithm. Applications can provide predictive results for pregnancy complications, such as bleeding, preeclampsia and hyperemesis gravidarum. Collecting data from register books, KIA books and medical records. From the results of the test with 72-fold cross validation, the accuracy value was 87.5% with 270 training data and 72 testing data. The use of prediction data is a basis for decision making.

Keywords: Prediction of pregnancy complications, k-fold cross validation, Naïve bayes classifier

I. INTRODUCTION

Complications in pregnancy can result from conditions that are specifically linked to the pregnant state as well as conditions that commonly arise or occur incidentally in women who are pregnant. Complications of pregnancy can appear in all trimesters; their diagnosis and management are great challenges [1]. Complications of pregnancy are health problems that occur during pregnancy. They can involve the mother's health. Some women have health problems that arise during pregnancy, and other women have health problems *before* they become pregnant that could lead to complications. It is very important for women to receive health care before and during pregnancy to decrease the risk of pregnancy complication.

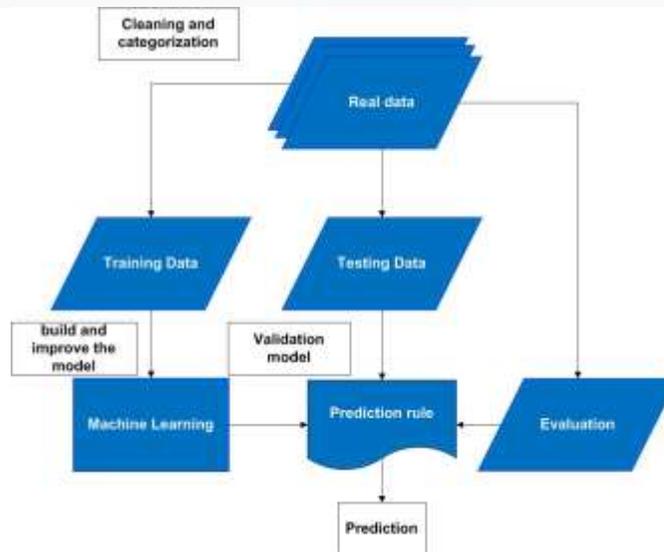
Pregnancies complicated by preeclampsia (PE), antepartum bleeding and hyperemesis are associated with an increased risk of maternal mortality [2]. Efforts to reduce maternal mortality should be focused on the direct causes of maternal mortality, including bleeding (28%), preeclampsia/ eclampsia (24%), etc. 11%. These complications are factors that can increase maternal emergency risk resulting in maternal death [3]. Common risk factors are estational age, gravida, parity, abortion, complaints, blood pressure, pulse, temperature, presentation, height of fundus uterus, fetal heart rate, hemoglobin and proteinurin [4].

About 15% to 20% of all pregnant women experience high risk conditions and experience complications that can endanger the lives of both the mother and her fetus if not handled optimally. Pregnancy complications can be prevented by improving the quality of health workers. Health workers must have the ability to identify and provide intervention before or during pregnancy so that they can provide a correct diagnosis. This will minimize the risk of maternal death and morbidity [5]. Clinical records has an important role to monitor the condition of pregnancy. Good quality recording will make it easier for health workers to identify the conditions of pregnancy complications.

One of the things that can support improvement in documentation is computerized recording and reporting so that data is easily accessible and easy to use. Recording and reporting can be optimal if health service management is carried out appropriately in accordance with applicable standards. Service quality can be improved through innovation with a machine learning approach to assist health workers in predicting pregnancy complications [6] [7].

II. METHODS

The methods of application prototypes for pregnancy complications prediction is done by developing machine learning, naïve bayes algorithms approaching mysql database, php-ml library, php, html, and css programming languages and xampp (apache) as web server. This prototype was developed with the aim of users being health workers who are responsible for the maternal health services section at Mitra Bangsa Hospital. Patient data is 342 data, divided into training data (270) and testing data (72) randomly selected (training data: testing data = 80%: 20%). The steps taken in preprocessing are editing, coding and tabulating.



Picture 1. Prediction by *Machine Learning*
 [8]

Testing data using naïve bayes algorithm. Naive bayes is a probabilistic classification and is mainly used when training set sizes are lacking. Naive bayes algorithm gets knowledge from the training process, then the probability is determined by how often the occurrence of the event occurs. The bayes theorem formula is as follows:

$$P(A|B) = \frac{(B|A)P(A)}{P(B)}$$

The library PHP-ML is as follows:

```

samples . [[35,4,2,1,7,160,100,90,36.7,2,1,155,1,2], [29,1 0,0,2,120,80,89,36.2,3,2,140,2,2]];
$labels . ['Preeklampsia', 'Perdarahan Antepartum'];

$classifier . new NaiveBayes();
$classifier->train($samples, $labels);
$classifier->predict([27,1,0,0,10,180,110,90,36.8,2,1,140,1,2]);
// return 'Perdarahan Antepartum'
'Perdarahan Antepartum'
$classifier->predict([[36.5,2 0,1,14,170,110,106,36,2,1,145,3,3],
[34.4,2,1,0,1,120,80,89,36.2,3,2,140 1,2]]);
// return ['Preeklampsia', 'Perdarahan Antepartum']
    
```

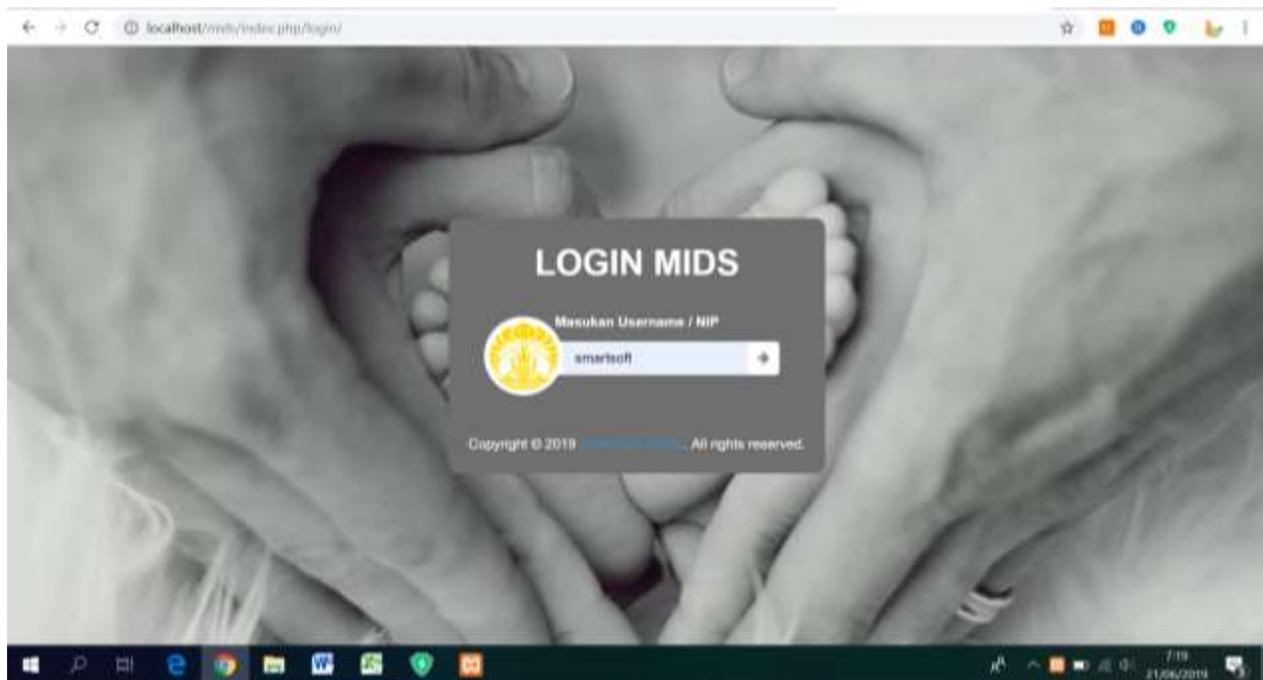
Accuracy calculations using the 72 fold cross validation formula.

$$\begin{aligned} Accuracy &= \frac{TP+FN}{TP+TN+FP+FN} \times 100\% \\ &= \frac{63}{72} \times 100\% \\ &= 87.5\% \end{aligned}$$

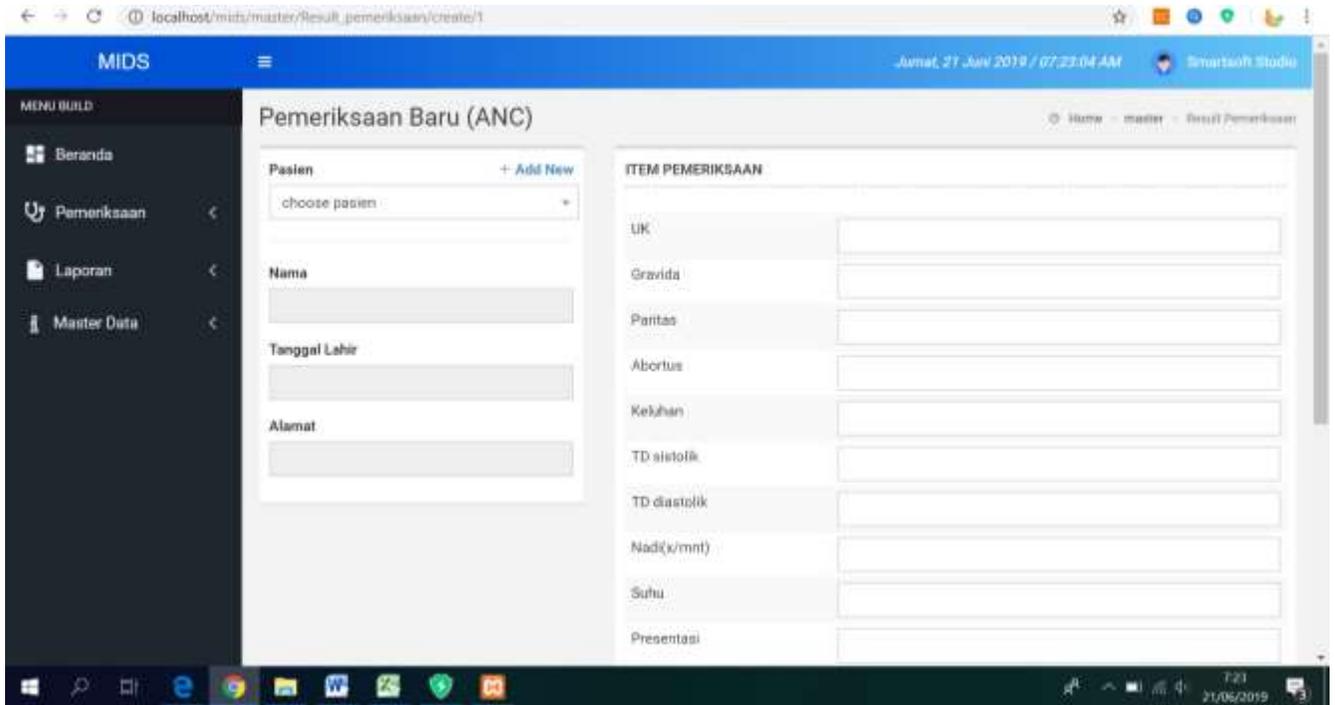
III. RESULTS

Data is used that are not found in the training process. When testing data is entered into the system, the process that will be passed is the determination of features, extracting features and classifying them according to the model that has been made. The system will provide predictive output of maternal complications. In testing Naive Bayes this Classifier uses the PHP ML library. The purpose of this test is to be able to automatically predict maternal complications. In the Naive Bayes Classifier method, the data classification process is based on previously stored training data. The test results showed that the accuracy of predictions of maternal complications in the ANC group showed an accuracy of 0.875 or 87.5%.

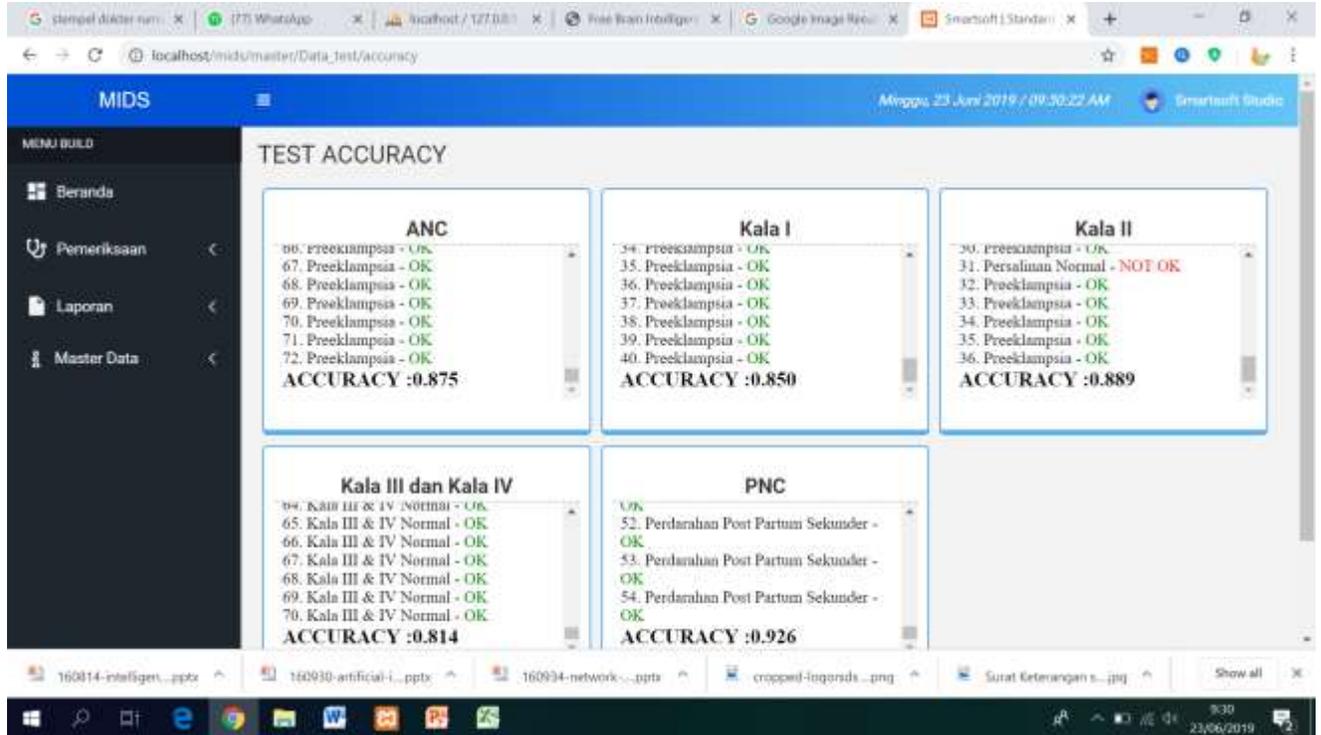
The following is the application interface:



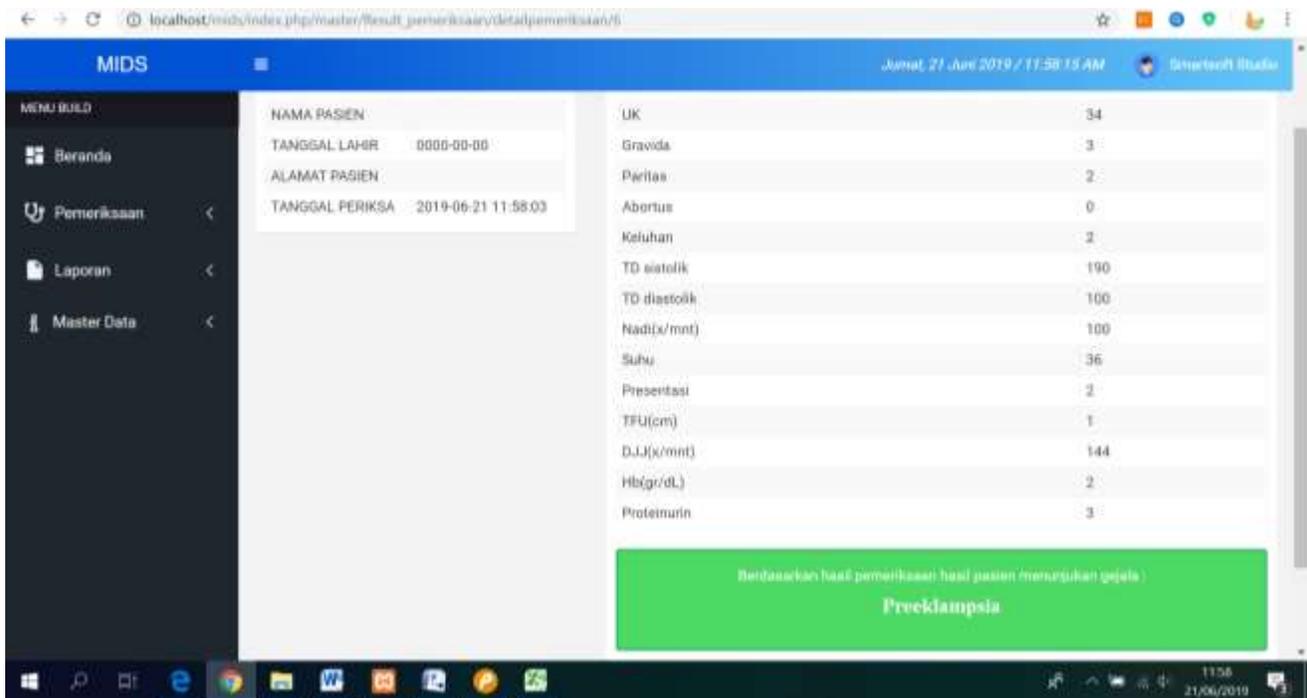
Picture 2. Login



Picture 3. New assessment



Picture 4. Accuracy



Picture 5. Prediction

IV. DISCUSSION

Manual record is an additional burden for officers in performing services with the many forms that must be filled out by midwives. With manual recording methods can result in duplication of visits to maternal health services or not even recorded at all. In addition, in the manual recording process, it is quite difficult to analyze mothers with risk factors because the analysis is done by relying on the memory of the midwife who has been screened and what maternal complications might occur in the patient.

Register books and medical records as a basis for predictions left in the health service place are not filled in completely. Filling out clinical data forms in a health service will help improve the availability of reliable data for making decisions, planning and appropriate interventions.

The prediction application for maternal complications that will be developed is the development of the existing system. However, the existing system will be made more concise and sequential after conducting midwifery services. Midwives and obstetricians who will conduct screening also do not require special qualifications because identification of maternal complications is automatically carried out by the system every time the patient performs an examination.

In addition, the application system will be created using a website approach where users of access rights can open this system on any media, whether laptop, tablet or PC. The time that midwives use to record electronically and predict maternal complications manually takes approximately 5 to 10 minutes, and the time needed by midwives to predict maternal complications by using the application will take between 1 to 3 seconds. This system will also cut the time needed in the process of recording and reporting to the Director of RSMB Pati.

The prediction process uses programming languages php, html and css with libraries for data preprocessing, Naïve Bayes Classifier algorithms with PHP-ML libraries, to performance accuracy. The inputted data will automatically be entered into the MySQL database, and can later be called back if the mother will make a repeat visit. This application is named MIDS, namely Midwifery Innovation Decision Support. This web-based information system was chosen because it has several advantages, namely the ease in developing the system and the application does not need to be installed into the hardware but simply by accessing the address of the application online using the browser engine (Internet Explorer, Mozilla, Chrome, etc.) so that easy to update. In addition, web-based applications are not only accessible through PCs or laptops, web applications tend to be more flexible so that they can be accessed through a variety of devices and various operating systems, such as tablets with devices based on Windows, Linux, iOS, Mac OS, Blackberry, Android , or other.

Accuracy results obtained in testing prediction models using 72-fold cross validation obtained an average accuracy of 0.875 from training data of 270 data and 72 data testing data with a comparison of training data: data testing = 80%; 20%. This accuracy is included in the high accuracy class for predicting maternal complications.

This prediction application for maternal complications has advantages and disadvantages as shown in the following table:

Table 1: Advantages and Disadvantages of Applications

| Advantages | Disadvantages |
|--|---|
| <ol style="list-style-type: none">1. The recording system is done through the web that can be accessed in the media (PC, or laptop) that is owned by the Pati Bangsa Pati Hospital, the data can be input anytime and anywhere provided that it is connected to the internet network.2. Data will be stored on a secure server3. Information in the form of results of examination of mothers in the form of health status of pregnant women, maternity, and postpartum as well as related reports. Reports will be immediately presented in the system. The resulting report can be changed to excel and can be downloaded.4. The form is adopted from the hospital medical record and is made easier. Midwives can immediately see the results of predictions and see reports after completing input without the need to process data.5. Information produced is in line with the data inputted into the system. Report according to information needs.6. Information can be obtained directly after inputting the results of the inspection. Automatic reports are made on the report menu. Inspection reports can be printed directly.7. Users can add complications data that will be predicted by export excel into the application, so that the application allows to produce pregnancy complications according to the patient's condition and the decision of the midwife / obstetrician8. The application can predict each patient to do an examination. | <ol style="list-style-type: none">1. This application system depends on whether or not the internet network connection is good.2. The system has not been able to analyze all pregnancy complications due to data limitations. |

V. CONCLUSION

There are several conclusions in this study.

- a. The Naïve Bayes Classifier method can be applied to predict maternal complications.
- b. The application for predicting maternal complications developed is considered sufficient. The results of the classification accuracy test performed by the application using k-fold cross validation obtained good results with an average accuracy of 0.875 or 87.5%.
- c. The information system design in the resulting application is able to predict each examination.
- d. The application prototype can collect data into the mother's database with risk factors and perform data processing directly so that it makes it easier for midwives to record and provide quality reports.
- e. The prototype application for predicting maternal complications can predict bleeding, preeclampsia and hyperemesis.
- f. The application prototype can predict within 1 to 3 seconds.

VI. RECOMMENDATION

For the next research can be done by increasing the training data. The more training data used it will increase the accuracy and accuracy of the system in recognizing testing data and periodic evaluation needs to be done to improve machine learning capabilities in predicting pregnancy complications.

ACKNOWLEDGMENT

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Population Census of Indian Flying Fox, *Pteropus giganteus* (Brünnich, 1782) With Relation to Climatic Conditions in Thazi, Mandalay Region, Central Myanmar

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Abstract - Population census of *Pteropus giganteus* (Brünnich, 1782) with relation to climatic conditions in Thazi, Mandalay Region in Central Myanmar was executed from July, 2015 to June, 2018. The initial population size of *P. giganteus* was recorded as 545.69 ± 55.63 individuals during first study period (July, 2015 - June, 2016) and 638.16 ± 35.81 individuals in second study period (July, 2016 - June, 2017). The population size was gradually increased to 655.53 ± 29.65 individuals in third study period (June, 2017 - July, 2018). Positive correlation was established between population size of *P. giganteus* and climatic conditions such as ambient temperature, relative humidity and rainfall. Relation between ambient temperature and monthly mean population size was positive ($R^2 = 0.042$, $R^2 = 0.1015$, $R^2 = 0.236$) in three study periods. Positive correlation between relative humidity and monthly mean population size revealed to ($R^2 = 0.0029$, $R^2 = 0.0261$, $R^2 = 0.0481$). The result of correlation between rainfall and monthly mean population size was occurred ($R^2 = 0.1506$, $R^2 = 0.2629$, $R^2 = 0.1457$) respectively during three years study.

Index Terms- population size, *Pteropus giganteus*, climatic conditions, positive correlation

I. INTRODUCTION

Of the rich diversity of vertebrate fauna, bats are unique in being the only group of mammals, like aves, have sustained flight (Kumar and Kanaujia, 2015). More than 20% all known mammal species of the world are bats. At present, there are about more than 1,300 extant species of bats distributed throughout the world (Voigt and Kingston, 2016).

Southeast Asia is a critical area for biodiversity conservation; level of species richness and endemism are the highest in the world, but rapid land – use changes endanger

much of the region's fauna. Bats are critical component of this biodiversity, comprising nearly a third of Southeast Asia's mammal species and providing vital ecological and economic services. However, nearly half the species are of conservation concern as many as 40% of bats species are predicted to be extinct by the end of this century if current deforestation rates persist (Kingston, 2008). The Indian flying fox, *P. giganteus* is scared while IUCN (2013) assessed the status least concern due to the decreasing its population.

Barlow (1999) pointed out that population estimation is an important initial step in determining what management programs and protective resources are required for a species. Hunting and habitat loss were identified as major threats to nearly all flying fox species (Biotani *et al.*, 2006). Another important factor is changes in climate. It is significant for natural system as climate changes can affect population abundance shift, in species invasions and extinctions and also climatic conditions play an important role in the dynamics of flying-fox roosts (Root *et al.*, 2003).

Bat conservation depends on research; especially is Population census is extremely important in evaluating conservation priorities for a species. Therefore, current population status of the *Pteropus giganteus* in the region is one of the critical factors to assess population dynamics of the studied species. The study area, Thazi Township is located in the Dry Zone Belt of central Myanmar, it suffers a

hot dry season annually. According to the local people, a colony of *Pteropus giganteus* took residence in this study site for more than 40 years. There is no formal data why *P. giganteus* can reside for many years and their population status in the study area with relation to environmental parameters.

Population census plays an important role in understanding the status of any species in a particular area. Therefore the estimation of population concerned with monthly occurrence must be considered as an important initial step in determining management priorities, protection and conservation of the Indian flying fox, *P. giganteus* in the central Myanmar. Therefore the study was conducted to assess the population status of *P. giganteus* with respect to climatic conditions.

II. MATERIALS AND METHODS

Study Area and Study Site

The study was conducted in Thazi, Mandalay Region. Thazi is located in the Dry Zone Belt of Central Myanmar and lies between North Latitudes of 20° 30' and 21° 05' and East Longitudes of 95° 28' and 96° 32'. Thazi is situated at 213.41m above sea level The study site, Yele monastery is situated at the southern border of Thazi and its western and southern borders are lined with an irrigated channel(Fig .1).

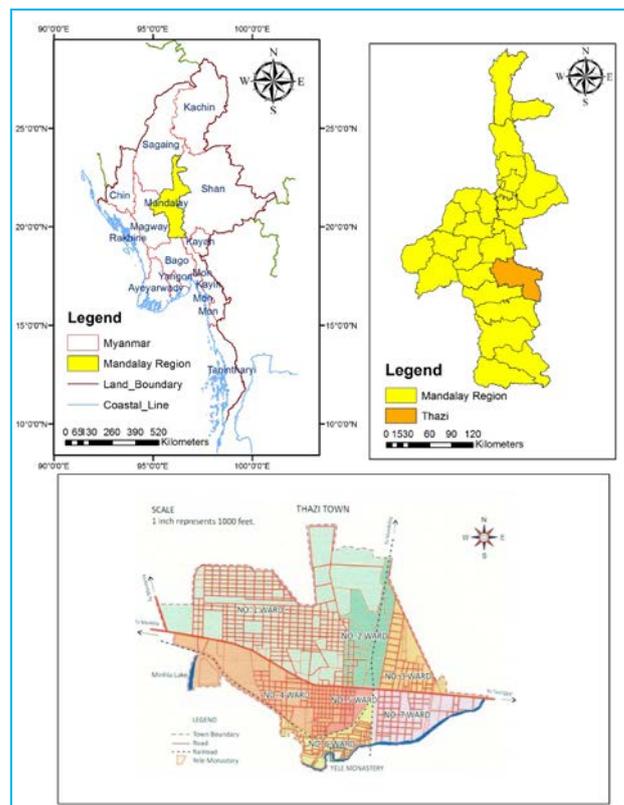


Fig.1.Map of the study area (above) and close-up view of study site (below)

Source: Land Records Department, Thazi Township

Study Period

The study was carried out from July, 2015 to June, 2018.

Estimation of Population size

Estimation of population size was conducted by direct visual count under the root trees followed by (Kunz, 2003). The roosting bats were counted between 9:00 am to 11:30 am. Counting was conducted two consecutive days per every weekend in every month regularly. The number of bats on each roost tree was visually counted with the help of binocular and recorded by hand tally counters. Two observers took the suitable distance of about 7.5 m to 10 m on either side of the roost tree and counted the bats and the result pooled.

Climatic Conditions

Monthly climatic conditions such as ambient temperature, humidity and rainfall were recorded. Ambient temperature and humidity were recorded by using thermohygrometer (Tm: -30°C~60°C, RH: 0%~100%, TH603, China) during day roost counts. Rainfall data were obtained from the Department of Meteorology and Hydrology, Thazi.

Statistical Analysis

Coefficient of determination was conducted to assess the relationship between ambient mean temperature, relative humidity and rainfall monthly mean number of individuals.

III. RESULTS

Population Size of *Pteropus giganteus*

During three years study, the total population size was occurred as slightly fluctuated. Total mean population size of *P. giganteus* in first study was nearly 545.69 ± 55.63 individuals and the maximum monthly population size was recorded in June. In the second study period, the total mean population size was 638.16 ± 35.81 individuals and the maximum monthly population was occurred in July. In third study, it was recorded that a total mean population as 655.33 ± 29.65 individuals and monthly peak population was counted in May (Table 1).

Table 1 Population status of *Pteropus giganteus* in study area (2015-2018)

| Month | First study period 2015-2016 | Second study period 2016-2017 | Third study period 2017-2018 |
|-----------|---------------------------------|----------------------------------|---------------------------------|
| July | 512.8 ± 5.88 | 706.7 ± 23.74 | 623.3 ± 7.5 |
| August | 512.29 ± 9.22 | 626.3 ± 42.02 | 656. ± 4.47 |
| September | 525.14 ± 8.74 | 667.7 ± 11.84 | 645.1 ± 27.65 |
| October | 494.67 ± 22.22 | 668.5 ± 16.13 | 642.8 ± 11.63 |
| November | 529.5 ± 48.01 | 625.3 ± 11.9 | 641.0 ± 6 |

| | | | |
|-------------------------------|-----------------------|-----------------------|-----------------------|
| December | 541.75 ± 58.91 | 642.9 ± 48.96 | 643.1 ± 8.6 |
| January | 520.7 ± 5.5 | 598.8 ± 31.94 | 634.8 ± 16.76 |
| February | 521.88 ± 8.19 | 605.3 ± 11.09 | 629 ± 1.92 |
| March | 496.33 ± 22.98 | 602.3 ± 9.92 | 639.6 ± 14.23 |
| April | 583.38 ± 57.06 | 638.1 ± 20.17 | 649.3 ± 41.35 |
| May | 638.7 ± 18.28 | 655.7 ± 64.41 | 734.7 ± 12.67 |
| June | 667.3 ± 25.7 | 637.17 ± 35.8 | 723.5 ± 10.85 |
| Total mean individuals | 545.69 ± 55.63 | 638.16 ± 35.81 | 655.33 ± 29.65 |

Statistical Analysis of Population Size and Environmental Parameter

The coefficient of determination between monthly mean population size and monthly mean environmental parameters such as ambient temperature, relative humidity and rain fall.

Coefficient of determination between ambient mean temperature and monthly mean population in first, second and third study periods revealed as positive ($R^2 = 0.0442$), ($R^2 = 0.1015$) and ($R^2 = 0.236$). Monthly mean humidity and monthly mean population size revealed positive correlation during the three study periods ($R^2 = 0.0029$), ($R^2 = 0.0261$) and ($R^2 = 0.0481$) respectively. Similarly between rainfall factor and monthly mean population size and the coefficient of determination was positive ($R^2 = 0.5106$), ($R^2 = 0.2629$) and $R^2 = 0.1457$) (Fig. 2, 3, 4, 5,6,7,8,9 and10).

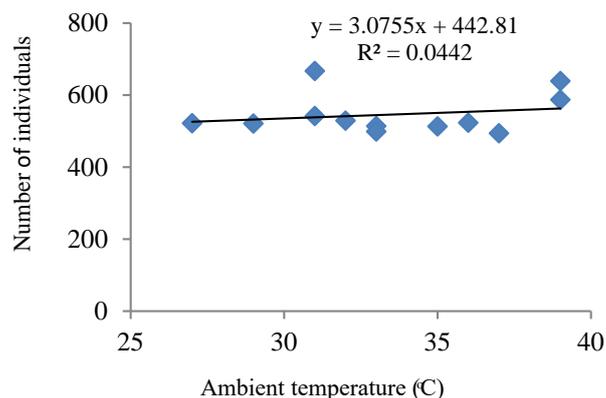


Fig 2. Relationship between ambient temperature and monthly mean population size in first study period

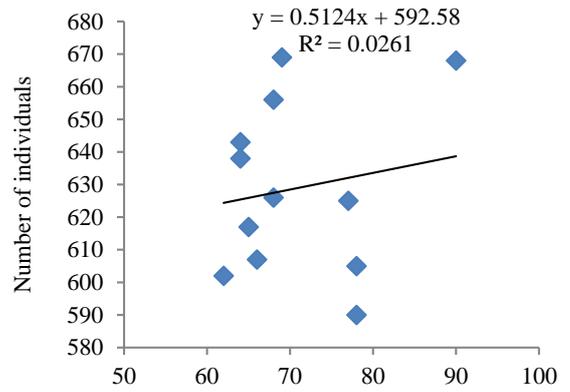
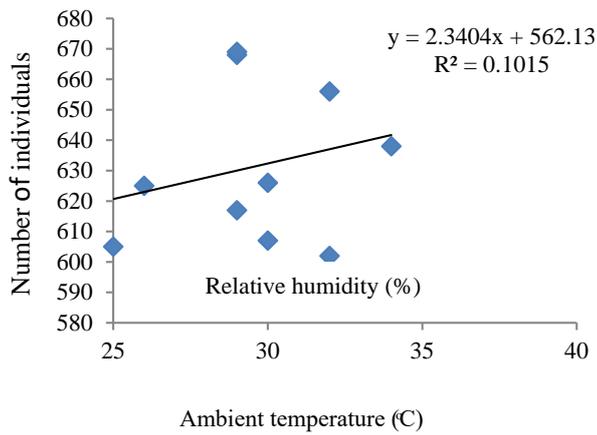


Fig 6. Relationship between relative humidity and monthly mean population size in second study period

Fig 3. Relationship between ambient temperature and monthly mean population size in second study period

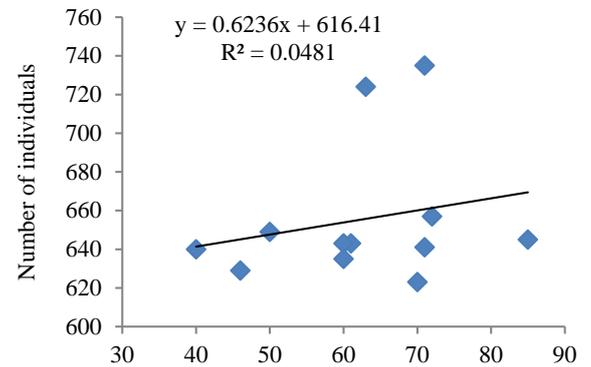
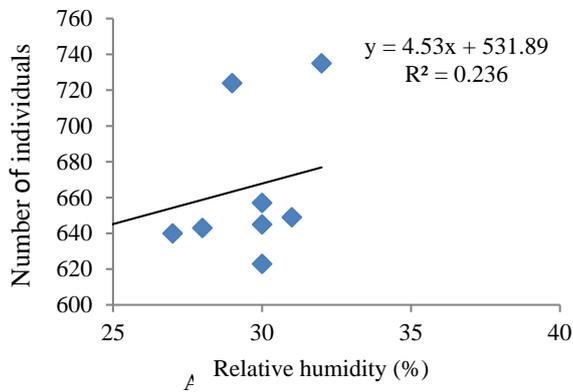


Fig 7. Relationship between relative humidity and monthly mean population size in second study period

Fig 4. Relationship between ambient temperature and monthly mean population size in third study period

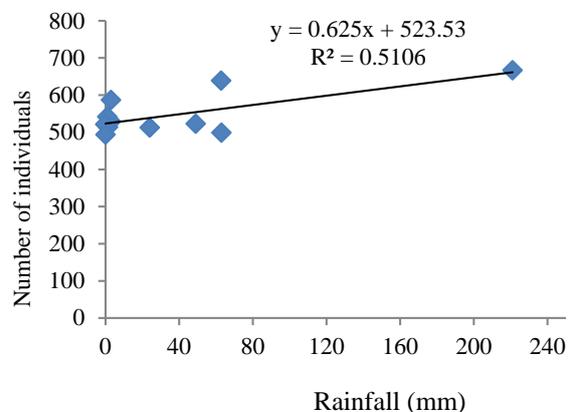
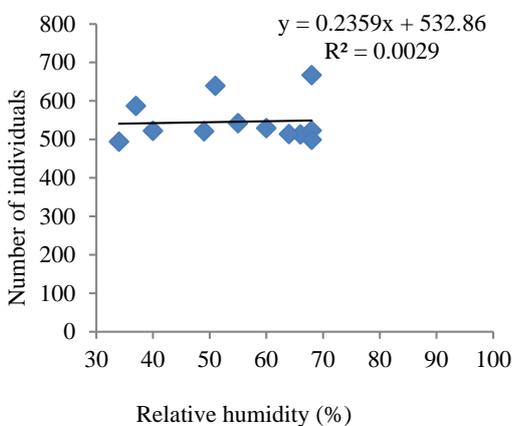


Fig 8. Relationship between rainfall and monthly mean population size in first study period

Fig 5. Relationship between relative humidity and monthly mean population size in first study period

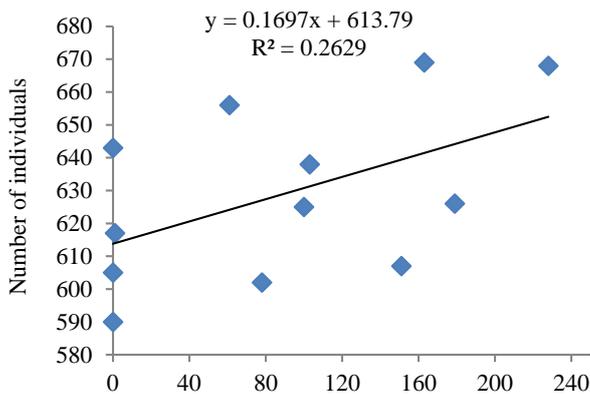


Fig 9. Relationship between rainfall and monthly mean population size in second study period

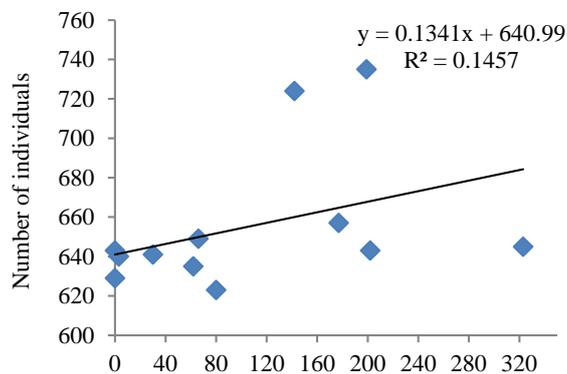


Fig 10. Relationship between rainfall and monthly mean population size in third study period

IV. DISCUSSION

During the present study, (July, 2015 to June, 2018) mean population size of *Pteropus giganteus* recorded ranged from 545.69 ± 55.63 to 655.33 ± 29.65 individuals. The largest population of nearly 660 individuals was recorded during third year study and followed nearly 630 individuals recorded during second study. Approximately 550 individuals were recorded during first study period. And then the colony size increased gradually year to year.

Roost occupancy and maintenance by *P. giganteus* requires a variety of geographic, physical and ecological

characteristics which control their behavior and population dynamics (Pierson and Rainey, 1992). Flying fox conservation and management of population status depend on the reliable estimation and indices of population size (Kumar and Kanaujia, 2015).

Throughout three years study, the maximum mean numbers were observed from May to July in each year. It is assumed that increasing the population size was due to the time of parturition period, and the newly pup appeared as recruitment in their colony. Rainfall (mm) and population size occurred in October, January, February and March during first, second and third study periods due to human disturbance, when people gathered in the precinct of the monastery and prepared food for the religious ceremony. But there was no abrupt change in monthly mean population size in each year.

During the present study, the result of correlation between monthly mean temperature, relative humidity and rainfall was positively during three study periods. The maximum mean temperature in three study periods was 39 °C, 34 °C and 32 °C, whereas the minimum temperature was 27 °C, 22 °C and 21 °C respectively. Therefore the temperature between 21 °C and 39 °C were favorable condition for *Pteropus* population size in study area.

It was observed that during three study periods, both ambient roost humidity and rain fall showed positive correlations with the monthly mean numbers of individuals. Khin Than Oo (2009) also stated that population size was positively correlated with both of humidity and rainfall. Sein Sein Win (2006) reported that there was no correlation between the ambient humidity and population size of fruit bat. It is assumed that these differences appeared because of spatial and temporal disparity. Physical characteristics of roost sites are important for the bats and roost selection of the bats. The most criteria for roost microclimate selection appear to be temperature and humidity for both temperate and tropical species (Churchill, 1991).

Habitat destruction, degradation and alteration have serious implications for bats, as these anthropogenic factors

can seriously reduce the availability of suitable roosting sites, which in turn affect population size and ultimately, species survival (Tan *et al.*, 1999). Estimation population and colony size for bats presents particularly challenges but is an essential element in effective assessments of conservation status and in providing a baseline from which to identify any future population decline (Kunz and Fenton, 2003)

Although the colony of *P. giganteus* had been residing more than 40 years in the study site, the fluctuation of colony occurred since five years ago. It is assumed that the appropriate roost facilities, lack of over hunting and availability of food resources are critical factor for roost fidelity of *P. giganteus* in the study site. In the present study, the climatic conditions especially ambient temperature, relative humidity and rainfall were somewhat related to population fluctuation of *P. giganteus*. Yele is a religious area so that hunting of *P. giganteus* is strictly prohibited. Other important factor is the roost trees which also provide for their food supply partially for long time survival for *P. giganteus* in study area.

Therefore, the study will provide as the information for effective conservation and management of Indian flying fox, *P. giganteus*. Moreover, this study may be elucidated for ecological and biological aspects of *P. giganteus* for long-term survival for the future.

V. CONCLUSION

From the result of the study , total population size of *Pteropus giganteus* in the study site ranged from 550 to 650 individuals. It was observed approximately 100 individuals increased during three years study period, moreover the climatic conditions, especially ambient temperature, relative humidity and rainfall were somewhat related to population fluctuation of *P. giganteus*. Yele monastery is a religious precinct, lush green in vegetation ad large trees provided as a safe haven not only for flying foxes

but also other living assets. Moreover, *de-facto* protection afforded ensured the long term preservation of *P. giganteus* in the study area.

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The Effect of Addition of Dextrin and Arabic Gum to The Quality of Crude Albumin Fish Cork (*Ophiocephalus striatus*)

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Abstract- Cork fish is a type of fish that is very high albumin. Making albumin powder is an alternative to consuming cork fish albumin so it is preferred and increases longevity. Making albumin powder can be done by foam drying method (foam-mat drying). In this study the addition of dextrin and arabic gum functions to protect albumin from heat damage. The purpose of this study was to obtain the concentration of dextrin addition with optimal arabic gum so it produced good cork fish albumin powder with the foam-mat drying method. Analysis of albumin powder produced on albumin levels, protein content, fat content, moisture content of ash content, amino acid profiles and organoleptics. This study uses a simple Randomized Design (CRD) with six treatments and four replications.

The results showed that the addition of dextrin concentrations with different arabic gums had a different effect on the quality of albumin powder. The best treatment was obtained at the concentration of dextrin and gum arabic 0.28%: 7.72% (E), with albumin levels of 0.55%, protein content of 4.54%, moisture content 10.18%, ash content 6.93% , yield of 10.33% and moisture absorption of 3.56%, color of 4.81 (rather like), aroma of 4.03 (rather like) and there are 9 amino acids in it

Index Terms- cork fish, dextrin, arabic gum, foam mat drying, albumin powder

I. INTRODUCTION

Albumin is one of the most common types of protein in blood plasma which is produced in liver and released directly into the blood circulation. Lack of albumin in serum can affect binding and transport of endogenous and exogenous compounds, including drugs. Procurement of albumin serum for surgical cases currently reaches 91%, 2/3 of albumin is used in the surgical section and the remaining 1/3 part is used for the treatment of internal diseases. So far in the market available HSA (Human Serum Albumin). According to Suprayitno (2014), the number of cork albumin can reach 6.24% at a temperature of 27-34 ° C. This amount is very high compared to other animal protein sources. The cork albumine crude produced from the usual extraction process is consumed in liquid form but smells fishy, so people don't like it.

The production of crude albumin powder is an alternative to consuming cork fish crude albumin, so it is preferred and increases durability. One method of drying liquid-shaped material

can be done by foam drying (foam-mat drying) which was previously used as foam first by adding foaming agents (Zubaedah, 2003). This drying temperature is relatively low so that the color, aroma and nutritional components of the product can be maintained. To reduce albumin damage due to hot temperatures, fillers can be added to function as binding agent binders or binders. Dextrin and gum arabic can be applied as a protein binder (Chamidah and Hakim, 2013). Dextrin has a function to protect sensitive food components, reduce nutrient loss, add liquid components to solid forms that are easier to handle than other fillers (Latifah and Apriliawan, 2007). In addition to decorating, the commonly used material is arabic gum which is an effective emulsifier because of its ability to protect colloids and is often used in the food industry (Meliala et al., 2014).

II. MATERIALS AND METHODS

2.1 Material

The materials used in the study include materials for extracting crude cork albumin, ingredients for making powder, and materials for chemical analysis. Materials for extracting crude cork albumin in the study using cork fish (*Ophiocephalusstriatus*) originating from Sidoarjo ponds were alive. The fish used weighs 210-650 g with a total length (TL) of 27-42 cm. In addition, filter cloth and aquades are also needed. The material used for making powder is crude albumin obtained from extracting cork, dextrin, arabic gum, and tween 80 fish. The materials used in chemical analysis are crude powder albumin, cork fish, silica gel, aquadest, and filter paper and biuret.

2.2 Analysis of Albumin Levels

According to Suprayitno (2014), albumin levels were determined using the spectrophotometric method. that is. sample of 2 ml added to the reagent was added with biuret and heated at 37 ° C for 10 minutes. Cooled then measured with electronic 20 and recorded the absorbance with a length between 350-2200 nm, then calculated the albumin level with the formula.

$$(\%) \text{Albumin Levels} = \frac{\text{ppm} \times 25}{\text{Sample weight} \times 10^6} \times 100\%$$

2.3 Analysis of Protein Levels

Protein content analysis was carried out using the Spectrophotometric method. Measurement of protein levels was carried out by taking 0.9 ml of protein samples, first applying it with the addition of crystal ammonium sulfate. Then centrifuged for 10 minutes, separated the clear part (supernatant). The precipitate which is a protein is then reconstituted with acetic acid buffer pH 5 to 10 ml. In the test tube, 0.9 ml of each sample was added, 0.8 ml of biuret reagent was added and 1.3 ml of an acetic acid buffer solution was added. Let stand for 10 minutes, read the absorbance at the maximum wavelength on the detection screen.

$$(\%) \text{Protein Level} = \frac{V_{\text{standard}} - V_{\text{blanko}} \times N_{\text{standar}} \times 14 \times 6,25}{\text{Sample weight} \times 1000} \times 100$$

2.4 Analysis of Water Content

The method of analyzing water content was carried out by means of a dry oven method (thermogravimetric method). According to Aventi (2015), water content analysis using the thermogravimetro method can be done by weighing the initial weight of the sample (gram), place it in the oven tray where the dryer is approximately 110oC, put the oven tray sample into the oven, leave for 2 hours after 2 hours, until the sample is completely dry constant homogeneous. This is known from the constant weight (no change / decrease again), then calculated by the formula:

$$(\%) \text{Water content} = \frac{(\text{initial weight} - \text{final weight})}{\text{initial weight}} \times 100\%$$

2.5 Analysis of Fat Levels

Fat content analysis according to Shahidi (2001), was carried out by the goldfisch method by transferring the sample and then put it into a thimble and placed in a buffer tube with a hole in the bottom, then the solvent placed on the back of the buffer tube. cooled by a condenser so that the material will be moistened by solvents in lipids will be extracted and then will be accommodated in bekerglas again, after extraction is complete (3-4 hours), the heater is turned off and the following sample buffer. The heater is turned back on so that the solvent will be evaporated again and condensed and floated into the tank which is installed at the bottom of the condenser. Thus the floating solvent can be used for other extractions, the residue in the bekerglas installed on the heater is then dried in an oven 100oC until a constant weight is obtained. This residual weight is expressed as oil or fat contained in the material:

$$(\%) \text{Fat Level} = \frac{A + B - C}{B} \times 100\%$$

2.6 Analysis of ash content

The method used in the analysis of ash content is the kiln method. According to Nugraha (1997), the steps that must be taken beforehand the cup is dried in an oven at 85 ° C overnight, cooled in a desiccator until it reaches a new room temperature then weighs its empty weight (G). Approximately 2 grams of standard / dry sample material is weighed into a cup with known weight (W). The cup containing the sample was placed into the kiln and burned at 550 ° C for 16 hours (Method A), and at 600 ° C for 3 hours.

The burned material is cooled in a desiccator (containing silica gel) to room temperature. Then weighed using a balance sheet. Calculation:

$$(\%) \text{ash content} = \frac{\text{weight of ash(g)}}{\text{sample weight (g)}} \times 100\%$$

2.7 Test for Water Absorption

Test of moisture absorption is carried out to determine the resistance of crude albumin powder to a moisture or air in the storage space. This is based on the hygroscopic powder properties so that it is necessary to test moisture absorption as a characteristic of crude cork albumin powder. Absorption of water vapor is inversely proportional to water content. The lower the water content, the more absorbable the moisture, the ability of the powder to absorb water depends on the product to be produced (Sari and Kusnadi, 2015).

2.8 Rendemen

The purpose of calculating the yield of crude cork albumin powder is to determine the effect of concentrations of arabic dextrin and gum and the efficiency of making crude cork albumin powder. The rendement calculation can be done based on the method carried out by Sudi et al., (2008), the formula used to calculate the yield as follows:

$$\text{Rendemen} = \frac{\text{ouput}}{\text{input}} \times 100\%$$

2.9 Organoleptic Analysis

Organoleptic testing can be done by scoring. Organoleptic testing with an autoleptic test scoring test method was carried out by giving a score on texture parameters such as taste, aroma and elasticity in each sample based on the numerical parameters chosen by the panelists, and drinking as a neutralizer after each sample test. Panelists were asked to fill out the form by stating the scent score as an example very very fishy = 7, very fishy = 6, not fishy = 5, rather fishy = 4, and somewhat fishy = 3, fishy = 2, very fishy = 1. Then (Suradi, 2007).

2.10 Analysis of Amino Acid Profiles

Analysis of amino acid profiles using HPLC consists of four stages, namely: the stage of making protein hydrolyzate by means of weighing 0.1 gram of sample and being crushed, then added with 10 mL HCl 6 and heated in an oven at 100oC for 24 hours. Then the drying phase of the sample aims to make the sample completely clean apart from the solids. The filter was taken as much as 30µL and added 30µL of the drying solution. The drying solution is made from a mixture of methanol, picotiocyanate and triethylamine (Babu et al., 2002). Solubilisation solution of 30 µL is added to the drying results, then mixed with methanol, sodium acetate and triethylamine, then diluted by adding 20mL 60% acetonitrile or buffer sodium acetate 1 M, then leave for 20 minutes. Then injection into HPLC was carried out by taking 40 µL of liquid to be injected into the HPLC, then calculating the amino acid concentration in the material was carried out by making a standard chromatogram using ready-made amino acids which experienced the same treatment as the sample (Bartolomeo and Maisano, 2006).

III. RESULTS AND DISCUSSION

3.1 Albumin

The results of albumin levels in crude albumin powder with the addition of dextrin concentrations and arabic gum reached 0.55%. The lower the concentration of dextrin and the higher the concentration of arabic gum, the higher the albumin level. Addition of dextrin with different arabic gum can protect the damage of albumin from heat treatment. Heat treatment on albumin will produce irreversible changes in structure, which can be seen with increasing water insoluble proteins (Nugroho, 2013). Based on research, Gum arab is able to increase albumin levels because arab gum can form a layer that can protect albumin from heat damage. Sugindro et al. (2008), states that the properties of arabic gum are good in fierce emulsions and form a film layer, so extract retention can still be maintained. Gum arabic also has the ability to inhibit oxidation and protect major components (Silalahi et al., 2014).

3.2 Protein

Analysis of proteins is important for the purposes of determining nutrition, knowing the functional properties and determining the biological properties of proteins (Andarwulan et al., 2011). The results of protein content in crude albumin powder with the addition of dextrin and arabic gum concentrations reached 4.54%. The more concentration of arabic gum, the greater the protection of AGP and GP which play a role in the addition of nitrogen in the product in the form of dissolved nitrogen, amino nitrogen and total protein. Gum arab has an arabinogalactan protein (AGP) group and glycoprotein (GP) that tends to bind to proteins (Rizki et al., 2014). According to Prabandari (2011), about 2% of the gum component is in the form of protein, while the remaining 98% is sugar.

3.3 Water Content

Water content in crude albumin powder with the addition of dextrin concentration with arabic gum reaches 10.18%. Food products in powder form with low water content have high resistance to microbiological damage because free water is used by microorganisms to live and grow (Faryake et al., 2001). Gum arabic has hydrophilic properties so that bound water is not easily released. Hydrocolloid or hydrophilic colloids are long-chain polymers that dissolve in water and are able to form colloids and gels (Puspasari, 2007). Wiyono (2007), added that the higher the addition of dextrin concentration, the lower the water content of the powder. Dextrin is also an ingredient that has the ability to bind to each other, so dextrin can reduce the value of water content (Meiyani et al., (2014).

3.4 Levels of ash

Ash content in crude albumin powder with the addition of dextrin concentration with arabic gum reached 6.93%. Ash content can be determined based on the dry weight of the material and expressed in percent. The lower the concentration of dextrin and the higher the concentration of arabic gum, the lower the ash content. The addition of dextrin stabilizers which can reduce the proportion of the mineral content of the starting material. The higher the concentration of dextrin added, the ash content of flour will increase as well (Naibaho et al., 2015). Syahputra (2008), added that the ability of dextrin to reduce the tendency of materials

that are easily damaged due to heat treatment. Ash content is also known as inorganic or mineral substances. Minerals are not significantly affected by chemical and physical treatment during the processing process, nor do they affect nutritional value. Although some components of food are damaged in the process of food warming, the process does not affect the mineral content in food (Ramadhia et al., 2012).

3.5 Absorption of Steam Water vapor

Absorption in crude albumin powder with the addition of dextrin concentration with arabic gum reaches 3.56%. The high humidity of the storage room will absorb moisture from the air into the pores of the food so that it will cause food water content to increase (Retnani et al., 2010). The lower the concentration of dextrin and the higher the concentration of arabic gum is added, the absorption of moisture from crude powder cork fish albumin decreases. Gum arabic hydrocolloid will have a high water content. The higher the hydrocolloid concentration, the more water is bound up in the hydrocolloid tissue (Putra et al., 2015). So that in the drying process, water is difficult to evaporate and causes high water content. High water content has a tendency to absorb water lower (Firdaushi et al., 2015).

3.6 Rendemen

The yield of crude albumin powder with the addition of dextrin concentration with arabic gum reached 10.33%. The recovery is an indicator to determine the effectiveness of the method applied in a study, especially about the optimality in producing a product. The lower the concentration of dextrin, the lower the yield. Dextrin is a group of polysaccharides that function as fillers (fillers) and are inert which can maintain fragile parts of the material (Syahputra, 2008). Yana and Kusnadi (2015), adding that the more fillers added will increase the total solids. So that if the higher concentration of dextrin is added, the yield will increase (Naibaho et al., 2015).

3.7 Organoleptics

The organoleptic parameters of food products have an important role, due to the relationship with the reception of panelists to the products produced. Quality products are not determined by physical and chemical analysis, but are also determined by the level of color and aroma assessment The assessment of the senses carried out by consumers is an important factor in evaluating a product and determining the feasibility of the product on the market (Lawang 2013).

3.7.1 Color

Color is one component that can determine the quality of a material or food product. The organoleptic test results of color scoring on crude albumin powder with the addition of a concentration of dehydrate with different arabic gum obtained an average value of 4.667% to 5.342%. The lower addition of dextrin makes the powder darker. Increasing the concentration of dextrin fillers with arabic gum added causes the color of the product to tend to be younger (paler) Firdhausi et al. (2015). Added by Wiyono (2007); Drajat et al. (2014), the brightness level of powder increases with increasing dextrin concentration.

3.7.2 Aroma

The organoleptic scoring test results on crude albumin powder with the addition of dextrin concentrations with different arabic gum obtained an average value of 3,650% to 5.517%. The lower the concentration of dextrin and the higher the concentration of arabic gum is added, the scent score on crude powder of cork fish albumin decreases. This is because the use of arabic gum is less effective for binding scents than dextrin. Where arab gum is an additional ingredient that has no aroma, (Prasetyowati et al., 2014). The addition of Arabic gum microcapsules does not affect the taste and aroma of the product (Nurhasanah et al., 2011).

3.8 Amino Acid Profiles

Chromatography is an analytical technique based on molecular separation due to differences in the composition structure. Different compounds can be separated from each other as they move through the column. Chromatographic separation can be carried out using various stationary phases, including immobilized silica on glass plates (thin layer chromatography), volatile gas (gas chromatography), paper (chromatographic paper) and liquid (liquid chromatography) (Kupiec, 2004). The results of the analysis of amino acid profiles of crude cork albumin powder can be seen in Table 9.

Table 9. Results of Analysis of Profile of Amino Acids in Crude Powder of Cork Fish Albumin

| No | Asam Amino | Nilai (mg/g) |
|----|-------------|--------------|
| 1 | Isoleusin | 0,70 |
| 2 | Leusin | 0,59 |
| 3 | Lisin | 2,13 |
| 4 | Fenilalanin | 15,37 |
| 5 | Arginin | 0,41 |
| 6 | Histidin | 0,19 |
| 7 | Aspartat | 0,02 |
| 8 | Sistein | 0,03 |
| 9 | Prolin | 0,30 |

IV. CONCLUSION

The best treatment in this study was treatment E with the addition of dextrin concentration with arabic gum of 0.28%: 7.72%, with parameters of albumin levels of 0.55%, protein content of 4.54%, moisture content of 10.18%, levels of ash 6.93%, yield of 10.33% and moisture absorption of 3.56%. While the results of organoleptic tests, the results obtained for the color scoring scale 4.81 (rather like), aroma 4.03 (rather like). Albumin levels obtained the highest results in Phenylalanine 15.37, Lisin 2.13, Isoleucine 0.70, Leucine 0.59, Arginine 0.41, Histidine 0.19, Aspartate 0.02, Cysteine 0.03, Proline 0.3

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Tourist satisfaction towards tourism products and market with special reference to Lumbini

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Abstract: Foreign tourists who visit Lumbini get a glimpse of the ancient art and culture of Nepal as well as acknowledge Buddha. Most of the respondents availed of high class accommodation and were satisfied with the hygienic conditions in these hotels. They travelled by different means of transport to reach the destinations the satisfaction related to the attitude of drivers and they not at all appreciated conductors. Lumbini market as symbol of culture and heritage are satisfactory but proper marketing of tourism product is not satisfactory which need of an hour. The places, the temples, the river, the spots, parks and tranquil environment of Lumbini are highly appreciated by the tourist. But the communication and banking facilities are found to be dissatisfactory in rural areas and tourist spots. There are many PCOs and banks are available in the area. Although they feel quite satisfied with their visit but still a gap exists between their expected and perceived services. One of the reasons for this gap has been identified as non-availability of tourism area packages, improper interpretation facilities, poor conditions of ordinary buses and share taxis plying between interior rural areas, awful maintenance of city roads, traffic congestion, non-availability of adequate information on official web site and non-availability of quality souvenirs at Lumbini. Based on this identification recommendations have been offered for eliminating gap. This may result in tourist delight and an increase in tourist satisfaction at Lumbini and ultimately into socio-economic development of the region.

Key words: Tourist satisfaction, Tourism Products and market, SWOT Analysis, Lumbini

1. INTRODUCTION

Tourism destination branding is a general concept; destinations can be branded like products or people. In this case, the power of branding is in making people aware of the location and linking desirable associations. Destinations are a large entity with sets of material and non-material elements (Florek, 2005). The attractiveness of a tourist destination encourages people to visit and spend time at the destination. Therefore the major value of destination attractiveness is the pulling effect it has on tourists. Without the attractiveness, tourism does not exist and there could be little or no need for tourist facilities and services. It is only when people are attracted to a destination that facilities and services follow (Ferrario, 1979). Tourism marketing is an integrated effort to satisfy tourists by making

the best possible services available to them. It is a device to transform the potential tourists into actual tourists. (Musa, Mohammad, 2013). Tourists are the indicators of foreign currency earnings and economic growth in and around the destination. So, the destination development, management and promotion are important marketing functions of tourism marketing.

Tourism is the major economic source of Nepal. Nepal is trying to develop its foreign currencies earning sector's status to compete in regional and global market. Lumbini being the birthplace of Lord Buddha, thousands of national and international Buddhist as well as non-Buddhists come to visit the cultural and religious place every year. It has direct and indirect effect in the socio economic development of this region. Effective and sustainable positioning of the destination in the regional and international level can be the source of increasing tourists flow in the place.

A tourism product can be defined as the sum of the physical and psychological satisfaction it provides to tourists during their travelling en route to the destination. The tourist product focuses on facilities and services designed to meet the needs of the tourist. It can be seen as a composite product, as the sum total of a country's tourist attractions, transport, and accommodation and of entertainment, which result in customer satisfaction. Tourism has certain basic components without which it cannot operate. Although tourism consists of various products, these may, however, be considered to be the basic. These basic products of tourism are accommodation, transportation, locale and security. Accommodation is a base of tourism industry as it is a vital and fundamental part of tourism supply. Tourists in their travel require location where they can rest and revive during their travel. A tourist, in order in order to get to his destination, has to travel and, therefore, some mode of transport is necessary for this. The locale may include a holiday destination and what it offers to the tourist. The holiday destination may offer natural attractions like sunshine, scenic beauty or sporting facilities and so on. Tourism and transportation has long been recognized as an engine of growth for long-term economic growth and development. This industry is considered as a great source of foreign exchange earner for many developing countries, who considered natural resources as their major assets (Thullen, 1996). Today, tourism is the fastest growing industry in the world and also one of the world's most competitive. This competition is constantly growing as more and more destinations seek to attract tourists and more companies and organizations are involved in the

highly-skilled business of destination planning, transportation, accommodation and catering for the tourists.

Tourism being the outcome of combination of the motivations, it depends upon the free consent and curiosity of the visitors. Satisfaction and achievement of goal are the major motivation factors. Leisure, transport facilities, income, accommodation, locale, package tours, climate, business, natural beautification, better education, world exhibition, trade, fairs and cultural heritages are known as motivating factors to visit. Geographical items, historical and archaeological monuments as well as pilgrimage sites are major elements of tourist attraction. In this situation Lumbini and its neighbor sites are related with cultural, archaeological and pilgrimage status. Lumbini, the birthplace of Shakyamuni Buddha, is the symbol of peace, compassion, pity and harmony. In the promotion of tourism transportation, accommodation, attractions (natural as well as cultural heritages), security, proper information and communication are the basic elements.

2. LITERATURE REVIEW

Tourism is a basic and most desirable human activity deserving the praise and encouragement of all people and all governments. It is an industry concerned with attracting people to a destination transporting them their housing, feeding and entertaining them upon their arrival and returning them to their homes. For many major economics of the world tourism is an integral part and is an important source of foreign exchange. (Sharma, 1988).

Accommodation is one of the basic product, which is essential for providing food and rest. Tourism and transportation has long been recognized as an engine of growth for long-term economic growth and development. This industry is considered as a great source of foreign exchange earner for many developing countries, who considered natural resources as their major assets (Thullen, 1996). Today, tourism is the fastest growing industry in the world and also one of the world's most competitive. This competition is constantly growing as more and more destinations seek to attract tourists and more companies and organizations are involved in the highly-skilled business of destination planning, transportation, accommodation and catering for the tourists.

It has been said rightly by (Batra & Chawla, 1995) in their study that travelling stimulates an increased interest in tourism. The decision of a holidaymaker to go for a particular destination is basically influenced by its comparative advantage in terms of attractiveness over the competing destinations. The applications of marketing principles in the tourism industry are meant for the formulation of marketing mix on the basis of the users' behavioral profile. For the successful execution of marketing strategies or for translating the strategies into the meaningful purposes, it is essential to have a detailed knowledge of the changing behavior of users of services in order to satisfy them. In the recent year tourists have become more demanding and discriminating. To keep pace with the changing tourists' needs and wants marketers have to identify ways to improve their products in order to satisfy the customers who are the king of the market.

Mustonen & Honkanen, (2007) examined perceived tourism behavior and desire to travel. The study is based on postmodern theories which state that instead of demographics, social

divisions are based on identity and lifestyle. In their article the effects of these both were also examined. Analysis was based on two nationwide surveys, "Finland 1999 and Finland 2004" the results were somewhat parallel with the hypothesis. Further, the study concludes that the effects have remained quite stable regardless of the finding that "desire to travel more" has increased while "perceived tourism behavior has increased.

Chauhan & Khanna, (2008) attempted to investigate the satisfaction of the tourist's vis-a-vis the tourist infrastructure which includes accommodation, transportation, communication, drinking water, and civic amenities available in the Jammu and Kashmir. The study is based on survey where 100 tourists were considered who visited the various tourist centers of Jammu and Kashmir. The research suggested measures to improvise the available infrastructure to enhance the tourist satisfaction.

3. REVIEW OF RESEARCH WORKS IN LUMBINI:

Kunwar and Ghimire (2012) in their study "Lumbini as International Pilgrimage Destination: Authenticity and Significance" focused for the need of development of Lumbini region as well as for the successful completion of Visit Lumbini year 2012 at that time. They think Tourism is the dynamic industries which contribute significantly in the national economy needs always new things, ideas, activities and attractions. Visit Lumbini 2012 could be the appropriate platform to publicize Lumbini and Nepal in the international market as well as create awareness among the domestic tourists. It is the slogan to develop Lumbini and attract more pilgrims and tourists from the international market and bring the momentum of tourism industry of Nepal.

Neupane (2009), in the study "Heritage Complexity and Tourism: The Case of Lumbini Nepal" provided some recommendations to make the site attractive for both visitors and local communities. One of the ways of getting support for conservation and development of the site from local communities in this case is providing economic benefits through tourism. However, despite the importance of spiritual and academic interests in Lumbini, its potential for attracting international visitors and a growing trend in arrivals, the area has not benefited well from tourism. Through the Tourism for Rural Poverty Alleviation Program (TRPAP), the government is trying to diversify the tourism product so that tourists will spend more money at the site and in surrounding villages. However, the diversification of tourism products by TRPAP without much tourism insight may not be appropriate. Rather, it is recommended to increase the length of stay of tourists through the development and promotion of other Buddhist sites around the area, including Kapilvastu and Devdaha. Certified guided tours and interpretive programs can also help employ locals and increase the length of stay. Lumbini is also suffering from a seasonal pattern of tourists as the site experiences very low visitation rates during summer months of April to July. Although monsoons are a big factor in seasonality shifts, their impact on heritage tourism should be much less than other types of tourism, such as nature-based tourism because it is easier to control the climatic factors in the built environment such as temples and museums. The monsoon can be a real constraint for a small portion of the tourists visiting Lumbini who also visit other mountain destinations. But for Asian

pilgrims, it should not be a significant factor. This warrants awareness and information dissemination, which should be incorporated in the tourism plan for Lumbini

Tourism activities began in time immemorial, early travels were mainly for sustaining livelihood activities but the modern travel and tourism is mainly for pleasure and recreation; this results in exploitation of newer and newer areas without any concern for nature. The over exploitation of the tourism areas can result in pollution and destruction of natural flora and fauna, the natural beauty of the area and adverse social, economic and cultural impacts on local population. Tourism developments based on carrying capacity and sustainable development becomes relevant in this scenario for proper management of natural resources so that the present as well as future generations may enjoy nature's beauty, and thereby enhance tourist flows and revenues.

All of the literatures and previous studies such as research activities, survey articles, and related online literatures, studied tourism in Lumbini by its historical perspective, socio-economic impacts, overall Lumbini development perspective and problems point of view in Lumbini. No studies are found to deal with tourists' satisfaction towards tourism products and services available in Lumbini. So, the researcher finds the scope in doing research in that area of tourism in Lumbini. However, this study somehow followed those studies to add value to the gap.

4. OVERVIEW OF TOURISM IN LUMBINI

Lumbini is the birthplace of Lord Buddha and its religious value has been attracting pilgrims since the very early ages. The archaeological remains, which were excavated throughout the last century and which are now conserved at the site, provide testimony of these pilgrimages since the 3rd century BC. It is for these reasons, that Lumbini was inscribed in the World Heritage List in 1997 (Kanno, 2006).

Lumbini has been a pilgrimage destination since the time of Buddha. However, there were no systematic records of tourists before 1984. Since 1984, the LDT has kept visitor records but only for visitors from countries that require a passport to enter Nepal. Tourism growth was disrupted by the Maoist insurgency and political turmoil in Nepal between 1999 and 2002. Tourist arrivals to Nepal and Lumbini show that tourism in Lumbini was more sensitive to political instability than the country's other destinations. However, since 2002, Lumbini has experienced a 684% growth in arrivals. The number of tourists to Lumbini increased by 43% between 2006 and 2007. The credit for this rapid growth goes to the recent peace process, political stability, the implementation of the Lumbini master plan project components and increased promotional activities (Nepal Tourism Board, 2008).

The holy site of Lumbini has ruins of ancient monasteries, a sacred Bodhi tree, an ancient bathing pond, the Asoka pillar and the Mayadevi temple, where the precise place of birth of Buddha is located. A pillar now marks the spot of Asoka's visit to Lumbini. Lumbini, as of 1997, is an UNESCO World Heritage Site specifically nominated for the international World Heritage program. The holy site of Lumbini is bordered by a large monastic zone, in which only monasteries can be built, no shops or hotels or restaurants. It is separated into an eastern and western monasteries zone, the eastern having the Theravada

monasteries, the western having Mahayana and Vajrayana monasteries.

The WTTC forecasts that tourism will grow on an average 4.5% annually between 2005 and 2014 (Choi & Sirakaya, 2005). Tourism is now viewed as one of the key sectors of economic growth and development in the state, both from the point of view income and employment generation as well as source of revenue for the state. No doubt tourism in Uttaranchal is definitely capable of generating more income than it is generating now. Efforts are lacking somewhere perhaps on the part of the stakeholders in the tourism industry, policy makers and developers as well as the travel intermediaries in the state.

5. OBJECTIVES AND HYPOTHESIS

It is evident from the foregoing enumeration of the gaps in the studies conducted so far that there is still dearth of research studies mainly focusing on the tourist's satisfaction in tourism products and market in Lumbini. The present work is conducted against this backdrop. It includes empirical study on tourist satisfaction on tourism products and market of Lumbini i.e. transports, locals, accommodation and so on. Every tourist has some expectations at the time of visiting any destination, which leads to different levels of satisfaction and dissatisfaction.

The primary purpose of this study is as follows:

- To study the level of satisfaction towards tourism products and services with special reference to Lumbini.
- To study the effectiveness of the tourism market in the area.
- To acquire a knowledge of the GAP (if any) that exists between tourists expected services and perceived services at Lumbini.
- To evaluate the problems faced by the tourist while they visit the spot Lumbini.
- To undertake a resource analysis to identify its strengths, weaknesses, opportunities and threats (SWOT Analysis) in the context of Lumbini.

6. HYPOTHESIS:

On the bases of the objectives of the study the designed hypothesis are as follows:

H1: It is presumed that tourists are satisfied with the tourism products of the Lumbini.

H2: The gap between the tourists' expected services and perceived services at Lumbini does not exist.

H3: In Lumbini, tourism has been developed.

7. DATA AND METHODOLOGY

This research work is basically exploratory in nature. The aim of this research is to collect detailed information about expectations and related satisfaction of tourists visiting Lumbini. It has been endeavor of the researcher to make an empirical study by analyzing and critically examining the relevant statistical collection from primary and related information from secondary sources. The collection of primary data includes Questionnaire; Discussions; and observations to find out tourist satisfaction level about the various tourism products like accommodation, transportation, communication, banking facilities and so on and the effectiveness of the marketing efforts in the state of Lumbini. Further a SWOT analysis of Lumbini Tourism is also carried out on the basis of the opinion survey and the interviews of the tourist.

7.1 Study Areas and Sample Size:

A sample size of 93 tourists from the study area that is pilgrimage places, stations, sanctuaries, parks, adventure spots of Lumbini is taken on convenient cum judgment basis. These places are chosen because they hold the perennial positions in terms of tourists' arrivals in the state.

7.2 Questionnaire Design

Pilot survey has been undertaken for pre-testing the questionnaire. Questionnaire has been edited in the light of the results of the pilot survey. The questionnaire consists of 20 statements, which are related to accommodation, locale, transportation and so on. Scaling: Five point scaling i.e. Strongly Agree, Agree, Uncertain, Disagree, and Strongly Disagree.

7.3 Non-Parametric Statistical Analysis

For the purpose of analyzing the collection of data, statistical techniques of mean, standard deviation and skewness have been used. In order to study the uniformity in the view of the various respondents. Chi-square test has been applied.

7.4 Limitations

- Some of the conclusions are based on the estimates, assumptions, observations and informal interviews.
- Sample size remains medium and the margin of error associated with it could creep in to influence the inferences drawn in this study.

8. RESULTS AND DISCUSSION

Table 1: Demographic Profile of Respondents (%)

| Description | Responses |
|----------------------------|-----------|
| Gender | |
| Male | 65 |
| Female | 28 |
| Age of Respondents (Years) | |
| Under 20 | 15 |
| 20-30 | 25 |
| 30-40 | 40 |
| 40-50 | 14 |
| Above 50 | 7 |
| Education | |
| Secondary | 5 |
| Higher Secondary | 26 |
| Graduation | 42 |
| Post Graduate | 17 |
| Other | 3 |
| Occupation | |
| Business | 19 |
| House-wife | 11 |
| Service | 38 |
| Student | 25 |
| Marital Status | |
| Married | 41 |
| Unmarried | 52 |
| Stay in Lumbini | |
| 1-7 | 55 |
| 7-15 | 28 |
| 15-above | 10 |

A look into demographic profile of the surveyed tourists (which include foreign tourists only) indicate that about 70% are male and 30% female, falling in the age group of 25-50 where as 44% are married and 56% are unmarried. Respondents are 100% educated, 41% of them are service class and remaining is

business class. The sampling method has been devised so as to ensure adequate representation for the entire foreign tourist with regard to tourism products and market.

Table 2: Tourists Satisfaction towards Tourism Products and Market of Lumbini (Accommodation Facility)

| Particulars | Mean | S.D. | Skewness | S.E.of Skewness | Chi-square (χ^2) | p |
|--|------|-------|----------|-----------------|-------------------------|------|
| Easy accessibility of hotels and lodges. | 3.77 | 1.205 | -0.782 | 0.241 | 1.3 | 0.01 |
| Banking facilities near tourist spots. | 3.33 | 1.393 | -0.178 | 0.241 | 9.7 | 0.01 |
| Availability of desired rooms in hotels. | 3.42 | 1.505 | -0.405 | 0.241 | 6.6 | 0.01 |
| Hygiene in the rooms of the hotels. | 3.56 | 1.438 | -0.664 | 0.241 | 3.2 | 0.01 |
| Maintenance of the tourist attraction. | 3.09 | 1.498 | -0.046 | 0.241 | 4.8 | 0.01 |

*strongly agree-1, ..., strongly disagree-5

Respondents' opinion towards easy accessibility of hotels at rural areas is strongly disagreeing. The mean value is higher at average score. The variation in the opinion and skewness is 1.20483 and -0.782. Calculated χ^2 value is significant at 1 percent equally distributed. This, it is concluded that they are not all satisfied with the accessibility of hotels at Lumbini. The majority of the respondents are distributed towards higher side on the issue of banking facilities near tourist spots. Mean value is higher at five-point scale. The standard deviation and skewness is 1.39302 and -0.178. Calculated χ^2 value is significant at 1 percent level of significant, which shows that opinion is not equally distributed and distributed towards the higher side of the average score. Therefore it is concluded that banking facilities are not satisfactory in Lumbini.

It is observed that foreign tourist is strongly unsatisfied with the availability of desired rooms in hotels. Further their opinion is distributed more towards higher side i.e. disagree to strongly disagree. The mean value is noted higher than the average standard score, while variation in the opinion and skewness is 1.50541 and -0.405 respectively. This supports the above analysis. The χ^2 test is significant at 1 percent level of significance. It reveals that opinion is not equally distributed. It is concluded that tourist satisfaction regarding reasonable rooms depends on the time i.e. at peak tourist time or normal time.

A majority of the respondents are dissatisfied with the hygiene at restaurants. Mean value is lower at five-point scale. The standard deviation and skewness observed is 1.43773 and -0.664 respectively. The calculated χ^2 value is significant at 1 percent level of significance. Therefore the conclusion drawn is majority of the tourists are not satisfied with the hygiene in the restaurants. A majority if the respondents strongly agree with the maintenance of tourists spots. The mean value is higher at five-point scale. The standard deviation and skewness is

1.49811 and -0.046. Calculated χ^2 value is significant, which shows that opinion is not equally distributed and distributed towards the higher side of the average score. Therefore it is concluded that a majority of the tourist are not satisfied with the maintenance of tourist places but on the other hand a few of them are satisfied also.

Table 3: Tourists Satisfaction towards Tourism Products and Market of Lumbini (Transportation Facility)

| Particulars | Mean | S.D. | Skewness | S.E. of Skewness | Chi-square (χ^2) | p |
|--|------|---------|----------|------------------|-------------------------|------|
| Accessibility of the roads in the city and rural areas. | 3.32 | 1.347 | -0.429 | 0.241 | 3.7 | 0.01 |
| Proper interpretation facilities at tourist spots. | 3.43 | 1.34281 | -0.371 | 0.241 | 10 | 0.01 |
| Availability of convenience in the city and rural areas. | 3.32 | 1.36241 | -0.308 | 0.241 | 9.9 | 0.01 |
| Adequate tourist information facilities in the city. | 3.43 | 1.335 | -0.6 | 0.241 | 8.9 | 0.01 |
| Safety at tourist place. | 3.39 | 1.302 | -0.454 | 0.241 | 1.3 | 0.01 |

*strongly agree-1,....strongly disagree-5

It is evident from the table that a majority of the respondents are uncertain and distributed towards higher side regarding the easy accessibility of interior roads in Lumbini. Most of them are dissatisfied with these conditions. The mean value supports the above opinion. The variation in the opinion and skewness are observed 1.34750 and -0.429 respectively. The calculated χ^2 value shows significant at 1 percent level of significance. It is concluded that majority of the respondents do not have the same opinion over the issue of easy accessibility in the interior roads of Lumbini.

A majority of the respondents are disagreeing regarding proper interpretation facilities at tourist spots. The mean value is higher at five-point scale further standard deviation and skewness supports the opinion. Calculated χ^2 value is significant at 1 percent level of significance. This shows that opinion is not equally distributed. Thus, it is concluded that tourists are not satisfied with the interpretation facilities at tourist spots in Lumbini.

It is observed that foreign tourist is strongly unsatisfied with the availability of conveniences in Lumbini. Further their opinions distributed more towards higher side i.e. disagree to strongly disagree. The mean value, standard deviation and skewness support the opinion. The χ^2 calculated value is significant at 1 percent level of significance, which shows that their opinion is not equally distributed. Thus the above analysis leads to the conclusion that those tourists who are interested in rural tourism or others are facing lots of problem in availability of

conveniences therefore proper transportation facilities should be arranged.

It is notable that majority of the respondents do not agree with the availability of tourist information facilities in the city. The mean value of the responses depicts that majority are lying towards higher side of the mean standard score at five-point scale. The standard deviation and skewness is 1.33526 and -0.6 respectively. Further χ^2 value is significant at 1 percent level of significance. It shows that opinion of the respondents is not equally distributed. It is concluded that tourists are not satisfied with the tourist information given on the signboards or offices at Lumbini.

As far as safety at tourist area is concerned, a majority of the responses do not agree with the same and their opinion is further distributed more towards higher side i.e. disagree to uncertain. The noted mean value is higher than the average standard score, while variation in the opinion and skewness is 1.30186 and -0.454 respectively. This supports the above analysis. Further χ^2 test is significant at 1 percent level of significance. It reveals the opinion is not equally distributed. Thus the above analysis concluded that tourist is not satisfied with the safety at tourist spots of Lumbini.

Table 4: Tourists Satisfaction towards Tourism Products and Market of Lumbini (Local Facility)

| Particulars | Mean | S.D. | Skewness | S.E. of Skewness | Chi-square (χ^2) | p |
|--------------------------------|------|-------|----------|------------------|-------------------------|------|
| Special tourism area packages. | 3.4 | 1.333 | -0.485 | 0.241 | 7.8 | 0.01 |
| Availability of tourist guide. | 3.37 | 1.308 | -0.415 | 0.241 | 9.7 | 0.01 |
| Quality of food at restaurant. | 2.79 | 1.472 | 0.178 | 0.241 | 5.6 | 0.01 |
| Hygiene at the restaurants. | 2.66 | 1.379 | 0.354 | 0.241 | 4.8 | 0.01 |
| Tele-communication | 3.06 | 1.406 | -0.064 | 0.241 | 1.4 | 0.01 |

*strongly agree-1, strongly disagree-5

As far as special tourism area packages is concerned, a majority of the respondents either disagree or strongly disagree. The mean value is higher at scaling point, whereas standard deviation and skewness is 1.33333 and -0.485, which indicate that their opinion is distributed towards higher side on this issue. The calculated value of χ^2 shows the significant at 1 percent level of significance. The conclusion can be drawn that foreign tourist are satisfied with special tourism packages at Lumbini.

Respondents' satisfaction levels towards easy availability of tourist guide at destinations are distributed towards higher side of the average score i.e. disagree to strongly disagree. The mean value is higher than the average standard score. The standard deviation and skewness is 1.30775 and -0.415. the χ^2 value is significant at 1 percent level of significance. Further it indicates that their opinion is not equally distributed. It is concluded that tourist guides are not easily available at every locations of Lumbini.

The above table further shows that majority of the respondents either strongly agree or agree with the quality of food at restaurants. The mean value noted lower than the average standard score. The standard deviation and skewness is 1.47227

and 0.178. It shows that opinion is distributed more towards lower side of average score. The χ^2 calculated value is significant at 1 percent level of significance, which indicates opinion is not equally distributed. The above analysis concludes that tourist is satisfied with the quality of food in the restaurants.

The table reveals that a majority of the respondents are strongly satisfied with the hygiene at the restaurants. Their responses are lying towards the lower side of the average score. The mean value is lower at five-point scale. The standard deviation and skewness is 1.37965 and 0.354. The χ^2 calculated value is significant at 1 percent level of significance. It is concluded that most of the tourist are satisfied with the hygiene at the restaurants.

It is evident from the table that a majority of the respondents are uncertain and distributed towards higher side regarding telecommunication facilities in Lumbini. The mean value if the response is on the higher side than the average standard score at five-point scale. The standard deviation and skewness noted are 1.40576 and -0.064 respectively. The χ^2 value at 1 percent level of significance. Thus opinion is not equally distributed. Thus it is concluded that telecommunication facilities near tourist spots are not satisfactory.

Table 5: Satisfaction towards Tourism Products and Market of Lumbini (Security)

| Particulars | Mean | S.D. | Skewness | S.E.of Skewness | Chi-square (χ^2) | p |
|--|------|---------|----------|-----------------|-------------------------|------|
| Personal safety and security | 3.36 | 1.35229 | -0.259 | 0.241 | 8.9 | 0.01 |
| Discipline in the country and Lumbini. | 2.73 | 1.32463 | 0.38 | 0.241 | 11.3 | 0.01 |
| Safety of luggage. | 3.28 | 1.457 | -0.422 | 0.241 | 2.7 | 0.01 |
| Law and order of the country. | 3.14 | 1.349 | -0.084 | 0.241 | 5.4 | 0.01 |
| Safety of families and females. | 3.06 | 1.406 | -0.064 | 0.241 | 1.4 | 0.01 |

*strongly agree-1,....strongly disagree-5

Majority of the respondents are distributed towards the higher side of the average score over the issue of personal safety and security in Lumbini. The mean value is the higher side of the average scale i.e. 4 at 5 point scale. The variation in the opinion and skewness is 1.35229 and -0.259. Calculated χ^2 value is significant at 1 percent level of significance. Thus the conclusion is that tourist is not satisfied with the personal safety and security.

Respondents are agreed that discipline in Lumbini and nation are symbol of culture and heritage. The mean value is lower than the average score. The variation in the opinion is 1.32463 and skewness is 0.380. The χ^2 calculated value is significant at 1 percent level of significance. This shows that opinion is not equally distributed. Thus, it is concluded that tourist are satisfied with the discipline in the country and Lumbini.

It can be seen that a majority of the respondents are dissatisfied with the safety of luggage. The mean value, standard deviation

and skewness indicate that their opinion is distributed towards higher side than the average score. The calculated χ^2 value is significant at 1 percent level of significant. Therefore the conclusion drawn is majority of the tourists are not satisfied with the safety of luggage.

It is shown that respondents either agree or disagree and further distributed towards the lower side of the average standard score. The mean value supports the above opinion. The standard deviation and skewness is 1.34855 and -0.084. The χ^2 calculated value is significant at 1 percent level of significance. Opinion is not equally distributed. It is concluded that tourist are dissatisfied with law and order of the region and country.

It is evident from the table that a majority of the respondents are uncertain and distributed towards the higher side regarding the safety of families and female in Lumbini. The mean value of the responses is on the higher side than the average standard score at five-point scale. The standard deviation and skewness noted are 1.40576 and -0.064 respectively. The χ^2 value at 1 percent level of significance. Thus opinion is not equally distributed. It is concluded that majority of the respondents do not have the same opinion over the issue of safety of families and female.

8.1 Hypothesis Test:

The question asked from the respondent's i.e. foreign tourist related to the tourism products and markets of Lumbini reveal the result that calculated value of chi-square is less than the table value 13.3.

Thus the above analysis rejects the null hypothesis (Ho) that tourist are satisfied with the tourism products and market of Lumbini and accepts alternative hypothesis (H1).

Further it rejects the null hypothesis (Ho) that there is no gap between the tourists expected services and perceived services in Lumbini tourism and accepts alternative hypothesis (H1).

The analysis also leads to rejects null hypothesis (Ho) that tourism is developed in Lumbini area and accepts alternative hypothesis (H1).

8.2 SWOT Analysis:

Based on the opinion survey/interviews and conversation of the foreign tourists a SWOT analysis has been carried out to find out more about strengths, weaknesses, opportunities and threats to the Lumbini.

8.2.1 Strengths:

- As the birthplace of the Lord Buddha, testified by the inscription on the Asoka pillar, the sacred area in Lumbini is one of the most holy and significant places for one of the world's great religions.
- Lumbini, as of 1997, is an UNESCO World Heritage Site specifically nominated for the international World Heritage program.
- Lumbini-a place evokes a kind of holy sentiment to the millions of Buddhists all over the world-as do the Jerusalem to Christians and Mecca to Muslims. Lumbini is the place Lord Buddha -the apostle of peace and the light of Asia was born.
- Lumbini is blessed with immense beautiful temples and stupas. The Maya Devi temple is one of the major attractions of Lumbini.
- Lumbini holds almost similar position with Mecca. Millions of pilgrims and tourists visit Mecca; however, less than 100

thousands international tourists/pilgrims visit Lumbini every year.

- Lumbini is famous and very popular among the tourist who comes for holy places and experience fascinating culture and environment.
- Lumbini is a holy place, which is very rich and varied in terms of its tourist attractions.
- Lumbini has facilities for yoga and meditation fast becoming an added attraction for tourist.
- Many monuments, monasteries and a museum, and the Lumbini International Research Institute are also within the holy site. Also, there is the Puskarini, or Holy Pond, where the Buddha's mother took the ritual dip prior to his birth and where he had his first bath.

8.2.2 Weaknesses:

- There is less marketing in Nepal as well as abroad, this is cited as the major weakness prevailing in Lumbini tourism industry.
- Lumbini is not being projected as a land of all seasons.
- The quality of facilities and services at the areas are not up to the mark.
- Parking problem is seen at its worst during the peak tourist season.
- Condition of roads in the rural areas of Lumbini is bad.
- Limited availability of tourist information offices, and premises, poses a problem, create dissatisfaction among the tourists.
- Lack of trained, professional guides.
- In addition to the cement factory which was established despite the Industrial Promotion Board's 2009 decision not to allow any carbon emitting factories within a 15-km radius of the sacred site, there are 57 manufacturing plants producing bricks, cement, clinker, steel, noodles, paper and flour registered in the Lumbini Protected Zone.

8.2.3 Opportunities:

- The trend of building hotels with modern facilities has intensified in Lumbini following an increase in the influx of tourists.
- Tourism has provided an opportunity for the local citizens and craftsmen to make handicrafts materials. This has ensured a steady flow of income for them as well as a mean of preserving our heritage.
- Lumbini, which attracts international pilgrims as the birthplace of the Buddha, has observed the construction of large-scale infrastructure from an international airport, industrial corridor, trade highways to a bevy of luxury hotels.
- The campaign i.e. Visit Lumbini 2019/2020 has been aimed at attracting domestic visitors this year with Province 5 government starting promotional campaign drive in all seven provinces.
- Special events like handicrafts fair, exhibition and sports events can be organized in Lumbini.
- The new breed of tourists likes alternate form of accommodation like staying as a paying guest with the local people. On the one hand it provides them with an opportunity to have firsthand experience of the native culture and customs and on the other hand it does not

pressurize the natural and the government resources. This also ensures community approach towards tourism.

- It is a holy site for more than 535 million Buddhists and a centre of spiritual belief for many. If we could attract just one percent of this population to Nepal, it will generate a massive amount of direct and indirect employment in the country.
- The demand for Nepali sculptures is also quiet high in the international market. Promoting Buddhist thangkhas and sculptures is clearly beneficial for the country, but for that the younger generation of Nepal should be encouraged to take up the traditional occupations.
- Nepal needs to initiate the process of uplifting the international status of Lumbini and to explore many Buddha-related religious places like Tilaurakot, Debdaha, Ramgram and others.
- The government should therefore accord due importance to developing Buddhist culture and heritage, and allocate necessary funds for this purpose. Strong political commitment and consensus are necessary for this.

8.2.4 Threats:

- Lumbini, the birthplace of Lord Buddha, a pilgrimage site for all the people of the world, the fountain of peace and a Unesco World Heritage Site, is facing a serious environmental threat due to the proliferation of factories all around it.
- A study conducted by the World Health Organisation (WHO) showed that the air at the Lumbini World Heritage Site contained particulate matter amounting to 270 micrograms per cubic metre ($\mu\text{g}/\text{m}^3$) which is 11 times higher than WHO's permissible limit.
- Even though numerous such legislative and institutional frameworks and policies, plans, decisions and standards are in place, environmental pollution in Lumbini is continuing and increasing, putting public health, flora, fauna, the environment and culturally important temples, stupas and monasteries including the Mayadevi Temple and the 2,000-year-old Ashoka Pillar under severe threat of degradation.
- Despite the richness of Buddhist heritage, Lumbini is located in one of the country's poorest regions.
- Adverse socio-cultural and environmental impacts.
- Growing population and construction of international airport is posing a threat to the area. To accommodate this growing population more and more trees are being cut. The main tourist areas are turning into concrete jungle.
- Adverse publicity in the media regarding scarcity of water and lack of parking space also pose a threat.

9. Conclusion and Recommendations:

In more than 70 years of tourism development, we are still struggling to bring one million tourists despite the fact that we have numerous unparalleled tourism products and destinations. Why have we failed? What has paralyzed our tourism sector? What are the impediments to development of tourism? Compare this with our tourism products and activities. Except for some adventurous activities like trekking and sightseeing, our tourism products largely fail to captivate the imagination of tourists. This is the main drawback of Nepali tourism sector. We are largely confined to nature-based tourism and have put other potential sectors – culture, heritages and leisure activities

– on the back burner. We have failed to develop new destinations and products in the last many years. Most of the organizations responsible for tourism development have been focusing mainly on mountain trekking and sightseeing. Accessibility, accommodation and attraction are the basic components of tourism development. A single international airport, poor state of air network, bad roads and weak road networks are some serious impediments to tourism development. Tourists often face a hard time finding accommodation facilities when they are not in major cities. Trekking routes lack resting places. Good accommodation facility, tea houses (shops) and lookout points can certainly add value to trekking.

Whatever we are doing is a routine affair or to be more precise it is an eye-wash. It would be therefore be our endeavor to develop and implement thoroughly professional market strategies to get better mileage and value for money expended. This would be based on the market analysis and consumer preference. There are many tourism products like fairs and festivals, handicrafts, proper transportation, accommodation that boost tourism of an area, but these are taking a back seat in Lumbini as of now. It should be made an important and integral part of tourism. Foreign tourist visit Lumbini to get a glimpse of the ancient art and cultures of Lumbini. They travel by different modes of transport to reach Lumbini. Some of them stay at Lumbini just for few hours while some stay for few days. The places, the temples, the museum, and the tranquil environment and hygiene appreciated by all foreign tourists. Although they feel quite satisfied with their Lumbini visit but still a gap exist between their expected and perceived services. The reasons for this gap have been identified as poor conditions of ordinary buses and share taxies plying between tourist places, awful maintenance of city road, traffic congestion, unhygienic condition of restaurant, and non-availability of quality souvenir. Based on this identification recommendation have been offered for eliminating the gap. This may result into a tourists' delight and an increase in tourist arrivals in Lumbini. Based on this study the following has been recommended for increasing the satisfaction of foreign tourists visiting Lumbini.

- For overcoming the problem of related to non-availability of good quality souvenirs at Lumbini it is recommended that the LDT may motivate existing souvenir traders by offering them financial and merchandising assistance or may construct outlets at strategic locations in the city and offer them on lease to traders interested in setting up business.
- The dissatisfaction of backpackers with the transport available in Lumbini and back is a matter of grave importance. To eliminate this dissatisfaction it is recommended that provision of comfortable three-wheeler share taxies may be done to transport tourists directly from airport or border to Lumbini and back. In order to distinguish these taxies from the ordinary taxies they may be painted in some different colors. The number of passengers in these taxies may be strictly restricted to six and the budget hoteliers of Lumbini are motivated to operate these taxies on a cooperative basis.
- The non-availability of quality food at budget hotels at Lumbini is a cause of inconvenience to backpacker tourists.

In a view of this situation it is recommended that during off season, training programs may be organized at Lumbini by Lumbini Development Trust to develop culinary skills of budget hoteliers and their employees.

- A tourist place which is not neat and clean creates a bad impression and causes inconvenience to tourists. In order to overcome this problem at Lumbini it is recommended that construction of cemented drains may be done all over the city as well as in rural areas by the administration.
- It is also recommended that medium sized garbage bins must be placed in the main market area and local residents and shopkeepers be motivated to use them. In addition to this special drives may be carried out by the local administration every week to keep the riverside clean.
- Keeping in view the poor condition and congestion on roads it is recommended that cemented roads may be laid in Lumbini and its area and traffic policemen is deputed for controlling traffic on the roads in tourist area.
- A special incentives package will be made available for encouraging new tourism projects as well as expansion of existing tourism units.

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The Lost String: Unusual Location & Management

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Abstract- Intrauterine contraceptive devices (IUCDs) are the major contraceptive measures in the developing countries like India where population is ever increasing and people are non-compliant. Perforation of the uterus is not an unusual complication of an IUCD with its incidence being 1 to 3 in 1000. It is important to minimize complications, detecting them early by educating people, training the staff to insert cu-T by arranging workshops. However, here we had a unique case in TNMC & BYL Nair Hospital, Mumbai, where A 25year female P2 L 2 MTP2 with an IUCD which not only perforated the uterus but also migrated to the anterior abdominal wall engulfed by the omentum and floating in a pocket of pus. IUCD was removed laparoscopically with tubal ligation.

Index Terms- IUCD, Intrauterine contraceptive devices, contraceptive measures

I. INTRODUCTION

Since ages there have been debates conducted on the pros and cons of usage of contraception and their types. Intrauterine contraceptive devices (IUCDs) are the major type of contraceptive measures used in the developing countries like India where people are resistant to use any mode of contraception due to lesser literacy rate and sensitization of people towards its importance.

Most widely used IUCD's are copper releasing devices. Since Cu-T 380A is the commonest IUCD used in India as it has been supplied by the Government free of cost. They are one of the most effective, safe, reliable, and cheapest contraception methods with failure rate < 1 per 1000 women year^{1,2}. IUCDs have minimal side effects like bleeding, pain. But there have been incidences

reported where it has caused grave complications like infection, perforation, transmigration, and accidental pregnancies.³

Misplaced IUCD is termed as the condition when IUCD thread is not visualized through the cervical OS.⁴ Malpositioned IUCD is a condition where, although the IUCD is present within the uterine cavity but its placement is eccentric and part or the whole of it may be embedded in the myometrium.⁵

Transmigration of IUCDs is a very rare but a dangerous complication. Perforation of the uterus is not an unusual complication of an IUCD with an incidence of 1 to 3:1000⁶. However here we have a unique case where an IUCD not only perforated the uterus but appeared to have penetrated the bladder too and migrated to anterior abdominal wall which was finally removed by laparoscopy.

II. CASE REPORT

A 25 years old female P2L2 MTP2 referred from Shatabdi hospital Mumbai with complaints of pain in lower abdomen since 15 days. The pain was localized to hypogastric region, dull aching type, not radiating to any other site with no diurnal variation not associated with any urinary complaints or any vaginal discharge. Her menstrual cycles were regular and normal. She had two full term normal deliveries and conceived for the third time for which she went through MTP and had cu-T inserted in June 2016 in Bihar. Unfortunately, she conceived again with cu-T in situ in December 2016 and the local doctors opted for Dilation and evacuation. The procedure was done at 8 weeks of amenorrhea. During this cuT was not found in uterine cavity. X ray KUB was done to find the lost cu-T which was suggesting of Cu-T being dislodged extra uterine.

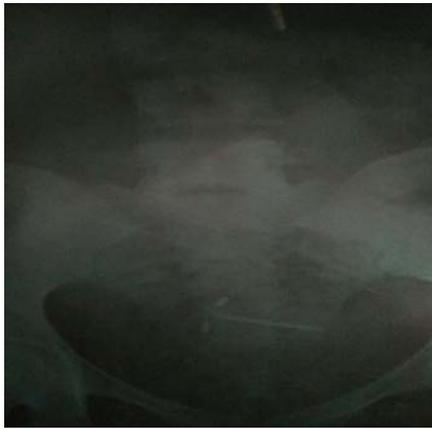


Figure 1

1.X-ray KUB showing extrauterine cu-T

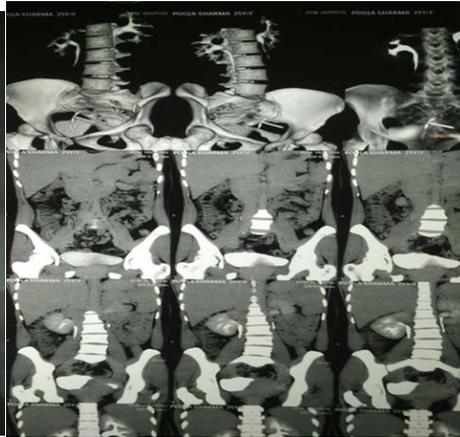


Figure 2

2.CT-IVP showing IUCD outside uterus

Patient was referred to our center with USG showing a cystic anechoic out-pouching of urinary bladder containing cu-T . Her Per abdominal examination was not significant. On, bimanual examination a mass of 2x2 cm was palpable anteriorly. Hence we decided to do CT IVP to confirm the location which was suggestive of IUCD displaced outside uterus above urinary bladder (figure 2). There was no significant defect in uterus. Location was not clear from the imaging hence further to approach cystoscopically or laproscopically was a dilemma. Laparoscopic

approach was decided through which the strings were found hanging below anterior abdominal wall, which was thought to be located in the urinary bladder (figure 3). Adhesiolysis was done and found that there was a pus pocket of 4x4 cm where IUCD was engulfed in that by omentum. The offending IUCD was removed and Tubal Ligation was done. The post-operative status was uneventful.

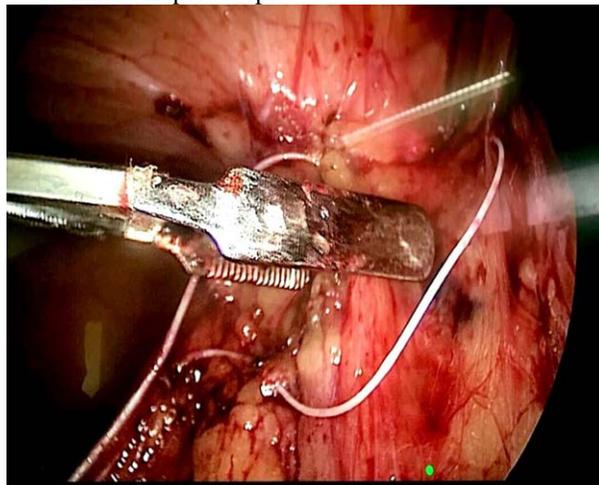


Figure 3

3. IUCD thread hanging engulfed by omentum adhered to anterior abdominal wall

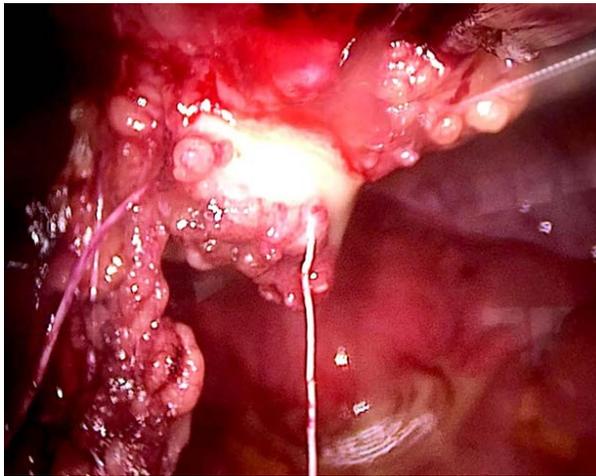


Figure 4
4. Iucd inside pus pocket

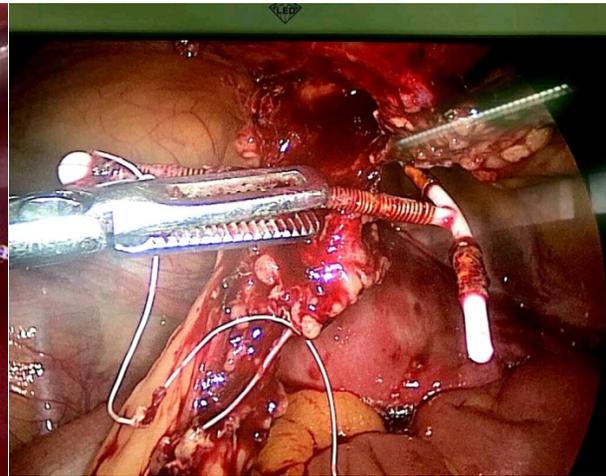


Figure 5
5.Laprosopic Iucd removal

III. DISCUSSION

There are 3 generations of IUCD. Cu-T which is 2nd generation is most commonly used. Out of which cu-T 380A is most commonly used as it is supplied free of cost by government of India. It can be inserted post-placental, post abortal, post menstrual within 5 days in parous women. It is effective for 10 years once inserted, so if reinserted after the 1st it almost covers the reproductive period of a women, as good as permanent contraception i.e. sterilization. Contraindications for IUCD insertion are pregnancy, pelvic inflammatory disease, genital Koch's, genital malignancy, mullerian anomaly, postpartum hemorrhage in case of PPIUCD. It may cause complications like menorrhagia, irregular bleeding, pelvic inflammatory diseases, ectopic pregnancy and silent uterine perforation.^{7,8}

Most perforation occurs at the time of insertion⁸ while migration occurs after that. Parity, timing of IUCD insertion, uterine position, abortions, type of IUCD and the operator experience and skill, these factors are responsible for transmigration.⁷ Chronic inflammatory process initiated by copper content of the IUCDs which leads to the erosion of the uterine wall causing its migration.⁹ Uterine contractions and the pressure difference between the uterine (high) and the peritoneal cavity (low)⁸ further facilitates it while the migration in the peritoneal cavity is facilitated by the contractions of the abdominal organs as well as movement of the peritoneal fluid.^{1,8}

Most perforation go undetected as it may lead to transient pain and bleeding at the time of insertion. Perforation is suspected if thread is missing and unexplained abdominal or pelvic pain. Diagnosis in can be done with USG and CT.

If USG is not available or non-affording patient, plain X-ray of the abdomen is done to see its presence in the pelvis or abdomen (when IUCD is not loclised on USG). Uterine sound is used to measure the distance of the IUCD from the uterus during an X-ray. IUCD located in abdominal cavity should be removed urgently even in asymptomatic patients¹⁰ because of risk of dangerous complications like bowel perforation, rectovaginal fistula, rectal strictures, bladder perforation, bowel obstruction, appendiceal perforation and mesenteric perforation, peritonitis.¹¹ Laparoscopy is a preferred modality for the removal of all types

of misplaced or malpositioned IUCDs,¹² if it fails then laparotomy is required. Hysteroscopy can be used to remove cu-T in uterine cavity or embedded in the myometrium.

IV. CONCLUSION

Effective contraception is need of time in India where the population is ever increasing with limited resources. People should be motivated to use cafeteria approach of contraception. It is important to minimize complications, detecting them early by educating people, training the staff to insert cu-T by arranging workshops. Increasing participation by incentives thereby improving quality of life by spacing children and eventually reduce maternal mortality.

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The Effect of Problem Based Learning Model on Understanding Concepts and Problem Solving Skill in Social Sciences in Grade IV Students of SDN 1 Mulung Driyorejo Gresik

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Abstract- This study aims to determine whether the use of the problem based learning model can influence the understanding of concepts and problem solving skills in social studies learning in the fourth grade of SDN 1 Mulung. This study uses a quantitative method with quasi-experimental design type nonequivalent sampled group design. The dependent variable in this study is the understanding of concepts and problem solving skills and the different variables are problem based learning models. The sample chosen in this study uses namely IV-A class students totaling 20 students and IV-B class students totaling 20 students, using the sample random sampling technique. Data collection techniques using tests (pre test and post test). The research instrument used was a test sheet for understanding concepts and problem solving skills. Instrument analysis technique uses validity test and reliability test. While the data analysis technique uses the normality test, homogeneity test, hypothesis test, and normalized n-gain test. Based on the calculation of the T test, Sig. (2-tailed) that is equal to 0,000 < 0,05, then H_a is accepted or there are significant differences between the difference between the results of the post test and pre test of the control class with the difference between the results of the post test and the pre test of the experimental class. This can be interpreted that the problem based learning model has a significant effect on the understanding of concepts and problem solving skills in social studies learning in the fourth grade of SDN 1 Mulung on natural resource material. To provide effective, interesting, and fun learning for students, teachers should use an interesting learning model.

Index Terms- Problem Based Learning, Underdntanding Concepts, Problem Solving Skill

I. INTRODUCTION

Social Sciences (IPS) as one of the subjects obtained by elementary school students (SD) that must be taught to elementary students has many concepts that are still abstract in nature such as the concepts of space, change, continuity, ritual, acculturation, value and role. Seeing how many abstract concepts exist in social studies learning, it is undeniable that social studies subjects are still lessons that sometimes cause problems in learning, namely students' low understanding. Judging from the IPS material which contains facts, concepts, and generalizations, it does require a large portion in the aspect of understanding. Moreover, IPS is oriented towards the establishment of a democratic and responsible society. By understanding concepts, students can take advantage of the knowledge gained in everyday life.

But in reality, there is a significant gap between what is expected and the reality that appears in the class. Students are asked to understand all IPS subject material well by just reading all the reading texts in the handbook. While the teacher just holds on to the handbook and sits quietly without doing anything to help students in learning in class, where learning activities should be needed that are more than just reading to support students' knowledge and understanding. In line with what was stated by Dwason in Mulyono (2017: 2) that a teacher cannot expect his students to be able to understand concepts, how to evaluate and use learning resources just by reading.

The material consists of many concepts and students are only asked to memorize it to understand it, so students who are good at memorizing their learning outcomes will be good and other students learning outcomes will be less or below the Minimum Completion Criteria (KKM). According to Andriansen (2012: 2) a teacher needs to break down the social studies learning process into

the purpose of its preparation, analyze the problems and misunderstandings of students in relation to learning objectives and create activities designed to overcome problems in learning.

This is directly proportional to what Rini said (2017: 1741) that so much IPS material will make students easily bored in the learning process, and when understanding the material students are only asked to memorize it, so students who have difficulty memorizing results learning will be lacking or brought by the KKM. Regarding students, concepts such as curiosity, need, motivation, skepticism and investigation, research, and investigation need to be regulated during learning. Studies conducted on permanent education and flexible learning with these elements show that passive acceptance of students must change and students must have their own learning responsibilities. The purpose of education must be to increase the creative, exploratory and natural instincts of students and to make students really eager to learn (Timmins and Bryant in Semerci, 2005: 415).

In fact, effective problem solving is not only important for the survival of the community, but also important for the future of community prosperity (Mukhodhapayah, 2013: 21). Students are future citizens and the potential they have can significantly affect the nation's progress. Problem solving skills enable them to deal with various challenges that arise effectively. Therefore, developing student problem solving skills is one of the current needs. In line with Rini's opinion (2017: 1741) that problem solving skills is one of the basic abilities that must be possessed by every student, because students are part of the community who will certainly experience social problems so that when experiencing problems, of course problem solving skills are needed.

Problem solving is an activity carried out by each individual in identifying problems or problem situations, then giving a temporary answer or hypothesis after that from the hypothesis data collection or data collection will be carried out until it reaches the final stage of drawing generalizations. The problem solving approach in the learning process can provide a solid foothold for students to think effectively. Ahmad (2014: 2) revealed that one of the final objectives of the social studies learning process in elementary schools is that students have basic skills in solving problems. Educating students to have problem solving skills needs to be done from an early age, so that later when they are adults and in their environment, students do not feel confused to deal with the problem. If students do not have the ability to solve problems, then it is possible that students will solve the problem in the wrong way.

Consequently, schools must be able to go beyond verbalism in transferring knowledge, should provide experience in relation to how they apply outside of school. According to Purwadi (2014: 343) the use of the PBL model can help students in communicating that is conveying something they know through dialogue or mutual relations events that occur in the classroom environment, namely the transfer of messages in the form of concepts, or problem solving strategies. Also emphasized by Isrokijah (2015: 100) explains that PBL is considered as an instruction approach that will inspire students to develop thinking skills in problem solving and one type of student-centered model. PBL is an active learning model that supports flexibility and creativity in learning changing knowledge and considering individual differences. This is a learning method that makes students face to face with problems that they can encounter in the real world, which makes them aware of their own interests based on problem solving skills, and this focuses on student activities that depend on mastery and adequacy.

Students who are in the PBL learning environment have well-trained problem solving skills. As Giatry said (2014: 25), students who learn to use PBL demonstrate better clinical problem solving skills. Problems are considered to be one of the three key elements of PBL, problems must stimulate thinking or reasoning and lead to independent learning in students (Sokalingam & Schimdt, 2011: 6). In addition, students can use all the abilities they have in problem solving efforts. According to Savery (2006: 12), in a learning environment PBL students work in collaborative groups to identify what they need to learn in order to solve problems.

Learning using the PBL model will prioritize students more actively, students' understanding of the concepts learned is clearer and have good problem solving skills, this is because understanding concepts and solving problems using PBL models is done through group discussions. An issue related to the subject in the lesson is given to students to be completed in groups. The problem chosen should have a conflict issue or controversial nature, the problem is important, urgent and can be solved (solvable) by students. The researcher hopes that through this Problem Based Learning learning model each student can receive the information provided. Learning becomes easier and more enjoyable for children. All information that is processed in the brain through such a system makes it easy to learn, understand, and re-analyze precisely and efficiently. Based on the explanation above, the title of this research is "The Effect of Problem Based Learning Model on Understanding Concepts and Skills in Solving Problems in Learning Social Sciences in Grade IV Students of SDN 1 Mulung Driyorejo Gresik".

II. METHODOLOGY

The type of research carried out is experimental research with the design used is Quasi Experimental or quasi-experimental. The research design used in this study is Non Equivalent Control Group Design, namely the experimental group and the control group cannot be selected randomly or randomly (Sugiyono, 2008: 116).

Tabel 1: Research Design

| Kelas | Pre test | Perlakuan | Pos test |
|--------------|-----------------|------------------|-----------------|
| X1 | O1 | R1 | O3 |
| X2 | O2 | R2 | O4 |

Information :

X1: Experimental Class

- X2: Control Class
- R1: Treatment is a problem based learning model
- R2: The treatment is a conventional model
- O1: Pre test experimental class
- O2: Pre test control class
- O3: Post test experimental class
- O4: Control class post test

This research was conducted in the fourth grade of SDN 1 Mulung, East Java, Indonesia with a population of all fourth grade students of SDN 1 Mulung in grades IVA, IVB, and IVC which totaled 75 students. The researcher chose the sample random sampling technique, in the sampling the researcher mixed the subjects in the population so that all subjects were considered the same. Data collection techniques using tests. Tests are used to measure concept understanding and problem solving skills in this study. The test is done twice, namely before the material is given (pre test) and after learning (post test).

Data analysis techniques in this study through several stages, namely analysis of items and analysis of test results. Butri analysis of the question through validity test using product moment correlation test analysis, then test reliability with spearman brown. For analysis of test results there are several tests, namely normality test, homogeneity test, and T-test test with the help of SPSS 22 application which has a provision that the significance value must be greater than 0.05 (Sig > 0.05) so that the research data will be normal, and homogeneous. The normality test is used to determine whether the sample in the study is normally distributed both in the pre test and post test population values. Homogeneity test is used to determine the group variation between the experimental class and the control class is a homogeneous sample.

Then for the t-test, the statistical technique used to test the significance of the difference in 2 mean fruits derived from two distributions, in this t-test the significance value must be less than 0.05 so that there is an influence in the study or H_a is accepted. And the last test is to calculate the normalized N-Gain value to find out how much influence the use of the concept of time and the chronology of students.

III. RESULT AND DISCUSS

Table 2: Average Results Pre test and Post test

| Class | Understanding Concepts | | Problem Solving Skills. | |
|-------------------|------------------------|-----------|-------------------------|-----------|
| | Pre-test | Post-test | Pre-test | Post-test |
| Control | 55,05 | 61,95 | 54,75 | 59,5 |
| Experiment | 55,4 | 85,25 | 53,5 | 85,75 |

Based on the average results obtained from the two classes in table 2 shows that the average test results at the end of the experimental class are higher than the results of the average test at the end of the control class. After obtaining the average results of the two groups, the next step is to analyze the test results as follows:

1. T test Experimental Class Post-Test and Control Class Post-Test

Independent-Sample analysis t-test of the experimental class post-test and control class post-test was conducted to determine whether there were significant differences in the post-test scores in the two classes. The following are the results of t test analysis:

Table 3: Test results of Post-test Understanding of Concepts of Experimental Classes and Control Classes

| Independent Samples Test | | | | HASIL PENILAIAN | |
|---|-----------------------|--|--|-------------------------|-----------------------------|
| | | | | Equal variances assumed | Equal variances not assumed |
| Levene's Test for Equality of Variances | F | | | 1.855 | |
| | Sig. | | | .181 | |
| t-test for Equality of Means | t | | | 7.329 | 7.329 |
| | df | | | 38 | 34.573 |
| | Sig. (2-tailed) | | | .000 | .000 |
| | Mean Difference | | | 23.300 | 23.300 |
| | Std. Error Difference | | | 3.179 | 3.179 |
| 95% Confidence Interval of the Difference | Lower | | | 16.864 | 16.843 |
| | Upper | | | 29.736 | 29.757 |

The conceptual understanding posttest t test revealed that the average results of the experimental class were 85.25 and the mean of the control class was 61.95, so it was concluded that the average experimental class was greater than the control class. From table 3 the significance value (0,000 < 0,05), means that there are differences in the scores of the results of students' conceptual understanding significantly in both classes.

Table 4: Test Results t Post-test Skills for Solving Experiment Class Problems and Control Classes

| | | HASIL PENILAIAN | | |
|---|---|-------------------------|-----------------------------|--------|
| | | Equal variances assumed | Equal variances not assumed | |
| Levene's Test for Equality of Variances | F | 1.431 | | |
| | Sig. | .239 | | |
| t-test for Equality of Means | t | 10.536 | 10.536 | |
| | df | 38 | 34.668 | |
| | Sig. (2-tailed) | .000 | .000 | |
| | Mean Difference | 26.250 | 26.250 | |
| | Std. Error Difference | 2.491 | 2.491 | |
| | 95% Confidence Interval of the Difference | Lower | 21.206 | 21.190 |
| | | Upper | 31.294 | 31.310 |

The post-test t-test for problem solving skills revealed that the average results of the experimental class were 85.75 and the mean results of the control class were 59.5, so it was concluded that the average results of solving the experimental class were greater than the control class. From table 4, the significance of the significance value ($0,000 < 0,05$) means that there are differences in the score of the results of solving the problems of students in both classes.

2. N-Gain Test Normalized

The n-gain calculation is done to see the effect of the problem based learning model on improving concept understanding and problem solving skills. The following table shows the results of N-Gain calculations:

Table 5: N-Gain Test Results Normalized Concept Understanding

| Class | N-Gain Skor | Category |
|------------|-------------|----------|
| Control | 0,1 | Low |
| Experiment | 0,7 | Middle |

From table 5 it is known that the N-Gain score in the control group is 0.1 low category, and the experimental group score is 0.7 in the moderate category, based on the results obtained above, it can be concluded that the mastery of concepts in the experimental class is higher than the control class .

Table 6: N-Gain Test Results Normalized Problem Solving Skill

| Class | N-Gain Skor | Category |
|------------|-------------|----------|
| Control | 0,1 | Low |
| Experiment | 0,8 | High |

From table 6 it is known that the N-Gain score in the control group is 0.1 low category, and the experimental group score is 0.8 in the moderate category, based on the results obtained above, it can be concluded that the mastery of concepts in the experimental class is higher than the control class .

1. The Effect of Problem Based Learning Model on Understanding Student Concepts

Based on the description that has been explained in the results of the study, the researcher conducted a discussion of the research on the findings from the analysis of test data mastery concepts and problem solving skills. The research was carried out through the learning process in the experimental class and the control class that had been designed in such a way as to use learning tools and research instruments.

In this discussion, we will discuss the effect of using the problem based learning model on understanding the concepts in social studies learning in the fourth grade of SDN 1 Mulung. The data obtained from the results of the study are quantitative data from the results of the pre-test and post-test to determine the students' ability to understand concepts. The learning process carried out both in the experimental class and in the control class was conducted during 2 meetings. Geographical material used in this study is material about natural resources and their use in daily life. Thus, in this study students are expected to be able to understand the concept well.

Concepts are the main points of a series of relationships and ideas and all the other things that are associated with it. In other words, before we reveal the material further, we must master or understand the concepts that exist in the material (Tanoe, 2004: 50). Understanding the concept can be done in two ways, namely arranging information in one main theme along with the main points and developing a chart of concepts that describe the central theme along with related concepts, interrelated relations. In this case, understanding concepts can be obtained through the application of learning using problem based learning learning models in the experimental class.

So that in this study learning a concept will be developed by knowledge that has to do with facts from various data which includes events, landscapes, objects or known symptoms. Students will be able to conceptualize and develop their own concepts not only understand the name of a concept. The concept will help students organize data into patterns that can provide meaningful mastery of

the data. In this study, the researcher provides an interrelated category where the evidence will be collected from the data or from the experience of the students themselves.

Research conducted during 2 meetings or learning in both classes was conducted so that there are no factors that disrupt the process of research in both groups so that it can produce a maximum result. When the teacher carries out learning activities about concepts, students can associate a number of examples and not examples of known geographic concepts so that students fully and comprehensively understand the concepts learned. The benefits obtained by students in learning the concept that students are able to classify both in the form of characteristics and differences in a group, explain something that is considered complicated or need detailed information and is able to conceptualize things carefully through symbol-sombol (Suparda, 2013: 54).

This statement can be proven through this research. For example, in learning the concept of natural resources can be updated. Students will classify objects that are included and not included in the concept. Students understand the meaning, mention examples and not examples, classify them and in learning the teacher also shows some images of an object to support concept learning. Therefore, through this study students can easily understand the concepts obtained through effective, fun, and meaningful learning activities so that IPS material that is considered boring can be studied with fun.

In this study the problem based learning model is considered a good model and is able to simplify the concept of geographic material that is natural resource material which is one of abstract material, so the problem based learning model is used to simplify and concretize the material so that mastery of student concepts increases. The use of a problem based learning model that is fun and in accordance with basic competencies and learning indicators is one of the reasons researchers use the model.

In this study students find out what happened, manipulate objects, symbols, ask questions and try to find their own answers, match what they find at other times, and compare their findings with the findings of other students, while the teacher only directs and guides students in learning and formulating their knowledge. The teacher provides motivation so that the learning process runs effectively, so that learning objectives can be achieved.

This is in line with several previous studies that are relevant to this study. The study was conducted by Syahroni Ejin in 2016 on fourth grade students of the elementary school entitled "The Influence of Problem Based Learning (PBL) Model on Understanding Concepts and Critical Thinking Skills of Class IV Students of Guava Downstream Baluti 2 in Natural Sciences". This study shows that the use of the problem based learning model influences and enhances the ability of students to understand concepts and critical thinking skills compared to those using the direct learning model.

In the research that has been carried out there are also some limitations including: (1) the limitation of the research location is that the research is only limited to one place, namely SDN 1 Mulung Driyorejo Gresik whose population is limited to 40 students so if samples are taken there may be different results if implemented in schools with a greater population of class IV, (2) limited material, namely learning material in this study focused only on natural resource material, it allows different results of research to occur if research is carried out on other learning materials, and (3) limitations ability, that is, the researcher realizes that researchers have limited abilities, especially in the scientific field, but researchers will try their best to understand with guidance from experts.

This shows that not all variables can be strictly controlled. Therefore, if this research is conducted with different variables it will be able to allow different research results. Although many limitations were found in this study, the authors are grateful that this research can be resolved smoothly. Various kinds of limitations above can be overcome during the implementation of research so that research continues in accordance with predetermined planning and from all the explanations described above, it can be interpreted that social studies learning using the problem based learning model has a significant influence on understanding concepts and problem solving skills.

2. The Effect of Problem Based Learning Model on Problem Solving Skill

Based on the description that has been explained in the results of the study, the researcher conducted a discussion of the research on the findings from the results of the data analysis test for problem solving skills. The research was carried out through the learning process in the experimental class and the control class that had been designed in such a way as to use learning tools and research instruments. In this discussion, we will discuss the effect of using the problem based learning model on problem solving skills in social studies learning in the fourth grade of SDN 1 Mulung.

The learning process carried out both in the experimental class and in the control class was conducted during 2 meetings. Geographical material used in this study is material about natural resources and their use in daily life. Thus, in this study students are expected to improve their skills in solving problems.

Students as citizens of the future and the potential they have will significantly affect the nation's progress. Problem solving skills enable them to deal with various challenges that arise effectively. Confirmed by Rini (2017: 1741) that problem solving skills is one of the basic abilities that must be possessed by every student, because students are part of the community who will certainly experience social problems so that when experiencing problems of course problem solving skills are needed.

Besides that, after this research was carried out it was proven that a theory related to the results of the study was in harmony with research. The related theory put forward by John Dewey who describes the view of education with schools as a mirror of a larger society and class will be a laboratory for investigating and overcoming real life problems. Dewey Pedagogy encourages teachers to engage students in problem-oriented projects and help them investigate important social and intellectual problems. Learning in school should be purposeful and not abstract. Purposeful and problem centered vision learning supported by students' innate desire to explore situations that are personal.

Gijselaers (in Isrokijah, 2015: 100) explains that PBL is based on the view of learning as a process in which students actively build knowledge. This can help students well, because each student can work at different speeds according to their abilities. PBL can help students in communicating that is conveying something that they know through dialogue or mutual relations that occur in the classroom environment, namely the transfer of messages in the form of concepts, or strategies for solving a problem. According to Savery (2006: 9), PBL is student-centered, empowers students to conduct research, integrates theory and practice, and applies knowledge and skills to develop appropriate solutions for defining problems, PBL is an instructional approach.

This is in line with several previous studies that are relevant to this study. This research was conducted by Kustiyo Rini in 2017 in grade IV elementary school students entitled "The Effect of Using the Problem Based Learning Model on problem-solving ability of fourth grade students of Krembung Keret SDN". This study shows that the application of the problem based learning model is able to improve problem-solving skills so that social studies learning outcomes are better than those using direct learning models.

In addition, the same research conducted by Khuroidah Asna in 2013 on students of class XI IPS MAN 3 Tulungagung about "Increasing the Ability to Solve Problems and Geography Learning Outcomes through Problem Based Learning Learning Models" has been proven that the use of problem based learning models can improve problem solving skills and social studies learning outcomes of students of class XI IPS. Some of these studies are relevant to this study.

In the research that has been carried out there are also some limitations including: (1) the limitation of the research location is that the research is only limited to one place, namely SDN 1 Mulung Driyorejo Gresik whose population is limited to 40 students so if samples are taken there may be different results if implemented in schools with a greater population of class IV, (2) limited material, namely learning material in this study focused only on natural resource material, it allows different results of research to occur if research is carried out on other learning materials, and (3) limitations ability, that is, the researcher realizes that researchers have limited abilities, especially in the scientific field, but researchers will try their best to understand with guidance from experts.

This shows that not all variables can be strictly controlled. Therefore, if this research is conducted with different variables it will be able to allow different research results. Although many limitations were found in this study, the authors are grateful that this research can be resolved smoothly. Various kinds of limitations above can be overcome during the implementation of research so that research continues to run according to predetermined planning and from all the explanations described above, it can be interpreted that social studies learning using the problem based learning model has a significant influence on problem solving skills.

IV. CONCLUSION

Based on our review and study result, there are some influences that found. The n-gain obtained by the two classes, namely the understanding of the experimental class concept get a gain value of 0.7 with a moderate category and the control class gets an n-gain value of 0.1 with a low category. Thus it can be concluded that there is a large and significant influence on social studies learning by using the use of problem based learning models to understand the concept in grade fourth on Mulung Elementary School.

While the n-gain value for problem solving in the experimental class is 0.8 with a high category and the control class gets a n-gain value of 0.1 with a low category. Thus it can be concluded that there is a large and significant influence on social studies learning by using the use of a problem based learning model for problem solving skills in grade IV fourth on Mulung Elementary School.

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The Effect Of Project Based Learning Model On Activities And Results Of Social Learning In Class IV Students Of SDN Domas Menganti Gresik

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Abstract- Through the Project Based Learning learning model, it is very helpful for students in receiving material or concepts in learning social studies subjects. Especially for elementary students. Students no longer carry out learning activities as limited as sitting, listening, noting, memorizing and seeming boring. Students will learn more actively and build their own knowledge so that learning is more meaningful. So it is very appropriate and can be the right choice in the elementary school class. Timothy agreed in his literary journal (2014: 46), revealing that project-based learning is feasible to be applied in elementary schools.

Therefore, with several descriptions of existing problems, and the existence of several advantages and characteristics of the research, also several studies conducted by previous researchers succeeded, the researchers will conduct research with the title "The Effect of Project Based Learning Model on Student Social Studies Learning Activities and Results Class IV of SDN Domas Menganti Gresik ". The formulation of the problem that can be taken is how the influence of the Project Based Learning model on social studies learning outcomes of fourth grade students of SDN Domas Menganti Gresik. The purpose of this study is to describe the effect of the Project Based Learning model on social studies learning outcomes of fourth grade students of SDN Domas Menganti Gresik.

Index Terms- Project Based Learning, Activites, Study Result

I. INTRODUCTION

Entering the 21st century, there are still some students who are still not actively developing their potential widely in the learning process. This is motivated by the ongoing learning process. Learning is still a lot of teacher center and textual (textbook), meaning that the main source of student learning is teachers and books (Ika et al., 2016: 3). Ika asserted (2016: 3), through such learning the involvement of students becomes less active and learning becomes less alive because the teacher only transfers what is in the book into the brain of students during learning. Students are not given the opportunity to develop their own knowledge. So that it is less able to provide learning experiences for students. Learning activities are only limited to sitting, listening, noting, and memorizing.

Learning activities like that occur in several subjects, including IPS. The problem is in line with Zemelman, Daniel, & Hyde (in Debora, 2009: 40), that social studies learning in elementary schools tends to teach "cursory coverage of the curriculum, limited memorization of facts, and fixated only on textbooks, reading and examinations". Learning activities that are fixated on books (listening, noting, memorizing) and teacher centered seem boring and cause students to accept and understand a less optimal learning material. Less optimal learning causes students to not be able to develop their thinking skills, so that it will have an impact on the lack of knowledge that can be found by students (Agung, et al, 2013: 2). Finally it affects the learning outcomes.

Constructivist learning is needed, meaning learning that builds knowledge independently or in groups. In line with the opinion of Ilhar in the journal (2014: 488), that constructivist learning causes an increase in academic motivation to develop cognitive abilities in a variety of classes in social studies (IPS). Social Sciences learns many concepts in social problems (Agung, et al, 2013: 1). The concept can be a concept from several scientific disciplines, namely geography, sociology, economics, history, archeology (in elementary education). Building concepts does not have to be memorized, concepts will be more embedded in the brain of students with students discovering and building understanding of the concept (Agung, et al, 2013: 2). In line with Dewey (in Scott and Rudolph, 2009: 117), that learning does not have to be by reading and memorizing, but by doing something, meaning learning is done by building one's own concepts through several activities.

Therefore, a learning process is needed that students can find and build students' own understanding of social studies concepts, so that they influence the learning outcomes. Sugiyanto (in Agung, et al., 2013: 2) says that for the understanding and / or learning approach to social phenomena for students it is easier to be presented in an integrated manner, in achieving this important task, the Project Based Learning approach seems to be wrong one of the most effective teaching and learning tools (Diffily in Mehmet, 2005: 549). Project Based Learning is a learning model that emphasizes students in activities to learn contextually by digging information, determining goals where the final learning outcomes of students make products / projects (Sulisworo, 2013: 22). So that through Project Based Learning students no longer learn with a teacher-centered and textual pattern (textbook oriented). Because Project Based Learning puts forward an innovative and student-centered learning process (Djehan, 2014: 4). In this model, teachers are placed as motivators, mentors, and facilitators (Diffily, 2009: 41).

According to Dewey (in Bellanca, 2012: 17) that students in learning must be 'learning while doing'. It means learning is not just listening, reading, writing or just being a recipient of knowledge, but learning can be done by doing something to make it more meaningful. Strengthened with Moursund (in Mehmet, 2005: 550) explains that Project Based Learning focuses on "doing something" rather than "learning about something". In the situation of the Project Based Learning model, students are asked to build their own knowledge, integrate material so that understanding is more comprehensive, and teach problem solving skills (Suprijono in Agung et al, 2013: 72).

International Research from Ilha Iiter of the University of Bayburt, Turkey in 2014 entitled A Study of Efficiency of Project Based Learning on Social Studies: Conceptual Achievement and Academic Motivation states the results that conceptual ability and motivation for student learning can increase with Project Based Learning . In addition, a study from Djehan Nur Mulyani in 2014 entitled Improvement of Learning Outcomes through the Application of Project Based Learning Methods in Class V Students at Al-Syukro Universal Islamic Elementary School in Jakarta, also stated that Social Sciences learning outcomes of Grade V students in Elementary School this can increase after applying the Project Based Learning model.

According to the 2013 Ministry of Education and Culture, there are several advantages of the Project Based Learning model, including: (1) increasing students' ability to solve problems, (2) making students more active, (3) making the learning atmosphere pleasant, (4) increasing students' learning motivation to learn, (6) increasing the ability to work together (collaboration), (7) developing and practicing students in communication skills, (8) involving learning students by integrating knowledge / information with the real world.

Through the Project Based Learning learning model, it is very helpful for students in receiving material or concepts in learning social studies subjects. Especially for elementary students. Students no longer carry out learning activities as limited as sitting, listening, noting, memorizing and seeming boring. Students will learn more actively and build their own knowledge so that learning is more meaningful. So it is very appropriate and can be the right choice in the elementary school class. Timothy agreed in his literary journal (2014: 46), revealing that project-based learning is feasible to be applied in elementary schools.

Therefore, with several descriptions of existing problems, and the existence of several advantages and characteristics of the research, also several studies conducted by previous researchers succeeded, the researchers will conduct research with the title "The Effect of Project Based Learning Model on Student Social Studies Learning Activities and Results Class IV of SDN Domas Menganti Gresik ". The formulation of the problem that can be taken is how the influence of the Project Based Learning model on social studies learning outcomes of fourth grade students of SDN Domas Menganti Gresik. The purpose of this study is to describe the effect of the Project Based Learning model on social studies learning outcomes of fourth grade students of SDN Domas Menganti Gresik.

II. METHODOLOGY

The type of research carried out is experimental research with the design used is Quasi Experimental or quasi-experimental. The research design used in this study is Non Equivalent Control Group Design, namely the experimental group and the control group cannot be selected randomly or randomly (Sugiyono, 2008: 116).

Tabel 1: Research Design

| Kelas | Pre test | Perlakuan | Pos test |
|--------------|-----------------|------------------|-----------------|
| X1 | O1 | R1 | O3 |
| X2 | O2 | R2 | O4 |

Information :

X1: Experimental Class

X2: Control Class

R1: Treatment is a project based learning model

R2: The treatment is a conventional model

O1: Pre test experimental class

O2: Pre test control class

O3: Post test experimental class

O4: Control class post test

This research was conducted in the fourth grade of SDN Domas, East Java, Indonesia with a population of all fourth grade students of SDN Domas in grades IVA, IVB, and IVC which totaled 75 students. The researcher chose the sample random sampling technique, in the sampling the researcher mixed the subjects in the population so that all subjects were considered the same. Data collection techniques using tests. Tests are used to measure concept understanding and problem solving skills in this study. The test is done twice, namely before the material is given (pre test) and after learning (post test).

Data analysis techniques in this study through several stages, namely analysis of items and analysis of test results. Butri analysis of the question through validity test using product moment correlation test analysis, then test reliability with spearman brown. For analysis of test results there are several tests, namely normality test, homogeneity test, and T-test test with the help of SPSS 22 application which has a provision that the significance value must be greater than 0.05 (Sig> 0.05) so that the research data will be normal, and homogeneous. The normality test is used to determine whether the sample in the study is normally distributed both in the pre test and post test population values. Homogeneity test is used to determine the group variation between the experimental class and the control class is a homogeneous sample.

Then for the t-test, the statistical technique used to test the significance of the difference in 2 mean fruits derived from two distributions, in this t-test the significance value must be less than 0.05 so that there is an influence in the study or H_a is accepted. And the last test is to calculate the normalized N-Gain value to find out how much influence the use of the concept of time and the chronology of students.

III. RESULT AND DISCUSS

The results of the research study "The Effect of the Project Based Learning Model on the activities and learning outcomes of fourth grade students of SDN Domas Menganti Gresik" can be seen from the findings of the researchers as follows:

Before the research was conducted, a validation test was carried out beforehand on the research instruments that would be used. In the first stage, the items in the test instrument were assessed for validity by the expert lecturer, Drs. Supriyono, M.Pd. as a PGSD lecturer at Surabaya State University. Based on the results of the validation from experts, there are 25 of the 30 questions that should be used, and it can be concluded that the test sheet is feasible to be used with a good predicate.

While in the second stage, the items were validated by using SPSS 22. The test questions were 25 questions which were tested on the fourth grade students of SDN Gemurung Gedangan Sidoarjo with 25 students, and it was found that 25 multiple choice questions were declared valid. Based on the criterion price table list of the product moment with a significance level of 0.05 it is known that the table is 0.396.

After conducting the validation test, then do the reliability test. A test item is said to be reliable if the data shows a measurement that remains the same even though it has been tested twice or more. The testing of the reliability of an item by using an even-numbered Spearman Brown formula. Correlation coefficient criteria (r_{table}) for multiple choice items using a significance level of 5%. If the reliability index value (r_{11}) of the calculation results using SPSS 22 is greater than r_{table} ($r_{11} > r_{table}$), then the item item is declared reliable.

Table 2. Results of Problem Reliability with SPSS 22

| Reliability Statistic | |
|-----------------------|------------|
| Cronbach's Alpha | N of Items |
| .960 | 25 |

The above table can be seen that from the multiple choice questions the results of the reliability value of the problem r count are 0.960 while the table is 0 from $N = 25$ at the significance level of 5%, then $r_{xx} > r_{table}$, which is $0.960 > 0.396$ so the test instrument is said to be reliable.

The next step is analyzing the research data, namely by the normality test. The normality test is done to find out whether the population in the study is normally distributed or not. In this study the Kolmogorov Smirnov formula was used and used SPSS 22.

Table 3 Normality Test Results of the Pretest Control Class

| One-Sample Kolmogorov-Smirnov Test | | |
|------------------------------------|----------------|------------|
| | | Pretest_KK |
| N | | 32 |
| Normal Parameters ^{a,b} | Mean | 50.13 |
| | Std. Deviation | 6.179 |
| Most Extreme Differences | Absolute | .204 |
| | Positive | .135 |
| | Negative | -.204 |
| Kolmogorov-Smirnov Z | | 1.155 |
| Asymp. Sig. (2-tailed) | | .139 |

Table 4 Normality Test Results for Pretest Class Experiments

| One-Sample Kolmogorov-Smirnov Test | | |
|------------------------------------|----------------|------------|
| | | Pretest_KE |
| N | | 31 |
| Normal Parameters ^{a,b} | Mean | 51.10 |
| | Std. Deviation | 5.338 |
| Most Extreme Differences | Absolute | .148 |
| | Positive | .138 |
| | Negative | -.148 |
| Kolmogorov-Smirnov Z | | .823 |
| Asymp. Sig. (2-tailed) | | .507 |

a. Test distribution is Normal.

b. Calculated from data.

Based on table 3, it can be seen that the calculation of normality in the significance column obtained a value of 0.139 in the control class and in table 4, the experimental class obtained a value of 0.507. Both of these significance values are greater than 0.05. This means that samples from both groups came from populations that were normally distributed.

Table 5 Normality Test Results of the Control Class Posttest Data

| One-Sample Kolmogorov-Smirnov Test | | |
|------------------------------------|----------------|------------|
| | | Posttes_KK |
| N | | 32 |
| Normal Parameters ^{a,b} | Mean | 70.25 |
| | Std. Deviation | 5.831 |
| Most Extreme Differences | Absolute | .150 |
| | Positive | .150 |
| | Negative | -.131 |
| Kolmogorov-Smirnov Z | | .850 |
| Asymp. Sig. (2-tailed) | | .466 |

a. Test distribution is Normal.

b. Calculated from data.

Table 6 Normality Test Results of Experimental Posttest Data

| One-Sample Kolmogorov-Smirnov Test | | |
|------------------------------------|----------------|------------|
| | | Posttes_KE |
| N | | 31 |
| Normal Parameters ^{a,b} | Mean | 86.06 |
| | Std. Deviation | 5.921 |
| Most Extreme Differences | Absolute | .177 |
| | Positive | .137 |
| | Negative | -.177 |
| Kolmogorov-Smirnov Z | | .983 |
| Asymp. Sig. (2-tailed) | | .289 |

a. Test distribution is Normal.

b. Calculated from data.

Based on table 5, it can be seen that the calculation of normality in the significance column obtained a value of 0.466 in the control class and in table 6 the experimental class obtained a value of 0.289. Both of these significance values are greater than 0.05. This means that samples from both groups came from populations that were normally distributed.

The next step is the homogeneity test. The aim is to determine the group variance in the experimental class and the control class. Data homogeneity testing was carried out with the help of SPSS 22.

Table 7 Pretest Data Homogeneity Test Results

Test of Homogeneity of Variances

Pretest

| Levene Statistic | df1 | df2 | Sig. |
|------------------|-----|-----|------|
| 1,177 | 9 | 53 | ,329 |

Based on table 7, a significance value of 0.329 is obtained which means that the significance is greater than 0.05. This means that the variants of the two groups are homogeneous.

Table 8 Posttest Data Homogeneity Test Results

Test of Homogeneity of Variances

Pretest

| Levene Statistic | df1 | df2 | Sig. |
|------------------|-----|-----|------|
| 0,696 | 5 | 57 | ,629 |

Based on table 8, it can be seen that the homogeneity calculation in the significance column obtained a value of 0.629 which means that the significance is greater than 0.05. This means that the variants of the two groups are homogeneous. After the data is said to be normal and homogeneous, the next step is to test hypotheses. Testing this hypothesis is intended to test whether the hypothesis that has been proposed by the researcher is accepted or rejected, in other words H_a is accepted and H_0 is rejected. This test uses the Independent Sample T-Test, with the help of SPSS 22. The results of the calculation of t-test analysis can be seen in the following table.

Table 9 T-Test Test Results

| Group Statistics | | | | |
|-----------------------------|----|-------|----------------|-----------------|
| Kelas | N | Mean | Std. Deviation | Std. Error Mean |
| Posttes_KK Kelas kontrol | 32 | 70.25 | 5.831 | 1.031 |
| Kelas eksperimen | 31 | 86.06 | 5.921 | 1.064 |

Table 10 T-Test Test Results (Independent Sample Test)

| | Independent Samples Test | | | | | | | | |
|-----------------------------|---|------|------------------------------|----|-----------------|-----------------|-----------------------|---|---------|
| | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
| | F | Sig. | T | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference | |
| | | | | | | | | Lower | Upper |
| Equal variances assumed | 0.69 | ,793 | 10,680 | 61 | ,000 | 15,815 | 1,481 | 18,775 | -12,854 |
| Equal variances not assumed | | | 10,678 | 60 | ,000 | 15,815 | 1,481 | 18,776 | -12,853 |

Based on table 9, it is known that the difference in the average learning outcomes of the control class is 70.25 while the difference in the average learning outcomes of the experimental class is 86.06. This proves that the learning outcomes in the experimental class are greater than the control class.

While the chest table 10 can be seen that the significance test of the F test is obtained 0.069 Thus the significance is greater than 0.05 ($0.069 > 0.05$) then H_a is accepted. So, it can be concluded that the groups of pre test and post test values in the control and experimental classes have the same variant, so the t test uses Equal Variances Assumed.

From table 10, it is found that tcount is -10.680 while t table can be seen in the statistical table at the significance of 0.05: $2 = 0.025$ with the degree of freedom (df) $n-2$ that is $63-2 = 61$, the results obtained for t table are 1.999. If thitung is negative: there is a significant difference if tcount < t table. Tcount < ttable ($-10,680 < 1,999$) and significance less than 0,05 ($0,000 < 0,05$) then H_0 is rejected H_a accepted. So it can be concluded, that there is an effect of student learning outcomes using the Project Based Learning

model in class IV of Punggul 1 Elementary School 1 Gedangan Sidoarjo. Besides the difference in the average learning outcomes (mean) of the experimental class that applies the Project Based Learning learning model in the learning process is better than the learning outcomes of the control class which is a conventional learning model or direct learning model.

Furthermore, the centralized N-Gain test is used to determine the effect caused by the use of the Project Based Learning model. The following table shows the calculation of the average N-Gain.

Table 11 N-Gain Test Results Normalized

| Class | N-Gain | Category |
|------------|--------|----------|
| Control | 0.4 | Middle |
| Experiment | 0.7 | High |

From table 11 it is known that the average N-Gain score in the control class group is 0.4 with a moderate category, and the experimental class group score is 0.7 with a high category. So that it can be concluded that there is a significant increase in the presence of learning using the Project Based Learning model compared to the control class that uses conventional learning models. The average results obtained by students, can be seen in the diagram below.

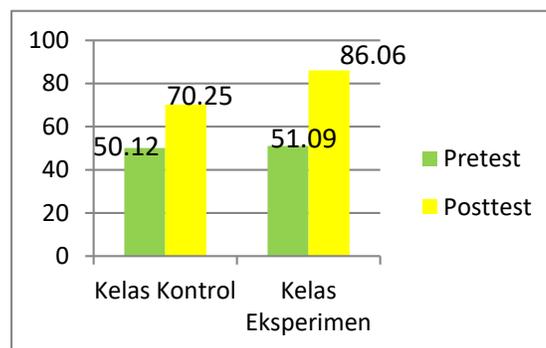


Diagram 1 Average Results of Pretest and Posttest Values

Based on diagram 1 shows that the average value of the pretest and posttest of both groups experienced an increase both from the control class and the experimental class. In the control class, the average score obtained by students is low compared to the experimental class. The pretest value of the control class students is categorized as low, because students when working on the pretest problem still do not know the learning material that will be delivered. Because the purpose of the pretest is to know the students' initial abilities before being given treatment. After students are given treatment, in this case using a conventional learning model, the control class students experience an increase in the average value of learning outcomes, but the increase is not significant, there are still many students who get scores below the KKM, which is below 75 and low, so students in the control class received the average posttest score with the moderate category.

As for the experimental class, students initially get the same pretest value as the pretest of the control class, which is in the low category. However, after being given treatment, the experimental class experienced a significant increase with a very good posttest average. When compared with the results of the low category control posttest, this proves that giving treatment using the Project Based Learning model can significantly improve the learning outcomes of class IV-B students in Domas Menganti Gresik Elementary School.

During the research phase, this research was conducted in the control class and experimental class. Before conducting research, researchers approach students with the aim that students get used to the existence of researchers so students do not feel afraid and awkward when dealing with researchers. The researcher approached the method by helping to fill the learning when the teacher was unable to attend, when the hours were empty, rest could interact with students in the control class and the experimental class.

On 25-28 a study was conducted at Domas Menganti Gresik Elementary School in Sidoarjo. On July 25, the pretest was conducted in the experimental class and in the control class to determine the students' initial ability before being given treatment, followed by learning or giving treatment to the IVA class as the control class and IVB class as the experimental class until the 27th. And after being given treatment to the two classes, on July 27 the posttest in the control class was held and on the 28th in the experimental class to determine the ability of student learning outcomes.

In this study, the initial learning conditions of students were not able to understand the Cooperative material, because students still did not get the lesson about the Cooperative material. This can be proven through the results of the pretest of both groups, both experimental and control classes. The average results of the pretest of the two groups still reached low scores. In this case the students' understanding of the Cooperative material is less than optimal.

The learning process in this study was conducted during 4 meetings. Conducted in class IVA as the control class and class IVB as the experimental class. The learning material used is about Cooperative material in Improving Community Welfare. With the existence of this learning material students are expected to be able to know the meaning of cooperatives and apply them in community

life later. This research was conducted during 4 meetings or learning in both the experimental and control classes so that there were no factors that disrupted the research process in the two groups so that they could produce a maximum result.

In control class learning, on the first day students do a pretest to find out the students' initial knowledge, followed by learning about Cooperative material in Community Welfare, it takes place every day until the third day, where on the fourth day students get a posttest. In the learning conditions, students are treated by using direct learning models, teachers here as centers or teacher centered and textual (textbook), meaning that the main source of student learning is teachers and books (Ika et al., 2016: 3). The teacher only gives a glimpse of the material from the existing curriculum. In learning this control class, students only read the text of the reading book, listen to what the teacher explains, record what the teacher writes on the board, and memorize the material. In short, learning activities are only limited to sitting, listening, noting, and memorizing. So that student involvement becomes less active (passive).

Whereas in the experimental class, this was also done on the same day, where on the first day students did a pretest to find out students' initial knowledge, followed by learning about Cooperative material in Improving Community Welfare, it took place every day until the third day, where at fourth day students get a posttest.

In the learning process using the Project Based Learning model students feel happy with the learning, because students do a learning activity that is starting by visiting a school cooperative, practicing a meaning and provision of Cooperative material in Improving Community Welfare, namely students practice how to become members of cooperatives, how being a member of a cooperative and a way to buy goods in the cooperative, cooperatives sell anything, and up to member meetings in cooperatives. Where at the end of learning is applied with a learning product where the product can be a medium for students in receiving learning materials, namely in the form of making and scrapbook. The learning is in accordance with the opinion of Agung, et al. (2013: 2), that constructing concepts does not have to memorize, concepts will be more embedded in the brain of students with students discovering and building understanding of the concept.

In this learning students become active, the teacher is only a facilitator, mentor, and motivator. In accordance with the concept of Diffly (2009: 41), which explains that in the Project Based Learning student model will be the center of learning (student centered), the teacher only becomes a motivator, mentor, and facilitator, meaning students are given the opportunity to work autonomously to construct learning. Students learn by finding their own knowledge of understanding the concepts of social studies material that is being studied. In other words, students build their own knowledge (constructivists).

This strongly shows that after this research has been carried out it has been proven that a theory related to the results of research is in harmony with research. Among them, according to Dewey (in Bellanca, 2012: 17) that students in learning must be 'learning while doing'. It means learning is not just listening, reading, writing or just being a recipient of knowledge, but learning can be done by doing something to make it more meaningful. Strengthened with Moursund (in Mehmet, 2005: 550) explains that Project Based Learning focuses on "doing something" rather than "learning about something". So this model prioritizes students constructivist learning or building their own knowledge. In accordance with Ilhar's opinion in the journal (2014: 488), one of the popular approaches to constructivist methods is Project Based Learning.

These theories are in line with the results of research (real world practice) shown from the implementation observation sheet of this study, namely from IVB class teachers as an experimental class, Ms. Yustu Nawangtari, S.Pd and colleagues and observers from the PGSD department, Dita Fathicotul Imron, he found that this learning model makes students more active, interested and enthusiastic about learning, builds their own knowledge, students learn material while doing so that students are not bored with the learning material learned, because learning is more meaningful and fun for students.

This research focused on student learning outcomes in Cooperative material in Improving Community Welfare. Learning outcomes obtained from the results of posttest students after receiving learning or receiving treatment. Other contributions contained in this study aside from focusing on student learning outcomes, namely regarding mastery of cooperative material in improving community welfare. In this study presents a new learning model, which is akfif, creative, innovative, learning model that developed in the 21st century, namely the Project Based Learning model. So this learning model is highly recommended for use today, the 21st century. This is in accordance with the opinion of Bender (2015: 2), explaining that Project Based Learning seems to be very appropriate to be the main model of 21st century teaching because the instructional approach is based and educators are advised to follow this innovative approach to teaching. Reaffirmed by Blumenfeld, et al. (In Jill and Gina, 2013: 3), that Project Based Learning enables students to take an active role in developing 21st century skills, which encourage high curiosity for knowledge. So it can be concluded that the Project Based Learning model is a very effective learning model when applied in learning in the 21st century.

IV. CONCLUSION

Based on the results of the research and discussion in chapter IV, it can be concluded that the Project Based Learning learning model influences the learning outcomes of fourth grade students of Domas Elementary School Menganti Gresik. This is evidenced by the results of the calculation of hypothesis testing using the Independent Sample T-Test formula. The results of the effect test were obtained after the treatment in the experimental class. From the calculation of the hypothesis test results obtained $t_{count} < t_{table}$, with a significance greater than the specified significance, then H_0 is rejected and H_a is accepted. This means that there is a significant effect on the posttest value of class IV B students of Domas. So that it can be concluded that the Project Based Learning model influences the activities and learning outcomes of fourth grade students of SDN Domas Menganti Gresik, which means H_a is accepted and H_0 is rejected.

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Effect of Hypertension on Stroke Events At the National Brain Center Hospital Jakarta 2017

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Abstract- Stroke is a deadly non-communicable disease. The high incidence of stroke in Indonesia shows that stroke is a health problem that is dangerous and needs special attention. Hypertension is the main risk factor that affects the incidence of stroke. The higher a person's blood pressure, the greater the likelihood that the person will experience a stroke. As a risk factor that can be changed and can be prevented, of course hypertension can be modified and detected so that it can reduce the risk of stroke events. This study was a cross-sectional that examined the effects of hypertension on stroke events. The population studies was stroke patients treated at the National Brain Center Hospital Jakarta in 2017 as many as 1,931 patients. The sample was chosen based on the inclusion criteria of patients treated with stroke (ischemic/hemorrhagic) as the primary diagnosis, the stroke that is now being experienced is the first (non-recurring) stroke and completes the patient's medical file according to the specified variable. The sample chosen was 309 respondents divided into 232 ischemic stroke patients and 77 hemorrhagic strokes. Data analysis was performed in univariable, bivariable using chi square and multivariable tests using multiple logistic regression analysis. The results showed that hypertension significantly affected the incidence of stroke in the National Brain Center Hospital. P value is 0.001 with odds ratio 0.296 (95% CI 0.141-0.621) which shows that hemorrhagic stroke patients who suffer from hypertension will be 0.296 times suffering from stroke compared to patients who are not hypertension after being controlled by age and diabetes mellitus.

Index Terms- Hypertension, stroke, ischemic, hemorrhagic, effect

I. INTRODUCTION

Stroke is a non-communicable disease caused by disruption of the blood supply to the brain which can be caused by a blockage (ischemic stroke) or rupture of a blood vessel (hemorrhagic stroke) [1]. As a neurological disease, stroke remains one of the most devastating, which often causes death or physical and mental damage. With the epidemiological transition occurring in many countries around the world, there has been a drastic change in the prevalence of stroke prevalence [2]. There is a difference in the incidence of stroke in developed and developing countries. Feigin, et al (2009) concluded that the incidence of strokes globally experienced inequality namely in developed countries experienced a decline of 42% while in developing countries increased by 100%. This can occur due to massive urbanization, changes in risk factors and the lack of prevention and treatment of stroke in developing countries [3].

The American Stroke Association (2017) mentions risk factors for stroke include hypertension, smoking habits, diabetes mellitus, high cholesterol, obesity, lack of physical activity, carotid artery disease, etc [4]. The National Stroke Association (2018) states that stroke risk factors are divided into 3 namely the first risk factors based on lifestyle namely diet and nutrition, physical activity, smoking and tobacco use and alcohol consumption, both medical risk factors consist of hypertension, atrial fibrillation, hypercholesterolemia, diabetes mellitus, circulatory problems, carotid artery disease, and the third, risk factors that cannot be modified include age, sex, race, family history of stroke, previous stroke history, fibromuscular dysplasia, patent foramen ovale and ischemic transient attack [5]. Based on the results of the Riskesdas 2013 data released by the Health Research and Development Agency of the Indonesian Ministry of Health, data on stroke prevalence based on diagnosis of health personnel were 7 per mile and those diagnosed with health personnel or symptom based were 12.1 per mile. This figure is increased when compared with the 2007 Riskesdas data, namely the prevalence of stroke based on the diagnosis of health workers amounting to 6 per 1000 population and which can be detected by health workers at 8.3 per 1000 population [6].

Ghani, Mihardja, and Delima (2016) in their research on the dominant risk factors for stroke in Indonesia stated that the prevalence of hypertension in stroke was 3.1% [7]. After being controlled by sociodemographic variables and biological factors, hypertension will increase 2.87 times to stroke. Kulshreshtha (2012) also stated in his systematic review that from several studies conducted in Southeast Asia, hypertension was the most frequent risk factor in the incidence of stroke [8]. The results of Sofyan, Sihombing, and Hamra [9] and Sari [10] research showed that from 77 people in the study sample of stroke patients, 68 patients (88.3%) had hypertension and 9 patients (11.7%) had no hypertension. Based on the analysis results $p = 0,000$ which means that there is a significant relationship between hypertension and ischemic stroke. In line with the study, the results of a study conducted by Sari (2015) stated there was a significant relationship between hypertension and the incidence of recurrent stroke, indicated by a P value of 0.022 [10].

Hypertension is a stroke risk factor that can be changed. Often referred to as the silent killer/silent killer because hypertension increases the risk of stroke as much as 6 times. Hypertension is said if the blood pressure is greater than 140/90 mmHg. The higher the patient's blood pressure the greater the likelihood of a stroke, because of the damage to the walls of the blood vessels making it easier

to block and even rupture the blood vessels in the brain. If a stroke occurs many times, the chances of recovery and survival will be smaller. By knowing the effect of hypertension on the incidence of ischemic stroke and hemorrhagic stroke, it is hoped that it can prevent the occurrence of ischemic stroke and hemorrhagic stroke and repeat stroke [11].

The increase in prevalence in national data was followed by an increase in the incidence of ischemic stroke in the inpatient room at the Jakarta Central Otak Hospital. In accordance with the mandate of Presidential Regulation of the Republic of Indonesia No. 29 of 2014, the National Brain Center Hospital is one of the vertical units within the Directorate General of Health Services of the Ministry of Health. As a national referral hospital, patients diagnosed with stroke in this hospital are patients from various regions in Indonesia. The incidence of new cases of stroke at the National Brain Center Hospital experienced a very significant increase from 2015 to 2017. The number of patients diagnosed with ischemic stroke who were treated in the inpatient ward of the National Brain Hospital in 2015 was 664 people, increasing in 2016 to 987 people and continuing increased in 2017 to as many as 1317 people.

Stroke will be a threat and nightmare for sufferers and their families, given the threat of disability that can persist in patients until the death that may be experienced. But basically some risk factors, especially hypertension, are risk factors that can be changed or modified. So it can indirectly reduce the risk of stroke [12]

II. DATA COLLECTION METHOD

This study was an observational analytic type using a cross sectional study design. Cross-sectional research is a descriptive study in which the variables used in the study are inflicted once on the subject of the study and then the relationship of the variables is only based on just one moment's observation [13]. The study was conducted using medical record data of stroke patients who were admitted to the national brain center hospital during 2017 with a total of 1931 patients. The study sample was stroke patients who were admitted to the stroke ward who met the inclusion criteria of 309 respondents divided into 232 ischemic stroke patients and 77 hemorrhagic stroke patients with the criteria of patients treated with stroke (ischemic / hemorrhagic) as the main diagnosis, stroke what is experienced is now the first stroke (not recurring) and the complete medical file of the patient according to the specified variable.

Data analysis began with the translation of univariable distribution, bivariable analysis, and multivariable analysis. Univariable distribution will describe the incidence of ischemic and hemorrhagic strokes based on the variables studied, among others, the independent variables namely hypertension and covariate variables, namely age, sex, diabetes mellitus and obesity using the frequency distribution table (proportion). after knowing the characteristics of each eating variable will be followed by bivariable analysis to determine the relationship between the dependent variable (stroke) and the independent variable (hypertension) after being controlled by covariate variables (age, sex, diabetes mellitus and obesity). the analysis used is the chi square test because the data connected are categorical with categorical data. chi square test will be able to conclude whether there is a difference in proportions between groups or in other words we can only conclude whether there is a relationship between two categorical variables but cannot explain the degree of relationship between these two variables. for multivariable analysis, researchers will conduct multiple logistic regression tests, namely mathematical models commonly used to analyze the relationship of one or several independent variables with one categorical dependent variable [14].

The dependent variable of this study is the incidence of stroke categorized into two, including bleeding / hemorrhagic stroke (code = 0) and blockage / ischemic stroke (code = 1). The stroke included in the inclusion criteria was a stroke that was diagnosed for the first time by RSPON doctors. The independent variable is hypertension (high blood pressure) which is defined into two categories, namely code 0 for patients who have systolic blood pressure below 140 mmHg or diastolic below 90 mmHg and code 1 for patients who have blood pressure greater than 140 mmHg or more diastolic from equal to 90 mmHg. This study uses a risk factor method, so that a variable covariate or intruder is needed. The covariate variables used were age, gender, diabetes mellitus status and obesity status. Age categories are divided into 2, 0 for ages less than 60 years and 1 for ages above 60 years. The sex category is divided into 2, namely 0 for women and 1 for men. The diabetes mellitus category is divided into two, namely 0 for not suffering from diabetes mellitus and 1 for diabetes mellitus. While the obesity category is divided into 4 categories, 0 for underweight, 1 for normal, 2 for overweight and 3 for obesity. For diabetes variables with more than 2 categories, a variable dummy is made with 0 (underweight) as a comparison.

III. STUDY FINDINGS

A. Univariable Distribution

The sample distribution of stroke patients consisting of 232 ischemic stroke patients and 77 hemorrhagic stroke patients based on the main independent variables (hypertension) and covariate variables (age, sex, diabetes mellitus and obesity) can be seen in the following table:

Table 3.1. Sample Frequency Distribution Based on Independent Variables and Covariate Variables Which Affects Stroke Events

| Variable | Stroke | | | | Total | |
|-------------------------------|-----------------|------|--------------------|------|-------|-------|
| | Ischemic stroke | | Hemorrhagic stroke | | n | % |
| | n | % | n | % | | |
| Hypertension | | | | | | |
| No | 69 | 87,3 | 10 | 12,7 | 79 | 100,0 |
| Yes | 163 | 70,9 | 67 | 29,1 | 232 | 100,0 |
| Age | | | | | | |
| Under 60 year | 101 | 68,7 | 46 | 31,3 | 147 | 100,0 |
| More than the same as 60 year | 131 | 80,9 | 31 | 19,1 | 162 | 100,0 |
| Sex | | | | | | |
| Women | 94 | 78,3 | 26 | 21,7 | 120 | 100,0 |
| Men | 138 | 73,0 | 27 | 27,0 | 189 | 100,0 |
| Diabetes Mellitus | | | | | | |
| No | 169 | 69,0 | 76 | 31,0 | 245 | 100,0 |
| Yes | 63 | 98,4 | 1 | 1,6 | 64 | 100,0 |
| Obesity | | | | | | |
| Underweight | 6 | 85,7 | 1 | 14,3 | 7 | 100,0 |
| Normal | 131 | 74,9 | 44 | 25,1 | 175 | 100,0 |
| Overweight | 77 | 75,5 | 25 | 24,5 | 102 | 100,0 |
| Obesity | 18 | 72,0 | 7 | 28,0 | 25 | 100,0 |

Based on the table 3.1, it can be seen that out of 232 hypertensive people, 163 people (70.9%) had ischemic stroke and of 79 people who did not suffer from hypertension, 69 people (87.3%) suffered from ischemic stroke. In the age group of less than 60 years of 147 people there were 101 people (68.7%) who suffered from ischemic stroke while the age group of more than 60 years, there were 131 people (80.9%) who suffered from ischemic stroke. Of the 189 male patients there were 138 people (73.0%) who suffered from ischemic stroke, while from 120 female patients there were 94 people (78.3%) suffering from ischemic stroke. Of the 245 people who did not suffer from diabetes mellitus, 169 people (69.0%) suffered from ischemic stroke while 64 of the people suffering from diabetes mellitus had 63 (98.4%) who suffered from ischemic stroke. For the obesity variable, from 7 people who were underweight, 6 people (85.7%) suffered from an ischemic stroke. Patients with normal BMI totaling 175 people were 131 people (74.9%) who suffered from ischemic stroke. 102 overweight patients had 77 people (75.5%) who suffered an ischemic stroke and of the 25 obese people there were 18 people (72.0%) who suffered from ischemic stroke.

In the group of hemorrhagic strokes can be described the following results: of 232 people with hypertension, there are 67 people (29.1%) suffering from hemorrhagic stroke and of 79 people who are not hypertensive, 10 people (12.7%) suffer from hemorrhagic stroke. In the age group of less than 60 years of a total of 147 patients there were 46 people (31.3%) who suffered from hemorrhagic strokes while the age group was more than 60 years, of the total 162 patients there were 31 people (19.1%) suffering from a hemorrhagic stroke. Of the 189 patients who were male there were 27 people (27.0%) who suffered hemorrhagic strokes, while of 120 people who were female there were 26 people (21.7%) who suffered from hemorrhagic strokes. Of the 245 people who did not suffer from diabetes mellitus, 76 people (31.0%) suffered from hemorrhagic strokes, while 64 people who had diabetes mellitus had only one person (1.6%) who suffered a hemorrhagic stroke. For the obesity variable, from 7 people who were underweight, 1 person (14.3%) suffered a hemorrhagic stroke. Patients with normal BMI totaling 175 people were 44 people (25.1%) who suffered hemorrhagic strokes. 102 overweight patients had 25 people (24.5%) who suffered hemorrhagic strokes and of the 25 people who were obese there were 7 people (28.0%) who suffered from hemorrhagic strokes.

B. Bivariable Analysis

After doing the description of the characteristics, a bivariable analysis was carried out. Bivariable analysis was performed to see the effect of each of the main variables (hypertension) and covariate variables (age, sex, diabetes mellitus and obesity) on the incidence of ischemic stroke and hemorrhagic stroke, which can be seen in the following table:

Table 3.2 Effect of hypertension and covariate variables on the incidence of stroke in National Brain Center Hospital

| Variable | P | OR | 95% CI |
|-------------------------|-------|--------|-----------------|
| Hypertension | 0,006 | 0,353 | 0,171 - 0,726 |
| Age | 0,020 | 1,925 | 1,139 - 3,251 |
| Sex | 0,358 | 0,748 | 0,436 - 1,285 |
| Diabetes Melitus | 0,001 | 28,331 | 3,858 - 208,073 |
| Obesity | 0,905 | - | - |

Based on table 3.2, the odds value of the hypertension ratio is 0.535 with a p value of 0.006. This shows that patients suffering from hypertension will experience 0.353 times the incidence of hemorrhagic stroke means that patients who have hypertension will be more likely to have an ischemic stroke (95% CI 0.171-0.726). This result is in line with Anwar's research conducted at Dr. RSUP Wahidin Sudirohusodo Makassar who got the results of $p(0.026) > \alpha(0.050)$ and CI (1,120; 3,571). People with a history of hypertension are more at risk of having a 2,000 stroke greater than people who have no history of hypertension [15]. Strengthened by the results of Alfica Agus Jayanti's research which states that people with hypertension have a risk of having a stroke of 17.92 times (14.05-22.86) than people who do not suffer from hypertension [16]

Age factor as confounding variable displays p value 0.020 with OR 1.925. The value of p indicates a difference in stroke incidence between the two categories of hypertension. the value of 95% CI obtained 1,139-3,251. This number passes number 1 so age is not necessarily a risk factor for stroke events. These results are not in line with previous studies by Zhang in China that age increases the incidence of ischemic stroke with OR = 2.122 (95% CI 1,335-3,374) [17].

Gender in this study received a p value of 0.358 with OR 0.748 which means that gender factors cannot be considered as risk factors for stroke at the National Brain Center Hospital. There are several studies that are appropriate and not in accordance with the results of this study. Sofyan's research states that gender is not related to the incidence of stroke with a p value of 0.308 [9]. Another study conducted by Puspita showed different results, namely that sex was associated with the incidence of stroke with the risk of stroke occurring in male sex by 4.375 times compared to women [18].

The next variable is diabetes mellitus which has a p value of 0.001 with OR 28,331 which means there is a significant relationship between diabetes mellitus and the incidence of stroke. A very high OR value indicates that diabetes mellitus is the most dominant factor affecting hypertension in the event of a stroke at the National Brain Center Hospital. The results of this study are in line with Usrin's study which found that diabetes mellitus affect the incidence of stroke with a p value of 0,0001 and OR 0.29 which means that patients suffering from diabetes mellitus will have 0.29 times to experience a stroke compared to those without diabetes mellitus [19].

The last factor in this study was obesity which obtained p value of 0.905 which means there was no significant relationship between obesity and the incidence of stroke in the National Brain Center Hospital. The results of this study are not in line with Atmaja's research (2014) which concluded that a person with a body mass index > 25 had a stroke risk 10 times compared to a body mass index < 25 [20]. The way to calculate body mass index is to divide the body weight (in kilograms) by the square height (in meters). Some new studies link obesity (especially central obesity) with an increased risk of stroke.

c. Multivariable Analysis

Based on bivariable analysis, the multivariable model candidates were obtained, namely hypertension, age and diabetes mellitus variables. Then a multivariate analysis is performed to create a model that describes the relationship between independent variables together with one dependent variable, and by controlling several confounding variables. After obtaining a multiple logistic regression model, then an interaction check and confounding examination were carried out, so that the results of multivariate analysis were obtained as follows:

Table 3.3 Final Model of Multiple Logistic Regression

| Variable | B | Exp(B) | SE | P | 95% CI |
|-------------------------|--------|--------|-------|-------|-----------------|
| Hypertension | -1,217 | 0,296 | 0,378 | 0,001 | 0,141 – 0,621 |
| Age | 0,616 | 1,851 | 0,284 | 0,030 | 1,060 – 3,232 |
| Diabetes Melitus | 3,475 | 32,294 | 1,020 | 0,001 | 4,372 – 238,554 |
| Constant | 1,445 | 4,243 | 0,369 | 0,000 | |

The above model was obtained after the interaction test and it was found that there was no interaction between hypertension as the main independent variable with other covariate variables, age and diabetes mellitus. Confounding test is not done because there is no variable with a p value greater than 0.05 so the final model is without interaction and confounding as seen in table 3.3. The results of multivariable analysis showed that hypertension significantly affected the incidence of stroke. The confounding factors included in the final model were age and status of diabetes mellitus, while the factors that were not proven to be confounding were gender and obesity. the above assessment is determined by considering the p value in the final model which is <0.05.

Based on multiple logistic regression analysis it can be concluded that the risk of hemorrhagic stroke incidence in hypertensive patients is 0.296 times compared to patients who are not hypertension after being controlled by age and diabetes mellitus (OR = 0.296, 95% CI 0.141-0.6621).

IV. DISCUSSIONS

Hypertension is a risk factor for the incidence of stroke in the National Brain Center Hospital. Hypertension can accelerate the hardening of the arteries so that it causes the destruction of fat in smooth muscle cells which can accelerate the process of atherosclerosis through the effect of suppressing endothelial cells in the arterial wall resulting in faster blood vessel plaque formation. The higher blood pressure, the greater the chance of having a stroke. If a stroke occurs many times, the chances of recovery and survival will be smaller [21]. Next variabel is age. Age is a risk factor for ischemic stroke that cannot be changed. the incidence of new cases of ischemic stroke increases with age. Hemorrhagic and ischemic stroke are often regarded as diseases that only appear in old age, but now there is a tendency for younger age groups (<40 years) to suffer. This can be caused by changes in the lifestyle of modern urban youth, such as consuming fast food containing high fat, smoking habits, drinking alcoholic beverages, excessive work, lack of exercise and stress. In this study gender did not significantly influence the incidence of stroke in the National Brain Center Hospital. This is because women have a higher risk of various complications such as thromboembolism with atrial fibrillation and cardioembolism [22]. Diabetes mellitus has a significant effect on stroke at the National Brain Center Hospital. This happens because diabetes mellitus will accelerate the occurrence of atherosclerosis in both small blood vessels and large blood vessels throughout the blood vessels including the blood vessels of the brain and heart. So that it will expand infarction (dead cells) because the formation of lactic acid causes anaerobic glucose metabolism to damage brain tissue [19]. Obesity factors did not significantly influence the incidence of stroke at the National Brain Center Hospital. Central obesity is defined as waist circumference > 102cm in men or > 88cm in women. Central obesity increases the risk of stroke through hypertension, diabetes and dyslipidemia which states that obesity is 10 times more likely to suffer a stroke than patients who do not suffer from obesity [23].

V. CONCLUSION

This study shows that the risk factors for stroke in the National Brain Center Hospital are hypertension after controlled by age and diabetes mellitus. These results are in line and in accordance with various literature and results of research related to stroke. Many ways to prevent stroke can be done, namely by increasing public awareness and changing lifestyle towards a healthier one. Primary prevention that can be done is activities to stop or reduce risk factors for hypertension before hypertension occurs, through health promotion such as a healthy diet by eating enough vegetables, low salt and fat, diligently doing activities and not smoking [24].

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The author opens the widest opportunity for other researchers who want to use the results of this study in the interest of advancing education throughout the world. The researcher also expressed his gratitude to the National Brain Center Hospital for giving the opportunity for researchers to process the stroke patient data available there.

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The Impact of Social Exchange Theory Implementation Over Organizational Attitude and Behavior

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Abstract- Medical sales representatives are sales force that is spearheading the sales and distribution of products in the health care organization. The tasks performed by medical sales representative have a high degree of difficulty that requires the support of the company and good communication with your boss. Research objectives to be achieved are: 1) To analyze the direct effect of organizational support on job satisfaction; 2) To analyze the direct effect of leader-member exchange (LMX) on job satisfaction; 3) To analyze the indirect effect of organizational support on organizational commitment; 4) To analyze the indirect influence of leader-member exchange (LMX) on organizational commitment. The approach used for this research is a quantitative approach. The population in this study is a medical sales representative at the Government General Hospital in Surabaya, dr. Soetomo and Haji General Hospital. The number of samples is four or five times the number of variables or attributes are specified by 72 respondents. Data were collected in person by the distributing questionnaires to number of respondents to obtain primary data. Analysis using path analysis. The result of the study is 1) The best medical support from the medical team ; 2) Perception of medical sales representatives to leader-member exchange (LMX) are better, it could increase job satisfaction directly; 3) Support organization is also better to have an impact on increasing organizational commitment; 4) Leader-member exchange (LMX) brings indirect effect on organizational commitment

Index Terms- Perceived organizational support, Leader-member exchange, job satisfaction, commitment organization

I. INTRODUCTION

Pharmaceutical companies are manufacturing companies that deal with the world of health. In the dissemination of its products the company established a working relationship with the hospital, doctors, pharmacies, and others. Medical sales representatives are the spearhead salespeople for the sales and distribution of products to health care organizations. Working mobility, making appointments, maintaining good relationships with doctors, pharmacies, hospitals and other healthcare services are the things that should be done by a representative medical sales. Attitude is a positive or negative feeling or mental state that

is always prepared, studied, and organized through experiences that have a special effect on one's response to people, objects, and circumstances (Gibson 1996: 144). Some employee attitudes to work and organization are an important part consisting of work motivation, work itself, work involvement, organizational commitment, responsibility (Kolman et al, 2007).

Job satisfaction is a common attitude of the individual to his work (Robbins, 2007). Organizational commitment is defined as a feeling of confidence and shared values with a person throughout the organization (Meyer and Allen 1991). Porter (Robbins, 2007: 95) argues that organizational commitment seems to be a better indicator because it represents a more global and lasting response to the organization as a whole rather than job satisfaction.

Organizational support is an employee's general belief that organizations value their contributions and care about their lives (Rhoades and Eisenberger, 2002). The inner work team consists of superiors and subordinates. Each organization has a leader and subordinates or followers with their main tasks and functions. Modern organizations usually already have vision and mission, and have set goals, objectives, and strategic steps agreed with the leadership and subordinates (Bennis et al., 1996). Leaders build a special relationship with their small group of subordinates (Robbins, 2007: 446). At the same time, subordinates reciprocally form a leader's self-schema through subordinate responses, either through individual reactions or group reactions (Luthans, 2006: 647).

Research on organizational support has generally been followed by two main streams until this era, first, focusing on the linkage between organizational support with organizational commitment, leader-member exchanges, and job satisfaction and secondly, focusing on the antecedents and consequences of organizational support.

Based on the background of the problems described above, then there are questions arised ; 1) Does organizational support have a direct effect on job satisfaction ? ; 2) Is the leader-member exchange (LMX) directly affecting job satisfaction ? ; 3) Does organizational support have an indirect effect on organizational commitment ? ; 4) Is leader-member exchange (LMX) having an indirect effect on organizational commitment?

II. LITERATURE REVIEW

Attitude and Behavior

Some theories seek to explain the formation and change of attitude. One theory holds that one "seeks fit between their beliefs and feelings toward the object" and "suggests that attitude change depends on either a change in feelings or beliefs. Robin (2007: 94) argues that these work-related attitudes pave the way for positive or negative evaluation that employees hold about aspects of their work environment. Most of the research in organizational behavior has focused on three attitudes: job satisfaction, work engagement, and commitment to the organization. However Laschinger (2003) states that organizational attitudes and behaviors are organizational commitment, job satisfaction, and trust to the organization.

Bhargava (2008) argues that when an organization provides employees with what employees are promised and respected, employees will respond in the form of positive attitudes and behaviors (commitment, job satisfaction, no intention to leave the organization and ordinary behavior) that helps an organization to achieve its goal.

Job satisfaction

Job satisfaction can be described as an individual evaluation of how well the work meets personal expectations and needs (McKenna, 2000), or, with a global approach, when employee feelings and emotions lead to their work experience (Price 2001). Mathis (2006: 121) explains that in the most basic sense, job satisfaction is a positive emotional state that results from the evaluation of one's work experience. Job dissatisfaction arises when one's expectations are not met. Locke (Luthans, 2006: 243) provides a comprehensive definition of job satisfaction that includes reaction or cognitive, affective, and evaluative attitudes and states that job satisfaction is a happy emotional state or positive emotion derived from a job assessment or a person's work experience.

Furthermore, Robbins (2007: 149) states that there are elements of job satisfaction commonly used in job satisfaction studies including "type of work, co-workers, benefits, treated with respect and fair, job security, opportunities to contribute ideas, wages, recognition of performance, and an opportunity to move forward.

Organizational Commitment

Organizational commitment is the degree to which an employee sides with a particular organization and its purpose, and intends to maintain its membership within the organization (Robbins, 2007). Organizational commitment has been conceptualized as a psychological state or mindset that binds individuals to an action relevant to one or more targets, and the willingness to persevere in an action (Cooper-Judge and Viswesvaran, 2005). Mathis (2006: 122) defines commitment as a level to where employees are confident and accepted organizational goals, and wishes to stay with the organization. As an attitude, organizational commitment is defined as (1) a strong desire to remain as a member of a particular organization; (2) a desire to strive to the best of the organization; and (3) certain beliefs, and acceptance of organizational values and goals. In other words, this is an attitude that reflects employees' loyalty to the

organization and the success and continuous progress (Luthans, 2006: 249)

Buchanan (Gibson, 1996: 315) says that commitment to the organization involves three attitudes: (1) Identification with organizational goals, (2) Feelings of involvement in organizational tasks, and (3) Feelings of loyalty to the organization. Organizational commitment includes the pride of members, loyalty of members, and the willingness of members to the organization. Organizational commitment can also be interpreted as an attitude that reflects the likes or dislikes of employees to the organization (Robbin, 2007). Allen and Meyer (Aube, 2007) share commitments in three dimensions that include affective commitment, normative commitment and sustainability commitments.

Organizational Support

Organizational support theory (OST) (Rhoades and Eisenberger, 2002) says that to meet socio-emotional needs and to assess the benefits of better employment, employees create perceptions about the conditions at which organizations value their contribution and care about life. Based on the theory, the development of POS is based on the tendency of employees to realize human-like organizational characteristics.

Organizational support theory also explains the underlying psychological processes resulting from perceived organizational support. First, reciprocity-based norms, POS should result in an obligation to care for the well-being of the organization and assist the organization in reacting to its objectives. Second, awareness, approval, and honor shown by POS must meet the socio-emotional needs, which make the worker use the membership of his organization and the status of his role as his social identity. Third, POS seeks to reinforce employees' beliefs that organizations recognize and giving reward higher work performance (i.e reward-performance expectations). This process creates good results for employees (i.e increased job satisfaction and positive mood) and for the organization (i.e increased affective and performance commitment, and reduced turnover) (Rhoades and R. Eisenberger, 2002).

Leadership Exchange Theory (Leader Member Exchange)

The LMX theory states that leaders treat each subordinate differently (Luthans, 2006: 646). Graen (Yukl, 2007: 141) develops relationships in the subordinate-dyad leadership described in life cycle models that have three possible stages. 1). The relationship begins with a preliminary test phase in which leaders and subordinates evaluate each other's motives and resource attitudes, and the potential resources that will be required, and the building of a shared role expectation. Some relationships never move beyond this first stage. 2). If this relationship continues into the second stage, exchange arrangements are cleansed, and mutual trust, loyalty and respect are developed. 3). Some exchange relationships move forward to the third stage (mature) where self-made exchange is transformed into a shared commitment to the mission of the work unit's goals.

Maslyn and Uhl-Bien (2001) further suggest that the influence, loyalty, and professional respect dimension is more than the social value that focuses on the social exchange between leaders and members, while the contribution dimension is more like a working relationship that focuses on the work-relationships

between leaders and members. Thus, a high "dominant-dominant" (work-related) exchanges tend to involve intensive interaction with task-related activities, while a "dominant exchange" (social exchange rate) tends to involve outside work, affective and personal interaction. As a result, LMX exchange rate differences tend to predict different work outcomes.

Conceptual Framework and Research Hypothesis

This study examines the effect of organizational support and leader-member exchange (LMX) on organizational attitudes and behavior (organizational satisfaction and commitment). The research framework, can be described as follow:

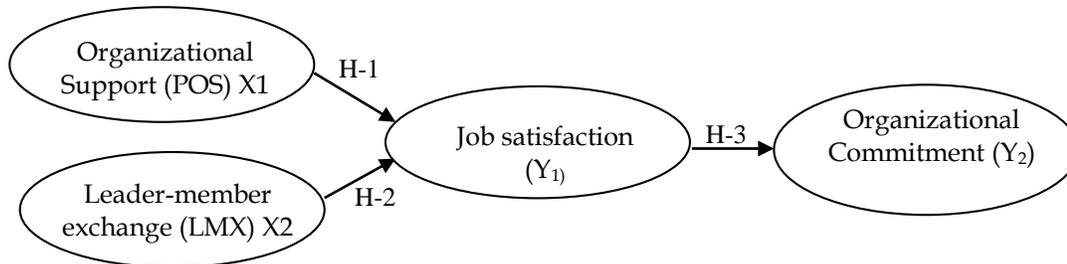


Figure 1. Concept Research Framework

Based on the problems and objectives of the study, as well as the study of theory and conceptual framework as described above, the research hypothesis can be formulated as follow : 1) Organizational support has a direct effect on job satisfaction; 2) Leader-member exchange (LMX) has direct effect on job satisfaction; 3) Organizational support has an indirect effect on organizational commitment; 4) Leader-member exchange (LMX) has an indirect effect on organizational commitment.

III. RESEARCH METHODS

Research Approach

The approach that will be used for this research is quantitative approach. Quantitative approach is used in this research because through that approach the process of research is done in a structured and using research samples that the number is relatively large enough as a representation or represent the description of the population studied.

Population and Sample Research

The population in this study represent representative medical sales at Government General Hospital in Surabaya. There are 2 (two) General Hospital with ownership of Surabaya Province local government that are dr. Soetomo and Haji General Hospital. The sampling technique, is accidental sampling.

Determination of samples according to Malhotra (1996) is at least four or five times the number of variables or attributes specified. The number of indicators in this study are 18 indicators, so the number of respondents is 4 times the number of indicators that is equal to 72 respondents.

Data Retrieval Method

This study is using primary data which is linked directly with research variables testing collected from respondents. Data were collected personally by distributing questionnaires to a number of respondents to obtain primary data.

Questions in the questionnaire are presented in the form of statements and scales to state the response. The statements contained in the questionnaire relate to respondents' perceptions of organizational support, member-member exchanges, and organizational attitudes and behavior.

Operational Definition of Variables

Organizational Support (X1)

Organizational support is a mechanism to fulfill socio-emotional needs and assess the benefits of performance improvement, employees create perceptions about the conditions at which the organization values its contribution and care about life. The indicators used are:

1. Reciprocity-based norms, organizational support should result in an obligation to care for the well-being of the organization and assist the organization in reacting to its objectives.
2. Care, agreement and honour which is which is shown by organizational support should fulfill emotional needs, which make the worker use the membership of his organization and the status of his role as his social identity.
3. Organizational support seeks to reinforce employees' belief that the organization recognizes and giving rewards an upward performance (i.e reward-performance expectations).

Leader-Member Exchange (Y1)

Leader-member exchange is defined as an assessment of the relationship and interaction between the supervisor (subordinate) and the subordinate shown by the degree of closeness of the relationship between the boss and the subordinate. The indicators of leader-member exchange used are :

1. Affection (affects), i.e the relationship of dyads to each other primarily based on interpersonal attraction, not based on work or professional values.
2. Loyalty, i.e expression of public support for the purpose and personal character of other LMX members. Loyalty involves a loyalty to an individual who is generally consistent from situation to situation
3. Contribution, i.e the perception of the current level of work-oriented activity puts each member forward each other toward the goal (explicit or implicit) of the dyads.
4. Respect Professionals, i.e perceptions of the extent to which each dyad member has built a

reputation, inside and / or outside the organization, from excelling in his line of work.

Organizational Attitudes and Behaviors (Y2)

Organizational attitudes and behaviors which consist of job satisfaction and organizational commitment are two of the most prominent in testing work and behavior attitudes in work and organization. Job satisfaction, and organizational commitment are used as dimensions that explain organizational attitudes and behaviors, as follow :

1. Job Satisfaction

What is meant by job satisfaction is an effectiveness or emotional response to various aspects of work.

2. Organizational commitment

Organizational commitment is a relatively strong identification and involvement of the organization, and the desire of members of the organization to maintain its membership in the organization and willing to make a high effort for the achievement of organizational goals.

Data analysis

Data analysis techniques used in research are descriptive statistical analysis techniques, and path analysis techniques .

Descriptive statistical analysis techniques used to describe the characteristics of each respondents in the study. The data collected is tabulated and descriptive. Descriptive measure is the provision of numbers, either in the number of respondents or in percentage form.

Analyzer used in this research is path analysis (path analysis), where tool can be used to know direct influence of exogenous variable to endogen variable.

IV. ANALYSIS AND DISCUSSION

Descriptive Analysis

Descriptive analysis conducted to determine the level of responses of respondents to the items of questions posed. By using SPSS 16.0 then got the result of analysis as follow : Organizational Support Respondents' results for each indicator on the variable support organization, presented in the following table:

Table 1
Descriptive Analysis Results Variable Organizational Support (X1)

| The general | Indicator | Respondents Response Score | | | | | | | | | | Mean | Leader-Member |
|-------------|--|----------------------------|---|---|-----|----|---|----|---|----|---|------|---------------|
| | | 1 | | 2 | | 3 | | 4 | | 5 | | | |
| | | F | % | F | % | F | % | F | % | F | % | | |
| | Norms of reciprocity (X _{1.1}) | - | - | 1 | 1,4 | 14 | 4 | 40 | 6 | 17 | 6 | 4,01 | |
| | Concern (X _{1.2}) | - | - | 1 | 1,4 | 17 | 4 | 43 | 7 | 14 | 4 | 3,97 | |
| | Approval (X _{1.3}) | - | - | 1 | 1,4 | 9 | 5 | 48 | 7 | 14 | 4 | 4,04 | |
| | Honor (X _{1.4}) | - | - | - | - | 10 | 9 | 48 | 7 | 14 | 4 | 4,05 | |
| | Recognition (X _{1.5}) | - | - | - | - | 10 | 9 | 42 | 3 | 20 | 8 | 4,13 | |
| | Reward (X _{1.6}) | - | - | 5 | 6,9 | 13 | 1 | 38 | 8 | 16 | 2 | 3,90 | |
| | Total Mean Organizational Support | | | | | | | | | | | 4,01 | |

respondent's perception on the variable of organizational support has successfully revealed that the respondent has concern, legal, moral and financial responsibility for the contribution given by the employee. This is seen in the mean total value generated by this variable is 4.01 which means in good score.

Exchange (LMX)

Respondents' results for each indicator on the variable support organization, presented in the following table:

Table 2
Results of Descriptive Analysis of Leaders-Member Exchange Variables (Y1)

| Indicator | Respondents Response Score | | | | | | | | | | Mean |
|-------------------------------|----------------------------|---|---|---|----|---|----|---|----|---|------|
| | 1 | | 2 | | 3 | | 4 | | 5 | | |
| | F | % | F | % | F | % | F | % | F | % | |
| Influence (Y _{1.1}) | - | - | - | - | 12 | 7 | 44 | 1 | 16 | 2 | 4,05 |
| Loyalty (Y _{1.2}) | - | - | - | - | 19 | 4 | 37 | 4 | 16 | 2 | 3,95 |

| | | | | | | | | | | | |
|---|---|---|---|---|----|---|----|---|----|----|------|
| Contribution (Y _{1.3}) | - | - | - | - | 11 | 3 | 43 | 7 | 48 | 25 | 4,09 |
| Professional Awards (Y _{1.4}) | - | - | - | - | 12 | 7 | 40 | 6 | 20 | 8 | 4,11 |
| Total Mean of Leaders Exchange | | | | | | | | | | | 4,05 |

The general respondent's perception on the leader member exchange (LMX) variable reveals that the interaction is done not only on the physical bond, where the subordinate must always follow the superior instruction, but more deeply the proximity between superiors and subordinates related to the emotional bond between the boss and subordinate. It appears that the total average value generated by this variable is 4.05 which means good.

**Organizational Attitudes and Behavior
 Job satisfaction**

Response of respondents for each indicator is presented in Table 4.3 below:

**Table 3
 Descriptive Analysis Results Variable Job Satisfaction (Y2)**

| Indicator | Respondents Response Score | | | | | | | | | | Mean |
|---|----------------------------|---|---|-----|----|---|----|---|----|---|------|
| | 1 | | 2 | | 3 | | 4 | | 5 | | |
| | F | % | F | % | F | % | F | % | F | % | |
| Salary or wages (Y _{2.1}) | - | - | - | - | 11 | 3 | 49 | 1 | 12 | 7 | 4,01 |
| Work (Y _{2.2}) | - | - | - | - | 11 | 3 | 48 | 7 | 13 | 1 | 4,02 |
| Promotional opportunities (Y _{2.3}) | - | - | - | - | 8 | 1 | 56 | 8 | 8 | 1 | 4,00 |
| Supervisor (Y _{2.4}) | - | - | - | - | 13 | 1 | 38 | 8 | 21 | 2 | 4,11 |
| Co-workers (Y _{2.5}) | - | - | 2 | 2,8 | 9 | 5 | 47 | 3 | 14 | 4 | 4,01 |
| Total Mean Job Satisfaction | | | | | | | | | | | 4,03 |

The general perception of respondents in this variable of job satisfaction revealed that satisfaction in the work is considered good, with the total average value generated by this variable is 4.03 which means good.

of members of the organization to maintain its membership in the organization and willing to make a high effort for the achievement of organizational goals. The results of the responses of respondents on organizational commitment appear in the following table:

Organizational Commitment

Organizational commitment is a relatively strong identification and involvement of the organization, and the desire

**Table 4
 Descriptive Analysis Results Variable Organizational Commitment (Y3)**

| Indicator | Respondents Response Score | | | | | | | | | | Mean |
|---|----------------------------|---|---|-----|----|---|----|---|----|---|------|
| | 1 | | 2 | | 3 | | 4 | | 5 | | |
| | F | % | F | % | F | % | F | % | F | % | |
| Confidence (Y _{3.1}) | - | - | 1 | 1,4 | 9 | 5 | 39 | 2 | 23 | 9 | 4,16 |
| Will (Y _{3.2}) | - | - | - | - | 11 | 3 | 49 | 1 | 12 | 7 | 4,01 |
| Desire (Y _{3.3}) | - | - | 2 | 2,8 | 11 | 3 | 45 | 5 | 14 | 4 | 3,98 |
| Total Mean Organizational Commitment | | | | | | | | | | | 4,05 |

Results of Path Analysis and Hypothesis Testing

Hypothesis testing is done by t-test on each path of partial direct influence. Path analysis is used to predict changes in the value of the dependent variable if the value of the independent variable increases or decreases. In this research, path analysis is used because the variables that become the topic in this study consist of two independent variables namely organizational support as variable X1 and leader-member exchange (X2), and two dependent variables consist of job satisfaction (Y1), and organizational commitment so that it can be known and can be proven how far the relationship between these variables.

Sub Sutructure Analysis 1A sub-structural analysis of 1 (one) will examine the direct influence of organizational support variables, and leader-member exchange (LMX) on job satisfaction. The relationship of sub-structure 1 can be seen in Figure 1 below:

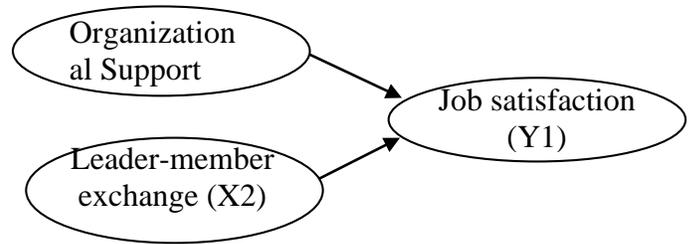


Figure 1. Sub-Structure Relationships X1 and X2 over Y1

In sub-structure 1, multiple linear regression analysis is used to know the influence of each exogenous variable to its endogenous variable.

**Table 5
 Model Summary - Sub Structure 1**

| Model | R | R square | Adjusted R Square | Std Error of the Estimated |
|-------|-------|----------|-------------------|----------------------------|
| 1 | 0,717 | 0,514 | 0,500 | 0,330 |

The magnitude of R square (r2) of 0.514 indicates that the influence of organizational support and leader-member exchange on job satisfaction is 51.4%, while the rest of 49.6% is influenced by other variables.

**Tabel 6
 Anova Model 1 – Sub Structure 1**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|-------|------------|----------------|----|-------------|--------|--------------------|
| 1 | Regression | 7.966 | 2 | 3.983 | 36,474 | 0,000 ^a |
| | Residual | 7.534 | 69 | .109 | | |
| | Total | 15.500 | 71 | | | |

The F value in Table 6 above is 36.474 with a significance level of 0.000 indicating that the regression model used is feasible or correct.

**Table 7
 Model Summary - Sub Structure 1**

| Model | | Unstandardized coefficient | | Standardized coefficient | t | Sign |
|-------|------------------------|----------------------------|-----------|--------------------------|-------|-------|
| | | B | Std error | Beta | | |
| 1 | Constant | 1,412 | 0,317 | | 4,461 | 0,000 |
| | Organizational support | 0,347 | 0,071 | 0,457 | 4,907 | 0,000 |
| | Leader-member exchange | 0,302 | 0,072 | 0,390 | 4,190 | 0,000 |

Table 7 above shows that the organization support variable (X1) has a t value of 4.907 with a significance of 0.000 < 0.005. This suggests that organizational support has a direct influence on job satisfaction. The result of path coefficient is 0.457 indicating the magnitude of the effect of organizational support on leader-member exchange is 0.457.

The leader-member exchange variable (X2) has a t value of 4.190 with a significance of 0.000 < 0.005. This suggests that leader-member exchanges have a direct influence on job satisfaction. The result of path coefficient is 0.390 which indicates the magnitude of the influence of leader-member's exchange on job satisfaction is 0.390.

Sub Sstructure Analysis 2

Substructure 2 is used to test the effect of organizational support (X1) and leader-member exchange (X2) directly on organizational commitment (Y2).

**Table 8
 Model Summary - Sub Structure 2**

| Model | R | R square | Adjusted R Square | Std Error of the Estimated |
|-------|-------|----------|-------------------|----------------------------|
| 1 | 0,713 | 0,508 | 0,486 | 0,439 |

The magnitude of R square (r²) of 0.508 indicates that the influence of organizational support and leader-member exchanges on organizational commitment is 48.6%, while the remaining 32.4% is influenced by other variables.

**Tabel 9
 Anova Model 1 – Sub Structure 2**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|-------|------------|----------------|----|-------------|--------|--------------------|
| 1 | Regression | 13,532 | 3 | 4,511 | 23,377 | 0,000 ^a |
| | Residual | 13,121 | 68 | 0,193 | | |
| | Total | 26,653 | 71 | | | |

The value of F in Table 9 above of 23,377 with a significance level of 0,000 indicates that the regression model used is feasible or correct.

**Table 10
 Model Summary - Sub Structure 2**

| Model | | Unstandardized coefficient | | Standardized coefficient | t | Sign |
|-------|------------------------|----------------------------|-----------|--------------------------|-------|-------|
| | | B | Std error | Beta | | |
| 1 | Constant | 0,200 | 0,478 | | 0,418 | 0,677 |
| | Organizational support | 0,234 | 0,109 | 0,235 | 2,145 | 0,036 |
| | Leader-member exchange | 0,355 | 0,17 | 0,350 | 3,309 | 0,001 |
| | Job satisfaction | 0,350 | 0,160 | 0,267 | 2,190 | 0,032 |

Table 10 above shown that organizational support variable (X1) has a t value of 2.145 with a significance of 0.036 < 0.005. This suggests that organizational support has a direct bearing on organizational commitment. The result of path coefficient is 0.235 which indicates the magnitude of the effect of organizational support on organizational commitment is 0.235.

Lead-member exchange variable (X2) has a t value of 3.390 with significance of 0.001 < 0.005. This suggests that leader-member exchanges have a direct influence on organizational commitment. The result of path coefficient is 0.350 which

indicates the magnitude of the effect of leader-member's exchange on organizational commitment is 0.390.

Job satisfaction variable (Y1) has a t value of 2.190 with a significance of 0.032 < 0.005. This shows that job satisfaction has a direct influence on organizational commitment. The result of path coefficient is 0.267 indicating the magnitude of the influence of leader-member's exchange on organizational commitment is 0.267.

Testing sub-structure 2 can also be seen in the following figure:

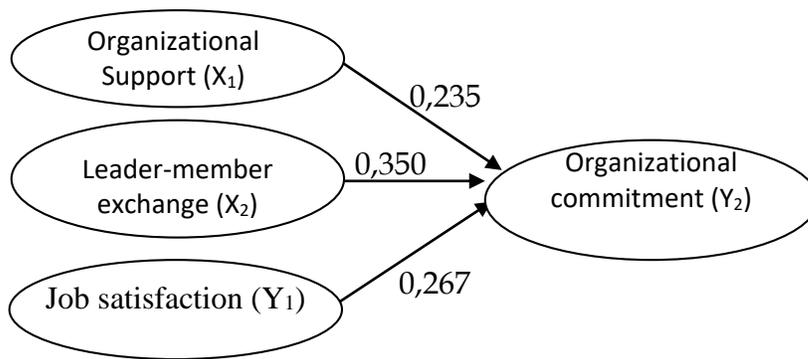


Figure 2. Results of Sub Structure Testing 2

Hypothesis testing

Based on calculations that have been done on sub-structure 1 and sub-structure 2, it can be obtained summary of results for testing the hypothesis as follows:

Table 11
 Summary of Path Coefficient Results

| Influence variables | of Influence | | Total |
|---------------------|--------------|-----------------------|-----------------------|
| | Direct | Indirect | |
| X1 → Y1 | 0,457 | | 0,457 |
| X2 → Y1 | 0,390 | | 0,390 |
| Y1 → Y2 | 0,267 | | 0,267 |
| X1 → Y1 → Y2 | 0,235 | 0,267 x 0,457 = 0,122 | 0,235 + 0,122 = 0,357 |
| X2 → Y1 → Y2 | 0,350 | 0,267 x 0,390 = 0,104 | 0,350 + 0,104 = 0,454 |

Based on Table 11 above, the path coefficient can be seen also in the following figure:

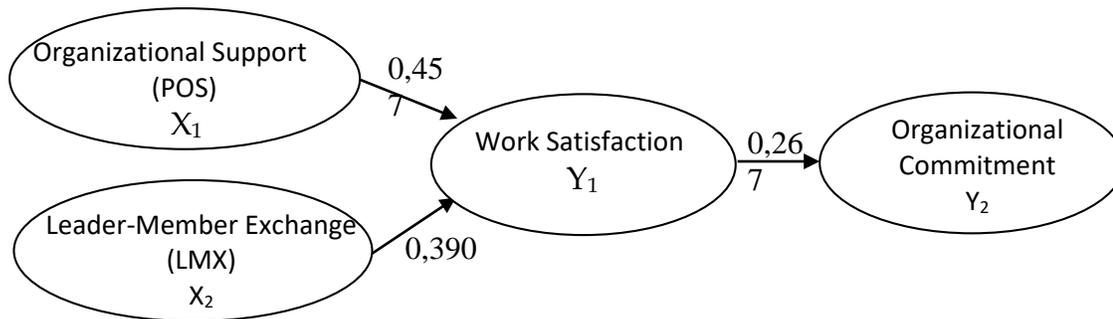


Figure 3. Results of Path Coefficients

V. DISCUSSION

The Effect of Organizational Support on Job Satisfaction

This hypothesis is to find out the improved quality of leader-member exchange predictable from increased organizational support. The result of path coefficient in this relationship is 0.457 (Table 11) and significant. This suggests that better organizational support will result in increased job satisfaction. This means that organizational support contributes greatly to the creation of job satisfaction.

Empirical conditions (descriptive analysis results) resulted in the recognition indicator as one of the parameters to measure the

organizational support variable has the highest descriptive mean value of 4.13 (Table 1) compared to other indicators in the organizational support variable. Recognition is an individual's socio-emotional need for the status of its role as part of the organization. With these averages, indicating that the employee's recognition by the company has done well.

Organizational support theory is oriented from the theory of social exchange which states that individuals voluntarily provide benefits to others, causing others to have an obligation to reciprocate by providing benefits to the giver. Organizational support can be enhanced by rewarding employees for their work

through media such as thanksgiving or small gifts (Andrew et al., 2009).

Based on above explanation, there are findings that support organization has been perceived either by the respondent can provide an increase in the satisfaction of medical sales representative job. These findings succeeded in proving the hypothesized relationship while enriching the limited findings of increased job satisfaction influenced by organizational support.

Effect of Leader-Member Exchange (LMX) on Job Satisfaction

This hypothesis is to find out an increase in leader-member exchange (LMX) on increasing job satisfaction. Empirical conditions (descriptive analysis results) brought the supervisor indicator as one of the parameters to measure job satisfaction variable has the highest descriptive mean value of 4.11 (Table 3) compared to other indicators in the organizational support variable. Supervision by the supervisor is a form of attention when the medical sales representative finds difficulties in the field.

The LMX theory illustrates how leaders develop different exchange relationships over time with various subordinates (Yukl, 2007: 140). This study is inconsistent with Andrew et al. (2009) brought in an insignificant relationship between LMX and employee satisfaction. This result is due to volunteer status so that the leader does not have legitimate power over the volunteers (e.g evaluation, compensation). Masterson's (2009) research was conducted on restaurant employees and stated that the quality of LMX relationships having a direct linear relationship with job satisfaction.

The descriptive analysis of leader-member exchanges (LMX) is shown by professional rewards with an average figure of 4.11 (Table 2). This indicates that in actual conditions leaders and members are able to create high exchange relationships so that members can feel appreciation from their superiors of their work professionally. The award can be a recommendation of salary increase, position, or recommendation in following job-related development program. Therefore this study is consistent with the theory that implicitly can be revealed that the exchange rate between superior and subordinate high will lead to subordinate job satisfaction.

The Effect of Organizational Support on Organizational Commitment Through Job Satisfaction

This study found that organizational support has a significant effect on organizational commitment through job satisfaction. This means both the good and bad of support organization provided by the company is able to increase job satisfaction which ultimately can increase organizational commitment. The amount of influence of organizational support to organizational commitment through job satisfaction is 0.357 (Table 11). This effect is smaller when compared to the direct influence of organizational support on organizational commitment of 0.457 (Table 7).

The results of this study are consistent with research conducted by Wood et al. (2003) who stated that high organizational support can increase organizational commitment through job satisfaction. The research was conducted on the employees of the School of Pathology (Speech-language pathologists (SLPs)) in the Midwest, USA. One hundred randomly

selected respondents in Illinois, Indiana, Iowa, Michigan, Minnesota, Wisconsin and Ohio. The results of this study reveal that perceptions of organizational support and high levels of job satisfaction can affect organizational commitment. Consistent with the research of Allen et al. (2003), that organizational support can increase organizational commitment through increased job satisfaction. This study shows that increased job satisfaction can increase organizational commitment as well.

The use of the same theory in different samples and locations gets the same result. This shows that job satisfaction successfully mediates the effect of organizational support on organizational commitment of employees to both service organizations and manufactures. Organizational support provided by pharmaceutical companies to medical sales representatives has been perceived well with a descriptive average of 4.03 able to provide job satisfaction so that it makes a representative sales representatives have a high commitment to the company. The findings succeeded in proving the hypothesized and consistent relationship with the research of its predecessor, and may enrich the findings of the effect of organizational support on organizational commitment mediated by job satisfaction on representative medical sales.

Effect of Leadership-Exchange (LMX) on Organizational Commitment Through Job Satisfaction

The study found that leader-member exchange (LMX) had a significant effect on organizational commitment through job satisfaction. This means that the high level of leader-member exchanges provided by the company can improve job satisfaction that ultimately can increase organizational commitment. The amount of influence of organizational support to organizational commitment through job satisfaction is 0.454 (Table 11). This result is higher than the direct influence of leader-member exchange on organizational commitment of 0.390 (Table 7).

Colins (2007) research was conducted for part-time and full-time employees at restaurants located in the Midwestern United States. The results revealed that the quality of leader-member exchanges can improve job satisfaction which further reduces the turnover intention. Ouyang et al. (2010) suspect that leader-member exchanges can affect organizational commitment through job satisfaction. The research instrument was distributed to 400 bank employees, securities and insurance companies in Taiwan using a seven-point Likert scale. Research has shown that keeping good relationships between managers and subordinates causes them to feel more satisfied in the job, making employees more willing to comply with organizational rules, and committed to the organization.

The results of this study are consistent with the results of the above research, that the higher the leader-member exchange rate, the better the level of job satisfaction that will ultimately impact on the increase of organizational commitment. The use of theories about the same research variables at different locations, as well as on different samples obtained the same research results.

VI. CONCLUSIONS AND SUGGESTIONS

Conclusion

Based on the results of the study, and the discussions that have been described in the previous chapter, the following conclusions can be drawn:

1. The better the support given by the company to the medical sales representative will be able to improve the satisfaction of the medical sales representative directly.
2. A representative representative medical representation of a better leader-member exchange (LMX) can increase job satisfaction directly. Supervision given by the superior directly perceived as a form of attention to subordinates, so it can help get problem solving if representative sales representatives have difficulty.
3. Improved organizational support also has an impact on increasing organizational commitment. This shows that job satisfaction mediates the relationship between organizational support and organizational commitment.
4. Leader-member exchange (LMX) has an indirect effect on organizational commitment. Improved leader-member (LMX) exchanges will have an effect on increased job satisfaction and result in increased organizational commitment.

Implications

The results of this study provide implications for the following:

1. Theoretical implications

- 1) The findings of this study, indicating that the theory of social exchange can be applied to the organization. Interaction patterns between individuals and other individuals in the company have an impact on increasing job satisfaction and organizational commitment. The interaction patterns as the result of this research is a favorable pattern of working relationships with one another.
- 2) The findings of this study enrich the results of research on the theory of social exchange. Job satisfaction, which is a reflection of the individual's attitude toward his work conditions, is capable of mediating to an increase in organizational commitment.
- 3) The theory of social exchange strengthens the relationships between individuals that form an interaction and produce an effort, to achieve balance in the relationship.

2. Practical implications

- 1) Giving rewards and loyalty between superiors and subordinates need to get the attention of the management. Reward is an indicator that motivates employees to enthusiasm in performing their duties as a representative medical sales while loyalty is the interaction of superiors and subordinates who must always be considered.
- 2) Growing the desire to remain an organization member by improving harmonious interrelationships between employees and organizations.

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The Influence of Work Environment and Compensation Towards Employee Job Satisfaction

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Abstract: The purpose of this research is to find out the influence of work environment and compensation, both partially and simultaneously, on employee job satisfaction of University X. The research was conducted on University X employees with a population of 2,722 people. Respondents of this research were all marketing division employees, all of them chosen by using Purposive Sampling, yielding as many as 145 respondents. Data collection was done by distributing questionnaires and the research method used was the Multiple Linear Regression Analysis. The results of this research indicates that the work environment has a positive and significant effect on employee job satisfaction, compensation has a positive and significant effect on employee job satisfaction, work environment and compensation simultaneously have a positive and significant effect on employee job satisfaction.

Keywords: Work Environment, Compensation, Job Satisfaction

I. INTRODUCTION

Working in company means that the employees work at the already set time. The work require also has put a lot of burden on the employees. Excessive work will make them become lazy and bored; coupled with working environment conditions that are not supportive and all monotonous, it can make them feel stressed in facing their work. If the environment is unstable and uncomfortable, the employees will experience boredom and discomfort that will influence the management of the company. So it is better to provide a work environment that can maximize the performance of the employees by making them feeling comfortable.

In addition to the work environment, the management needs to pay attention to compensation for employees as a reward for what they have done for the company. From the employees' point of view, compensation is still the strongest reason for someone to work. Employee salaries, in part, are based on the form of work they carry out. Salaries, wages, incentives, bonuses and commissions are examples of direct compensation. While indirect financial compensation can be in the form of various supports, health services, work environment, social security, and so on.

Regarding job satisfaction, each employee has a difference way of assessment due to its subjective nature. It also depends on differences in age, gender, education, and work experience. Job satisfaction seeks to measure affective responses to the work environment. Job satisfaction is related to how employees feel about the organization's expectations, such as rewards, and other similar things. Job satisfaction is seen as a happy or unhappy feeling that is relative, different from objective thinking and behavioral desires. Since satisfactions are related to one's feelings, then job satisfaction is defined as an attitude of employees that arise based on an assessment of the situation in which they work.

Based on mentioned background, the objective of this research is to find out the influence of the work environment and compensation both partially and simultaneously on employee job satisfaction of University X.

II. LITERATURE REVIEW

Work Environment

According to Davis & Newstrom (1996: 469), work environment is among the more obvious factors that can affect the behavior of workers are the physical conditions, including the level of lighting, the usual temperature, the level of noise, the amounts and the types of air chemicals and pollutants, and aesthetic features such as colors of walls and floors, and the presence of art work, music, plants decorative items.

According to Robbins and Coulter (2004: 95) work environment is an environment that refers to institutions or forces that are outside the organization and potentially affect organizational performance. In addition, work environment is a condition around the workplace both physically and non-physically which can give the impression of fun, securing, reassuring, and the impression of comfort at work and so on (Supardi, 2003: 37).

Herzberg (1968: 193-197) said that intrinsic 'Working Conditions' affect job satisfaction. Working conditions that are safe, comfortable, calm, and supported by adequate facilities and infrastructure will certainly make employees feel at home. With

comfortable working conditions employees will feel safe and be productive at work. The working conditions included in this category are the physical conditions of the workplace, the number of jobs or facilities available to do the work, which include ventilation, lights, equipment, work place, and work environment.

Compensation

According to Werther and Davis, cited by Hasibuan (2002: 119), "Compensation is what the employee receives in exchange of their work. Whether hourly wages or periodic salaries, personnel department usually designs and administers employee compensation."

Compensation is the total of all the benefits received by employees in lieu of the services they have provided, (Mondy, 2008: 4). Meanwhile, according to Handoko (2000: 155) compensation is everything that employees receive as a reward for their work. Based on the definitions stated above, it can be seen that the essence of the definition of compensation is reward/remuneration provided by an employer to someone who is paid in cash and other forms.

No organization can provide new and fresh spirit to its workforce or increase work productivity if it does not have a realistic compensation system. Compensation if used correctly will provide satisfaction for the employee himself, Herzberg (1968: 193-197).

Job satisfaction

According to Greenberg and Baron (2003: 148), job satisfaction is a positive or negative attitude of individuals towards their work.

According to Mathis (2006: 122), job satisfaction is a positive emotional state that is the result of evaluating one's work experience. Work dissatisfaction arises when someone's expectations are not met. For example, if an employee expects clean and safe working conditions for the job, the employee tends to be dissatisfied if the workplace is dirty and dangerous.

According to Robbins (2007: 79), job satisfaction can be defined as positive feelings towards their work resulting from evaluation of characteristics. Someone with a high level of job satisfaction holds positive feelings towards their work. While dissatisfied people hold negative feelings towards their work. Whereas according to Luthans (2006: 243), job satisfaction is the result of employee perceptions about how well their work provides things that are considered important.

Previous Research

Mukti Wibowo and Mochammad Al Musadieg, 2014. *The Effect of Work Environment on Employee Job satisfaction (A Study on Employees of PT. Telekomunikasi Indonesia Tbk. Kandatel Malang)*. The results showed that physical and non-physical work environment variables jointly had a significant effect on employee job satisfaction.

Septerina and Rusda Irawati, 2018. *The Effect of Compensation on Employee Job satisfaction at the Production Section at PT Etowa Packaging Indonesia*. The results showed that financial compensation variables significantly influenced employee job satisfaction, non-financial compensation variables also influenced employee job satisfaction, together both financial compensation and non-financial compensation affected employee job satisfaction.

Made Nensy Dwijayanti and A.A Sagung Kartika Dewi, 2015. *The Effect of Compensation and Work Environment on Employee Satisfaction at the Regional Water Supply Company Tirta Mangutama Bandung*. The results showed that compensation simultaneously and partially had a significant effect on employee job satisfaction, the work environment partially had a significant effect on employee job satisfaction, the work environment was a variable that was stronger than compensation for employee job satisfaction.

Fauzi, 2017. *The Effect of Compensation and Work Environment on Employee Satisfaction at PT Tor Ganda Medan*. The partial test results of compensation variables showed the most dominant significant influence on PT Tor Ganda Medan's job satisfaction, the work environment had a significant effect on PT Tor Ganda Medan's job satisfaction, the results of simultaneous testing of compensation variable and work environment variables simultaneously had a significant effect on variable related to job satisfaction of PT Tor Ganda Medan employees.

Frame of Thinking

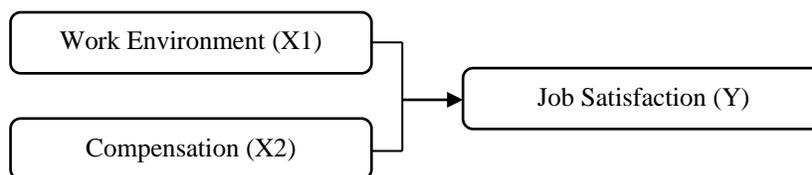


Figure 1: Frame of Thinking

III. RESEARCH METHODS

Research Design

This research only discusses matters relating to predetermined research variables which consisted of work environment and compensation towards employee job satisfaction. This research is a quantitative research where the data are in the form of numbers or qualitative data that are projected as numbers and it employs multiple linear regression analysis.

Population and Sample

This research used a type of purposive sampling, which is one of the non random sampling techniques where the researcher determines the sampling by specifying specific characteristics that are suitable with the objectives of the research so that it is expected to answer the research questions.

The populations of this research were all employees of University X, with a total of 2,722 employees. From those populations, the samples were taken only in the marketing division which amounted to 145 respondents.

Data Collecting Technique

According to Kriyantono (2010: 41), primary data are data obtained by the first data source or first hand in the field. Based on existing opinions, the writer took primary data, namely the main data obtained directly to be used in the research. The data collection techniques that were generated or obtained were done by distributing questionnaires. According to Anwar (2009: 168) questionnaire is a technique of data collection conducted by giving a number of questions or written statements about factual data or opinions related to the respondent's self, which are considered facts or truths that are known and need to be answered by the respondent.

Data Analyzing Technique

Validity Test

Validity test was used to determine the level of validity of the instrument (questionnaire) used in data collection. A questionnaire is said to be valid if the question in the questionnaire is able to express something that will be measured by the questionnaire (Ghozali, 2013: 52).

Reliability Test

Reliability testing was done to find out how accurate or similar the measurement results of twice or more attempts against the same symptoms using the same measuring device. A questionnaire can be said to be reliable or reliable if someone's answer to a question or statement is consistent or stable over time. (Ghozali, 2013: 47).

Multicollinearity Test

Multicollinearity test is used to find out whether in the regression model there was a correlation between independent variables. If there is a correlation, then there is a Multicollinearity (Multiko) problem. A good regression model should not have a correlation between independent variables (Santoso, 2010: 204).

Normality Test

The normality test is used to determine whether in a regression model, the residual value of the regression has a normal distribution. If the distribution of the residual values cannot be considered normal distribution, then it is said that there is a problem with the assumption of normality (Santoso, 2010: 210).

Heteroscedasticity Test

Heteroscedasticity test aims to test whether in the regression model there is an inequality of variance from the residual one observation to another observation. If the residual variance from one observation to another is fixed, then this is called Homokedasticity. And if the variance is different, it is called Heterocedasticity. A good regression model should not be heteroscedasticity (Santoso, 2010: 207).

Multiple Linear Regression Analysis

Multiple linear regression analysis is where the dependent variable is connected or explained by more than one independent variable, maybe two, three, and so on. But it still shows a linear relationship diagram. The general formula for multiple regressions is:

$$Y = a + b_1X_1 + b_2X_2 + e$$

Where:

- a = Constant Value
- b = Regression Coefficient
- Y = Dependent Variable (Job satisfaction)
- X₁ = Work Environment
- X₂ = Compensation
- e = error

T-test (Partial)

The level of significance used is 95%, so the level of precision or the limit of inaccuracy is (a) = 5% = 0.05. The t-test is intended to determine the level of significance of the effect of individual independent variables on the dependent variable. The criteria used are as follows:

- H₀ is accepted if the value of t count ≤ t table or sig value > a
- H_a is accepted if the value of t count ≥ t table or sig value < a

F-test (Simultaneous)

The F test is used to determine whether the two independent variables simultaneously influence the dependent variable. The criteria used are as follows:

- H_0 is accepted if the value of F count < F table or sig value > a
- H_a is accepted if the value of F count > F table or sig value < a

IV. RESEARCH RESULT AND DISCUSSION

Research Result

Validity Test Result

The results of the validity test ensure that the statement items used have valid values; this is because the value of the statement items shown in the Corrected Item Total Correlation (CITC) column has a value greater than r table. Processed data results where the value of r table = 0.3610 (N = 30, alpha = 5%) indicates that all indicators in the variable can be said to be valid.

The results of the validity test in detail can be seen in table 1 below.

Tabel 1: Validity Test Result

| Indicator | R-table | Corrected Item- Total Correlation | Result |
|-----------|---------|--------------------------------------|--------|
| LK1 | 0.361 | 0.644 | Valid |
| LK2 | 0.361 | 0.577 | Valid |
| LK3 | 0.361 | 0.742 | Valid |
| LK4 | 0.361 | 0.757 | Valid |
| LK5 | 0.361 | 0.446 | Valid |
| LK6 | 0.361 | 0.430 | Valid |
| LK7 | 0.361 | 0.467 | Valid |
| LK8 | 0.361 | 0.710 | Valid |
| LK9 | 0.361 | 0.647 | Valid |
| LK10 | 0.361 | 0.493 | Valid |
| K1 | 0.361 | 0.393 | Valid |
| K2 | 0.361 | 0.372 | Valid |
| K3 | 0.361 | 0.544 | Valid |
| K4 | 0.361 | 0.719 | Valid |
| K5 | 0.361 | 0.683 | Valid |
| K6 | 0.361 | 0.621 | Valid |
| K7 | 0.361 | 0.414 | Valid |
| K8 | 0.361 | 0.488 | Valid |
| K9 | 0.361 | 0.694 | Valid |
| K10 | 0.361 | 0.743 | Valid |
| KK1 | 0.361 | 0.379 | Valid |
| KK2 | 0.361 | 0.677 | Valid |
| KK3 | 0.361 | 0.610 | Valid |
| KK4 | 0.361 | 0.516 | Valid |
| KK5 | 0.361 | 0.537 | Valid |
| KK6 | 0.361 | 0.496 | Valid |
| KK7 | 0.361 | 0.576 | Valid |
| KK8 | 0.361 | 0.684 | Valid |
| KK9 | 0.361 | 0.642 | Valid |
| KK10 | 0.361 | 0.611 | Valid |
| KK11 | 0.361 | 0.444 | Valid |
| KK12 | 0.361 | 0.713 | Valid |
| KK13 | 0.361 | 0.467 | Valid |
| KK14 | 0.361 | 0.547 | Valid |
| KK15 | 0.361 | 0.648 | Valid |
| KK16 | 0.361 | 0.454 | Valid |
| KK17 | 0.361 | 0.605 | Valid |
| KK18 | 0.361 | 0.536 | Valid |

Data Source: SPSS Data Output, 2019

Reliability Test Result

Table 2 below shows that the results of Cronbach's Alpha are all above 0.60. Hence, it can be concluded that the data on the variable Work Environment (X1), Compensation (X2) and Job satisfaction (Y) are all reliable.

The results reliability test can be seen in table 2 below:

Tabel 2: Reliability Test Result

| Variable | Cronbach's Alpha | Cronbach's Alpha Standard | Result |
|-----------------------|------------------|---------------------------|----------|
| Work Environment (X1) | 0.869 | 0.60 | Reliable |
| Compensation (X2) | 0.856 | 0.60 | Reliable |
| Job Satisfaction (Y) | 0.905 | 0.60 | Reliable |

Data Source: SPSS Data Output, 2019

Multicollinearity Test Result

The results of multicollinearity test are presented in table 3 below:

Tabel 3: Multicollinearity Test Result

| Model | Tolerance | VIF |
|-----------------------|-----------|-------|
| Work Environment (X1) | 0.581 | 1.721 |
| Compensation (X2) | 0.581 | 1.721 |

a. Dependent Variable: Job satisfaction (Y)

Data Source: SPSS Data Output, 2019

Based on the data from the multicollinearity test, the results of the Tolerance score show that there are no variables that have a tolerance value of less than < 0.10 , which means there is no correlation between the independent variables with a value of 95%. The calculated VIF value is 1.721, so it can be concluded that the VIF value is < 10 , thus it can be concluded that there is no multicollinearity between the independent variables in the regression model.

Normality Test Result

The following residual normality test results were obtained by using statistical tests using the Kolmogorov-Smirnov test method, by looking at the Asymp.Sig value in the following table 4 below:

Tabel 4: Normality Test Result

| One-Sample Kolmogorov-Smirnov Test | | Unstandardized Residual |
|------------------------------------|----------------|-------------------------|
| N | | 145 |
| Normal Parameters ^{a,b} | Mean | 0.0000000 |
| | Std. Deviation | 6.05686592 |
| Most Extreme Differences | Absolute | 0.072 |
| | Positive | 0.035 |
| | Negative | -0.072 |
| Test Statistic | | 0.072 |
| Asymp. Sig. (2-tailed) | | 0.611 ^c |

Data Source: SPSS Data Output, 2019

If the probability is > 0.05 , then the distribution of the regression model is considered normal. Based on table 4 above, we can see the value of Asymp. The Sig is $0.611 > 0.05$ so it can be said that the residual data distribution is normal.

Heteroscedasticity Test Result

The results of the heteroscedasticity test are presented in table 5 below:

Tabel 5: Heteroscedasticity Test Result

| Coefficients ^a | |
|---------------------------|-------|
| Model | Sig. |
| (Constant) | 0.277 |
| Work Environment (X1) | 0.496 |
| Compensation (X2) | 0.225 |

a. Dependent Variable: Abs_RES

Data Source: SPSS Data Output, 2019

From the results of the above test, it can be seen that the significance value of the independent variable Work Environment is equal to $0.496 > 0.05$ and the independent variable Compensation is obtained at $0.225 > 0.05$. Thus, it can be concluded that there is no problem of heteroscedasticity in the regression model.

Multiple Linear Regressions Analysis Result

Multiple linear regression analysis is used to determine whether the primary data tested, namely the Work Environment and

Compensation has an influence on Employee Job satisfaction at University X. Based on the calculation of the data, we obtained the following result in table 6 below:

Tabel 6: Multiple Linear Regressions Analysis Result

| Model | Coefficients ^a | | |
|-----------------------|-----------------------------|------------|---------------------------|
| | Unstandardized Coefficients | | Standardized Coefficients |
| | B | Std. Error | Beta |
| (Constant) | 9.882 | 4.394 | |
| Work Environment (X1) | 0.372 | 0.129 | 0.203 |
| Compensation (X2) | 1.117 | 0.126 | 0.624 |

a. Dependent Variable: Job satisfaction (Y)

Data Source: SPSS Data Output, 2019

From table 6 above, the regression formula is obtained as follows:

$$Y = 9.882 + 0.372X_1 + 1.117X_2$$

The regression formula above can be explained as follows:

- Constant of 9,882 means that if the work environment variable (X1) and compensation (X2) is 0, then the value of job satisfaction (Y) is 9,882. The current job satisfaction of University X employees is 9,882 units, assuming that the working environment and compensation variables are currently constant.
- The regression coefficient of work environment variable (X1) is 0.372; meaning that if the other independent variables are fixed values and the work environment variable increases by 1 unit, then job satisfaction (Y) will increase by 0.372. The coefficient is positive, meaning that there is a positive relationship between the work environment and job satisfaction, the more the value of the work environment rises, the higher the value of employee job satisfaction.
- The compensation variable regression coefficient (X2) is 1.117; meaning if another independent variable is fixed and the compensation variable rises by 1 unit, then job satisfaction (Y) will increase by 1,117. The coefficient is positive, meaning that there is a positive relationship between compensation and job satisfaction, the more the compensation value rises, the higher the value of employee job satisfaction.

T-test (Partial) Result

Based on the results of data calculation, the following results of the t-test in table 7 are shown:

Tabel 7: T-test Result

| Model | Coefficients ^a | |
|-----------------------|---------------------------|-------|
| | T | Sig. |
| (Constant) | 2.249 | 0.026 |
| Work Environment (X1) | 2.887 | 0.004 |
| Compensation (X2) | 8.889 | 0.000 |

a. Dependent Variable: Job satisfaction (Y)

Data Source: SPSS Data Output, 2019

T-table can be searched in distribution table of t at 0.05/2 significance = 0.025 (2-tailed test) with df = n-k-1, where n is the number of respondents and k is the number of independent variables. So, df = 145-2-1 = 142, thus the t-table is 1.9766.

- First Hypothesis: Based on the results of the significance test of the Work Environment variable (X1), it was obtained a significant value at $\alpha = 0.05$ where the t-count value > t-table (2.877 > 1.9766) or value (Sig.) 0.004 < 0.05. This means that the influence of the work environment on job satisfaction of University X employees is significant. This also proves that the first hypothesis which states that the work environment has a positive and significant effect on employee job satisfaction at University X is proven to be acceptable.
- Second Hypothesis: Based on the results of the test of the significance of the Compensation variable (X2), we got a significant value at $\alpha = 0.05$ where the value is calculated > t-table (8.889 > 1.9766) or value (Sig.) 0.000 < 0.05. This means that the effect of compensation on job satisfaction of University X employees is significant. This also proves that the second hypothesis which states that compensation has a positive and significant effect on employee job satisfaction at University X is proven to be acceptable.

F-test (Simultaneous) Result

Data from the simultaneous test results (F-test) are presented in table 8 below:

Tabel 8: F-test Result

| ANOVA ^a | | | | | | |
|--------------------|------------|----------------|-----|-------------|---------|--------------------|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 7718.677 | 2 | 3859.338 | 103.739 | 0.000 ^b |
| | Residual | 5282.730 | 142 | 37.202 | | |
| | Total | 13001.407 | 144 | | | |

a. Dependent Variable: Job Satisfaction (Y)
 b. Predictors: (Constant), Compensation (X2), Work Environment (X1)

Data Source: SPSS Data Output, 2019

F-table can be found in the F distribution table at 0.05 significance with the provisions $df_1 = k-1$ or $3-1 = 2$, and $df_2 = n-k$ or $145-3 = 143$, where k is the number of variables. So, we obtained F table of 3.0593.

- Third Hypothesis: Based on the F-test results (Anova), it was found that the obtained F count was 103,739 greater than F table of 3.0593 and the level of significance simultaneously sig F was 0,000. This shows that simultaneously the independent variables in the research namely Work Environment (X1) and Compensation (X2) have a significant effect on the dependent variable of Job satisfaction (Y). This also proves that the third hypothesis which states that the work environment and compensation simultaneously have a positive and significant effect on employee job satisfaction at University X is proven to be acceptable.

Discussion

- The results of the first hypothesis test show that the work environment has a positive and significant effect on employee job satisfaction at University X. This finding is supported by the theory put forward by Robbins (2002: 36) that one of the factors influencing job satisfaction is the work environment, where job satisfaction is an attitude shown by employees to their work. Job satisfaction will be achieved if the work environment around the employee is considered such as spatial planning, cleanliness of the workspace, facilities, tools, temperature, and noise levels so as to create personal comfort and feeling of easiness of doing good work for employee. The results of this research are also in line with previous research by (Wibowo and Musadieq, 2014) which explains that the work environment has a positive and significant effect on employee job satisfaction. Based on the results of this research, it can be concluded that if the work environment variable is established well, it will have a positive impact on increasing employee job satisfaction. The environmental conditions in question are not only limited to comfort, security and workplace facilities, but also work procedures that are clear and easy to understand by employees.
- The results of the second hypothesis test show that compensation has a positive and significant effect on employee job satisfaction at University X. This finding is supported by Sofyandi's statement (2013: 162) that the purpose of providing compensation is to provide job satisfaction to employees, meaning if the company provides compensation that is in accordance with the expectations of employees, it will create job satisfaction. The results of this research are also in line with previous research by (Septerina and Irawati, 2018) which explains that compensation has a positive and significant effect on employee job satisfaction. Based on the results of this research, it can be concluded that if the compensation variable is given well, it will have a positive impact on increasing employee job satisfaction. The process of determining compensation needs to pay attention to fairness and feasibility requirements and be competitive with similar competitors, in the sense that the salary received is in accordance with the workload, giving incentives to increase work morale and providing overtime equitable so that employees will be happier and have satisfaction in their work.
- The results of the third hypothesis test show that the work environment and compensation simultaneously have a positive and significant effect on employee job satisfaction at University X. This is consistent with the theory stated by Nitisemito (2013: 75) which states that a good work environment will lead to feelings of satisfaction in employees so that they can give a positive influence on employee job satisfaction, then as revealed by Rivai (2009: 762) that one of the goals of compensation will be able to meet physical needs, social status and selfishness, in order to obtain job satisfaction from his position. The results of this research are in line with previous research by (Fauzi, 2017) which explains that the work environment and compensation simultaneously have a positive and significant effect on employee job satisfaction. Based on the results of this research, it can be concluded that if the work environment is good and compensation is given well, it will have a positive impact on increasing employee job satisfaction. If the work environment is good enough, the employee can work well too, as well as if the compensation by the institution is appropriate and fair so that employees feel satisfied with their work.

V. CONCLUSIONS AND RECOMMENDATIONS

Conclusion

The conclusions based on the analysis and discussions of this research are as follows:

1. The work environment has a positive and significant effect on employee job satisfaction at University X
2. Compensation has a positive and significant effect on employee job satisfaction at University X
3. Work environment and compensation simultaneously have a positive and significant effect on employee job satisfaction at University X

Recommendation

Based on the conclusions above, it is necessary to make improvements concerning the research conducted. As for suggestions for further research, it is expected that the results of this research can be used as a reference material or further research literature related to the variables under discussion, namely the work environment and compensation to employee job satisfaction, and it is expected that further research can use dimensions in the opinion of other experts so that later they can know what dimensions have the maximum effect on employee job satisfaction. In addition, further research can use different research objects with a wider scope and even more samples.

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Changing Trend of Central Venous Access in Adult Cancer Patients in A Tertiary Care Hospital- A Single Center Experience

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Abstract- Central venous access is common procedure for long term medication in oncology patients. Various options are available with each having its benefits and risks associated. A study with aim to see the change in trend in central venous access in adult cancer patients at our institute comparable with international standards was performed over a period of one year for patients who had central venous access. All central venous access procedures done in adult cancer patients were included. Number of patients, primary cancer histology and site and complications after each procedure were observed and analyzed. Total number of patients, gender, frequency and type of malignancy and method of central venous access along with its complications were observed. A rise in referrals for port A catheter in the last 6 months with decreasing referrals for PIC and broviac catheters was noted former having least complications.

Index Terms- Central venous access, Interventional radiology, Port A catheter, Cancer patients

I. INTRODUCTION

Central venous catheter also called as central line is frequently used for long term therapy in cancer patients. Catheters can be placed in upper limb veins or central veins. Peripherally inserted central catheters also known as a [PICC line](#) is inserted through superficial veins in the arms. Various types of central catheters are available depending upon the use and indication including broviac lines, tunneled catheters, implanted port A catheters, dialysis catheters, PICC line etc. Common uses of central venous catheters include administration of long-term medicine treatment for pain, infection or [cancer](#) and to supply [nutrition](#) ^[1]. All central lines have their own associated early and late complications.

Cancer patients need regular, intermittent and long term IV access at various stages of treatment. Certain drugs cannot be used by routine peripheral venous access owing to potential serious damage to skin and tissue in case of extravasation ^{[4][5]}. Further continuous chemotherapy infusion (more than 24 hours or more) can collapse peripheral veins making conditions more worsen ^[1].

A PICC line (Fig.1) is the most common way to gain central venous access utilizing brachial or cephalic venous access to place a long catheter. It may stay for many weeks to months. There may be one or more lumens on the PICC depending upon clinical requirement. The catheter and the skin around it will need care and regular flushing ^[6].

A port A catheter is implanted central venous catheter (Fig.2) It has a small chamber/central port made of plastic or metal connected with a central catheter up to superior vena cava (SVC) with a self-sealing diaphragm to be accessed with a special non-boring needle.

In adult cancer patients only PICC lines were inserted by our interventional radiology department in our institute and broviac lines by anesthesia department in Operation Theater. Since we started offering implanted port A catheter insertion on elective basis from April 2016 we performed a study to look for change in trend of central venous catheter on the basis of complications and trust of our referring peers.

II. MATERIALS AND METHODS

In our department we conducted this single center retrospective study after institutional review board approval by usual pathway. The study was done for all the adult cancer patients were reviewed who underwent central venous catheter insertion in the hospital including the interventional radiology department and operation theater by anesthesia team over a period of one year between 15-10-2016 to 14-10-2017. Electronic records including procedure details and follow up physician notes were reviewed for any potential complications related to procedure in early course of time. Few of the patients underwent central venous catheter insertion twice as well during the study period due to complications. All male and female patients were included in the study. We divided the study in two halves, the initial six months was the time period when we were offering only PICC line insertion in the interventional radiology services and broviac line placement was done the anesthesia team in Operation Theater and the later six months when we started offering implanted ports in interventional radiology. PICC lines and broviac lines were still being used during the latter half of the study period. We compared the frequency of increase in implanted ports insertion and reduction in number of PICC lines

and broviac catheter placement between the two halves of study to look for change in trend of the central venous access. Number of patients, gender, primary malignancy on the basis of histology and complications associated were observed and analyzed.

III. RESULTS

A total of 297 adult cancer patients had central venous access during one year of study period. Out of these 181(61%) patients were males and 116(39%) were females with male predominance in both halves of study (Fig.3). Commonest primary malignancy was lymphoma followed by adenocarcinoma of upper and lower gastrointestinal tract, osteosarcoma of the limbs remained third in frequency. Breast cancer, squamous cell carcinomas and multiple myeloma cases were less in number (Fig.4).

During the first six months of study duration 137 underwent central venous access procedures, 116 (84.7%) patients underwent PICC line insertion in interventional radiology suit and broviac catheter insertion was done in 21(15.3%) patients by anesthesia team in Operation Theater. Port

A catheter insertion was started in second half (later six months of the year) by interventional radiology team. 160 patients underwent central venous access during later six months out of which 68(42.5%) patients had port A catheter insertion, PICC line insertion in 76(47.5%) and 16(10%) had broviac line insertion of which one was done by interventional radiology and 15 in operation theater by anesthetist (Fig.5).

Various complications associated with various lines were observed during the two halves of the study and compared. In the first half patient who underwent PICC line insertion developed deep venous thrombosis (DVT), PICC line got infected or dislodged the line within two months after insertion. Various factors were observed related to these complications especially while handling and use of the line. No complications were seen with broviac lines. In the later half none of the patient who underwent implanted port insertion developed any complication. Few patients who had PICC line insertion either on emergency basis or electively had dislodged PICC line or it got infected (Fig.6).

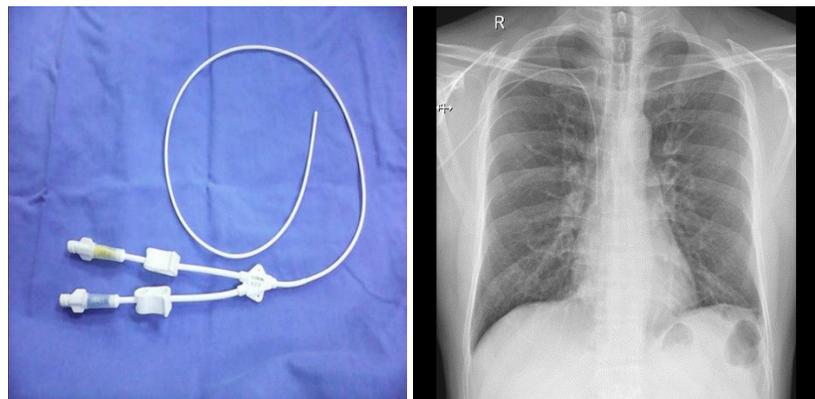


Fig.1 (A) Double lumen PICC line mostly used in our department (B) PICC line in place

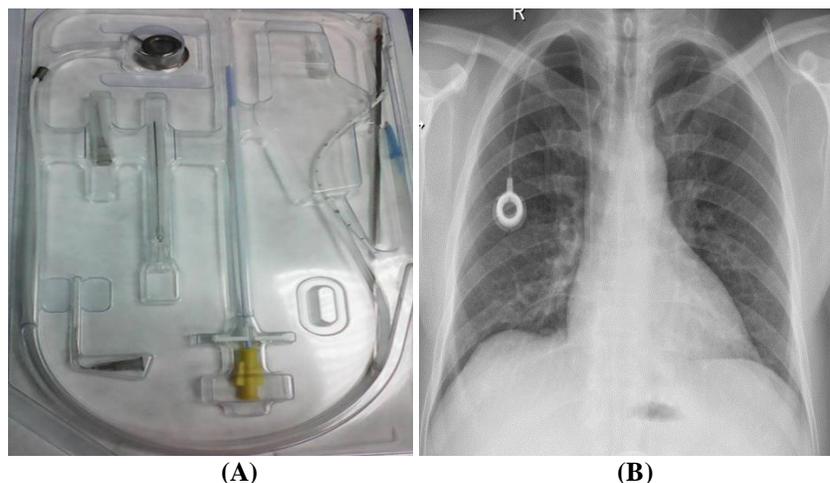


Fig.2 (A) Implanted port A catheter set with Huber needle (B) Implanted Port A catheter in place

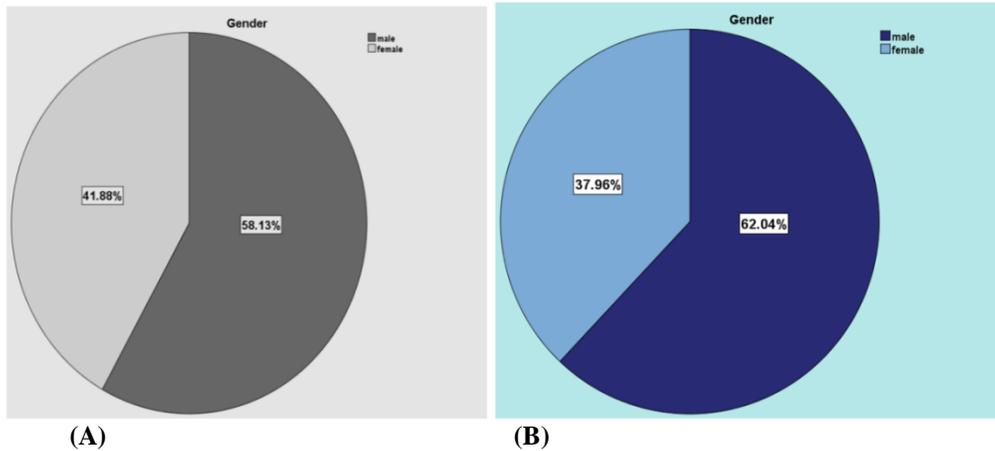


Fig.3 Percentages of male and female patients who underwent central venous access showing male predominance (A) first six months (B) later six months.

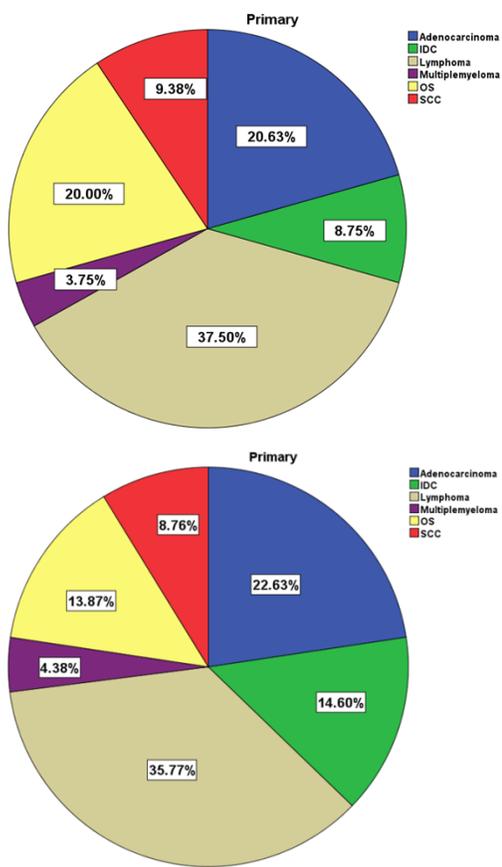
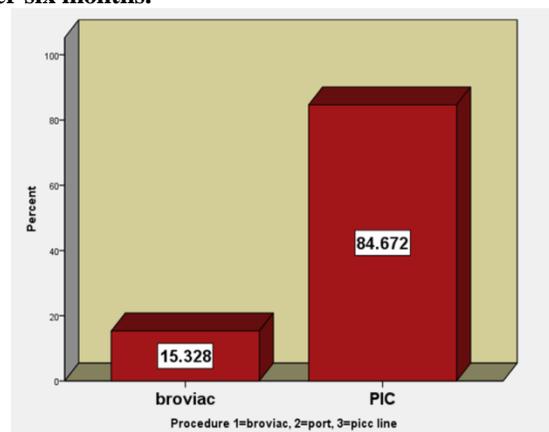
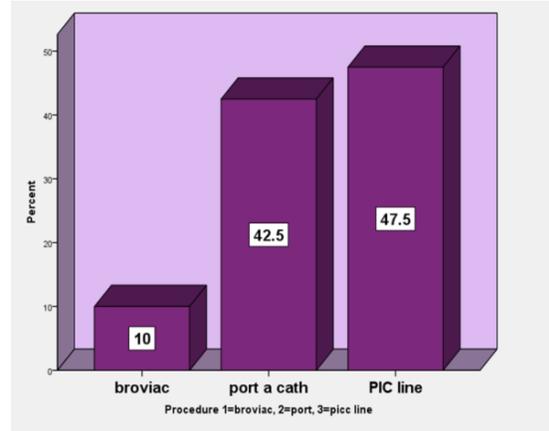


Fig.4 Percentages of patients who underwent central venous access on the basis of primary cancer histology (A) first six months(B) later six months.



(A)



(B)

Fig.5 Graphic representation of percentage of patients who underwent various central venous lines during one year(A) first half of study period(B) later six months of study duration

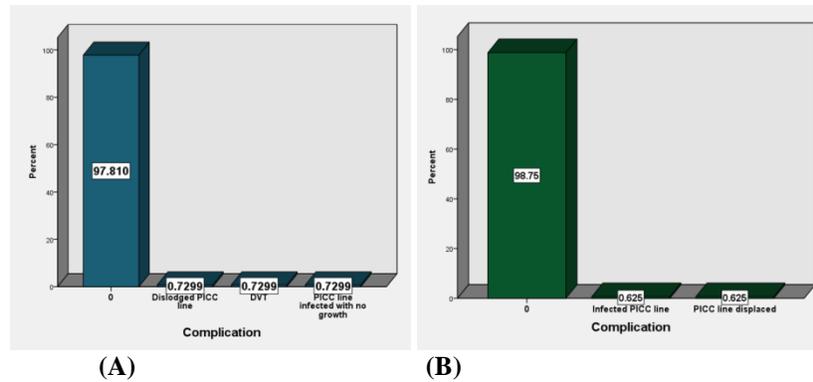


Fig.6 Graphic representation of percentage of complications with PICC lines (A) when only PICC lines and borviac lines were being offered (B) after port A catheter insertion.

IV. DISCUSSION

Central venous access remains one of the essentials procedures in cancer patients for their proper intravenous chemotherapy. Various options are available for central venous access all having own benefits and risks/complications associated with them. Implanted port A catheters remain most reliable way to get central access they being almost complication free for longer duration and easy to handle. PICC lines can be used as emergency alternative.

V. CONCLUSION

Since central venous access by various lines is common procedure done in most of adult cancer patients owing to their long term intravenous chemotherapy and repeated blood sampling over a period of months to years, implant ports remain complication free and most effective method of central venous access.

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Situational Underlying Value (SUV) – A Single Statistic for Individual Performance in Major League Baseball

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Abstract- Baseball's traditional litany of statistics have been displaced by many different statistics, often combined via convoluted formulas as to their meaning and overall use. It possible to assign some fraction of a run to each base and number of outs per inning the "run expectancy" concept), I developed one single statistic that encompasses all to measure an individual player's performance that encompasses both hitting and fielding for position players, including the combined performance, and pitching. The "Situational Underlying Value" (SUV) statistic is based on the "run expectancy" concept. This article develops the SUV concept for baseball, demonstrates its use, then summarizes a "proof of principle" exercise that analyzed one-third of one team's full season (i.e., 54 of 162 games) to compare the SUV ranking of the individual players to the more traditional statistics. Hitting and fielding for position players are analyzed separately and then as a combined measure; pitching is first analyzed on a "simplified" basis, then in more detail as part of the defensive analysis that accompanies fielding. Basing both offense (hitting) and defense (fielding), as well as pitching, on a single, all-encompassing statistic enables these aspects of performance, usually treated separately, to be treated together, enhancing the ability to compare individual performance. As an extension, it is envisioned that the SUV could be used in fantasy baseball circles as well, eliminating the need to combine different statistics in an arbitrary way to determine fantasy outcome.

Index Terms- Run Expectancy, Seasonal Comparison, Proof of Principle

I. INTRODUCTION

SUV – Situational Underlying Value – for professional baseball (MLB) is a concept based on the more traditional one of "run expectancy." This is a statistical estimate of the number of runs expected to result from a base runner or multiple runners given his/their presence at a particular base, or bases, and the number of outs in an inning. Numerous baseball websites discuss this concept, e.g., References 1 through 4. One can find dozens more with a simple internet search on "run expectancy." For my development of the SUV statistic, I employ Reference 1, since this provides the raw data from which the run expectancies were calculated (see Table 1):

Expected Runs/Chance of Scoring Table

The following table [Table 1] was produced from play-by-play data from every Major League baseball game played between 1984 and 1994. Shortened innings and extra innings are not included. The table gives the expected number of runs (column headed "Expected") that will score given a particular state in the inning, given by the number of outs ("Outs") and the runners on base ("Runners"). Numbers under the "Runners" column tell which bases are occupied. The column headed "Prob > 0" gives the probability that a team will score at least one run in that inning. Raw data used to produce the expected values are given in the final three columns. (Data from Project Scoresheet/Baseball Workshop, courtesy David Nichols)

II. FROM RUN EXPECTANCY TO SUV

The first three columns of Table 1 are the ones of interest, and I display them in a matrix format in Table 2, but to four significant figures given the raw data from the "count" and "total runs" columns. The first part of Table 2 lists the run expectancies for bases empty cases per number of outs. This implies that each inning is theoretically worth 0.4947 run (the ([0, 0] entry in the first table), from which the incremental run expectancy, which we subsequently term the SUV, for each bases empty case becomes -0.2320, -0.1639 and -0.0988, respectively. The second part of Table 2 lists the run expectancies for multiple men on base per number of outs. To develop SUVs

from these run expectancies, I scale each to the run expectancy for its corresponding bases empty case to yield the following SUVs (e.g., for the runner on 1st with no out, the SUV = $0.08800 - 0.4947 = 0.3853$). The results are displayed in two parts in Table 3.

Table 3 implies, e.g., that a leadoff single is worth 0.3853 run, while making the first out always deducts 0.2320 run (and maybe more if there are base runners). Ideally, the SUVs for individual bases would sum to their multi-base counterparts, e.g., with no outs and runners on 1st and 2nd, $0.3853 + 0.6344 = 1.0197$ would equal 1.0020. In reality, this is not exactly the case, as shown in Table 4 (based on sums of individual SUVs). However, the differences are uniformly small (none greater than ~6%, as shown in Table 5). From here on, restrict all SUVs to just two significant figures, which reduces the two SUV matrices to the values shown in Table 6. Table 7 shows the final results after adjusting the SUVs for the individual bases slightly.¹ As shown in Table 8, the differences with the multi-base SUVs becomes even smaller, no greater than ~3%. For example, the sum of the SUVs for 1st and 2nd separately with no outs = $0.39 + 0.63 = 1.02$, which is only $(1.02 - 1.00)/1.00 = 0.02$ or 2.00% higher. On average, the difference (absolute values) is only 1.36%. Thus, the SUVs as slightly adjusted in Table 7 are considered final.

Table 1. Major League Baseball Data by Outs and Base Runners from 1984 through 1994 (See Reference 1)

| Outs | Runners | Expected | Prob > 0 | Count | Total Runs | Shutout |
|------|---------|----------|----------|--------|------------|---------|
| 0 | --- | 0.49 | 0.275 | 377390 | 186702 | 273565 |
| 0 | 1-- | 0.88 | 0.435 | 97684 | 85966 | 55235 |
| 0 | -2- | 1.13 | 0.633 | 29342 | 33131 | 10768 |
| 0 | 12- | 1.50 | 0.636 | 21978 | 32895 | 7994 |
| 0 | --3 | 1.37 | 0.837 | 5360 | 7333 | 871 |
| 0 | 1-3 | 1.75 | 0.870 | 9845 | 17210 | 1284 |
| 0 | -23 | 1.98 | 0.860 | 5571 | 11011 | 781 |
| 0 | 123 | 2.37 | 0.882 | 5233 | 12419 | 617 |
| 1 | --- | 0.26 | 0.159 | 270279 | 70996 | 227329 |
| 1 | 1-- | 0.52 | 0.276 | 112521 | 58731 | 81420 |
| 1 | -2- | 0.69 | 0.414 | 52502 | 36227 | 30789 |
| 1 | 12- | 0.92 | 0.425 | 39375 | 36031 | 22649 |
| 1 | --3 | 0.96 | 0.667 | 18798 | 18020 | 6257 |
| 1 | 1-3 | 1.17 | 0.653 | 19988 | 23348 | 6942 |
| 1 | -23 | 1.40 | 0.686 | 14152 | 19800 | 4443 |
| 1 | 123 | 1.57 | 0.678 | 13474 | 21175 | 4339 |
| 2 | --- | 0.10 | 0.067 | 215735 | 21306 | 201378 |
| 2 | 1-- | 0.23 | 0.128 | 113013 | 25469 | 98497 |
| 2 | -2- | 0.33 | 0.224 | 64639 | 21275 | 50176 |
| 2 | 12- | 0.44 | 0.231 | 50463 | 22358 | 38792 |
| 2 | --3 | 0.38 | 0.275 | 27006 | 10272 | 19583 |
| 2 | 1-3 | 0.50 | 0.286 | 25826 | 13007 | 18447 |
| 2 | -23 | 0.61 | 0.277 | 15357 | 9304 | 11100 |
| 2 | 123 | 0.76 | 0.321 | 16281 | 12332 | 11060 |

III. WORKING WITH THE SUV: PART 1 – HITTING AND SIMPLIFIED PITCHING

Working with the SUV is best demonstrated via examples. In the first, the assumed inning proceeded as follows: initial out, single, sacrifice bunt (runner to 2nd), single (with RBI) and final out, leaving a runner at 1st. As shown in the first part of Table 9, all runs are earned and the individual batter SUVs are -0.23, 0.22, -0.15, 0.89 and -0.22, respectively, for an inning total of -0.51. The second example is more involved, starting with an error that

¹ Further simplification to one significant figure is also possible and would minimize potential changes to the SUV tables if the run expectancies were to be re-evaluated following each season. While this is not done in this article, the results of such a simplification are shown immediately below Table 7 just for illustration.

places a runner at 2nd, followed by an out, base on balls (runners now on 1st and 2nd), force out at 2nd (runner now at 1st and 3rd), double (with 2 RBIs), wild pitch (runner to 3rd), hit batter (runner additionally now at 1st), stolen base (runner to 2nd), error (runner on 3rd scores, runner advances to 3rd, plus runner now at 1st) and finally the third out (stranding runners at 1st and 3rd). The progression of SUVs is best revealed in the second part of Table 9, with the total of 2.51 including an unearned portion of 0.14.

Table 2. Run Expectancies from Table 1

| base→ outs↓ | 3 | 2 | 1 | 0 |
|----------------|--------|--------|--------|---------|
| 0 | 1.3681 | 1.1291 | 0.8800 | -0.4947 |
| 1 | 0.9586 | 0.6900 | 0.5220 | -0.2627 |
| 2 | 0.3804 | 0.3291 | 0.2254 | -0.0988 |

| bases→ outs↓ | 123 | 23 | 13 | 12 |
|-----------------|--------|--------|--------|--------|
| 0 | 2.3732 | 1.9765 | 1.7481 | 1.4967 |
| 1 | 1.5715 | 1.3991 | 1.1681 | 0.9151 |
| 2 | 0.7574 | 0.6058 | 0.5036 | 0.4431 |

Table 3. Run Expectancies (now SUVs) Scaled by Corresponding Bases-Empty Case

| base→ outs↓ | 3 | 2 | 1 | 0 |
|----------------|--------|--------|--------|---------|
| 0 | 0.8734 | 0.6344 | 0.3853 | -0.2320 |
| 1 | 0.6959 | 0.4273 | 0.2593 | -0.1639 |
| 2 | 0.2816 | 0.2304 | 0.1266 | -0.0988 |

| bases→ outs↓ | 123 | 23 | 13 | 12 |
|-----------------|--------|--------|--------|--------|
| 0 | 1.8785 | 1.4818 | 1.2534 | 1.0020 |
| 1 | 1.3089 | 1.1364 | 0.9054 | 0.6524 |
| 2 | 0.6587 | 0.5071 | 0.4049 | 0.3443 |

Table 4. Multiple-Base Runner SUVs from Sums of Individual Base Runner SUVs

| bases→ outs↓ | 123 | 23 | 13 | 12 |
|-----------------|--------|--------|--------|--------|
| 0 | 1.8931 | 1.5078 | 1.2587 | 1.0197 |
| 1 | 1.3826 | 1.1233 | 0.9552 | 0.6866 |
| 2 | 0.6386 | 0.5120 | 0.4082 | 0.3570 |

Table 5. Differences between Actual Multiple-Base Runner SUVs and Those from Sums of Individual Base Runner SUVs

| bases→ outs↓ | 123 | 23 | 13 | 12 |
|-----------------|-------|--------|-------|-------|
| 0 | 0.78% | 1.76% | 0.42% | 1.77% |
| 1 | 5.63% | -1.16% | 5.50% | 5.24% |

| | | | | |
|-------------------------|------------|-----------|-----------|-----------|
| bases→ outs↓ | 123 | 23 | 13 | 12 |
| 2 | -3.05% | 0.96% | 0.82% | 3.68% |

Table 6. SUVs Limited to Two Significant Figures (from Table 3)

| | | | | |
|------------------------|----------|----------|----------|----------|
| base→ outs↓ | 3 | 2 | 1 | 0 |
| 0 | 0.87 | 0.63 | 0.39 | -0.23 |
| 1 | 0.70 | 0.43 | 0.26 | -0.16 |
| 2 | 0.28 | 0.23 | 0.13 | -0.10 |

| | | | | |
|-------------------------|------------|-----------|-----------|-----------|
| bases→ outs↓ | 123 | 23 | 13 | 12 |
| 0 | 1.88 | 1.48 | 1.25 | 1.00 |
| 1 | 1.31 | 1.14 | 0.91 | 0.65 |
| 2 | 0.66 | 0.51 | 0.40 | 0.34 |

Table 7. Final SUVs after Minor Adjustments (Including Reduction to One Significant Figure, for Illustration Only)

| | | | | |
|------------------------|-------------|-------------|-------------|--------------|
| base→ outs↓ | 3 | 2 | 1 | 0 |
| 0 | 0.87 | 0.63 | 0.39 | -0.23 |
| 1 | 0.68 | 0.44 | 0.22 | -0.16 |
| 2 | 0.29 | 0.23 | 0.12 | -0.10 |

| | | | | |
|------------------------|------------|------------|------------|-------------|
| base→ outs↓ | 3 | 2 | 1 | 0 |
| 0 | 0.9 | 0.6 | 0.4 | -0.2 |
| 1 | 0.7 | 0.4 | 0.2 | -0.2 |
| 2 | 0.3 | 0.2 | 0.1 | -0.1 |

Table 8. Final Differences between Actual Multiple-Base Runner SUVs and Those from Sums of Individual Base Runner SUVs (based on Table 7)

| | | | | |
|-------------------------|------------|-----------|-----------|-----------|
| bases→ outs↓ | 123 | 23 | 13 | 12 |
| 0 | 1.89 | 1.50 | 1.26 | 1.02 |
| 1 | 1.34 | 1.12 | 0.90 | 0.66 |
| 2 | 0.64 | 0.52 | 0.41 | 0.35 |

| | | | | |
|-------------------------|------------|-----------|-----------|-----------|
| bases→ outs↓ | 123 | 23 | 13 | 12 |
| 0 | 0.53% | 1.35% | 0.80% | 2.00% |
| 1 | 2.29% | -1.75% | -1.10% | 1.54% |
| 2 | -3.03% | 1.96% | 2.50% | 2.94% |

Table 9. SUV Examples

| <u>Example 1</u> | <u>Earned</u> | <u>Unearned</u> | <u>Batter SUV</u> |
|------------------|---------------|-----------------|-------------------|
| Out | -0.23 | | -0.23 |
| 1B | 0.22 | | 0.22 |
| Sac | -0.15 | | -0.15 |
| 1B/RBI | 0.89 | | 0.89 |
| Out | -0.22 | | -0.22 |
| Sum | 0.51 | 0 | 0.51 |
| Total | 0.51 | | |

| <u>Example 2</u> | <u>Earned</u> | <u>Unearned</u> | <u>Batter SUV</u> |
|----------------------|---------------|-----------------|-------------------|
| E/Runner to 2B | -0.23 | 0.86 | -0.23 |
| Out | -0.42 | | -0.42 |
| BB | 0.22 | | 0.22 |
| GO/Runner to 3B | -0.41 | | -0.41 |
| 2B/2 RBI | 1.82 | | 1.82 |
| WP/Runner to 3B | 0.06 | | |
| HBP | 0.12 | | 0.12 |
| SB | 0.11 | | |
| E/1 Run/Runner to 3B | -0.62 | 1.51 | -0.62 |
| Out | -0.51 | | -0.51 |
| Sum | 0.14 | 2.37 | 0.14 |
| Total | 2.51 | | |

GO = Ground out SB = Stolen base

Table 10. SUV Examples with Formulas

| <u>Example 1</u> | <u>Earned</u> | <u>Unearned</u> | <u>Batter SUV</u> |
|------------------|-------------------------|-----------------|-------------------|
| Out | -0.23 | | -0.23 |
| 1B | 0.22 | | 0.22 |
| Sac | =0.23-0.22-0.16 | | -0.15 |
| 1B/RBI | =1.00-0.23+0.12 | | 0.89 |
| Out | =-0.12-0.10 | | -0.22 |
| Sum | =SUM(above) | =SUM(above) | =SUM(above) |
| Total | =Earned+Unearned | | |

| <u>Example 2</u> | <u>Earned</u> | <u>Unearned</u> | <u>Batter SUV</u> |
|------------------------|----------------------------------|----------------------------------|-------------------|
| E/Runner to 2B | =-0.23 | =0.63-Earned | -0.23 |
| Out | =0.44-0.63-0.23 | | -0.42 |
| BB | =0.22 | | 0.22 |
| <i>GO/Runner to 3B</i> | <i>=0.29+0.12-0.44-0.22-0.16</i> | | <i>-0.41</i> |
| <i>2B/2 RBI</i> | <i>=0.23+2.00-0.29-0.12</i> | | <i>1.82</i> |
| WP/Runner to 3B | =0.29-0.23 | | |
| HBP | =0.12 | | 0.12 |
| SB | =0.23-0.12 | | |
| E/1 Run/Runner to 3B | =-0.29-0.23-0.10 | =1.00-0.29+0.29-0.23+0.12-Earned | -0.62 |
| Out | =-0.29-0.12-0.10 | | -0.51 |

| | | | |
|--------------|-------------------------|-------------|-------------|
| Sum | =SUM(above) | =SUM(above) | =SUM(above) |
| Total | =Earned+Unearned | | |

Table 10 displays the formulas used to calculate each of the SUVs in the two examples from Table 9. For example, in Example 2, the **fourth batter (bold italicized)** hit into a ground out with runners on 1st and 2nd with one out, forcing the runner going into 2nd for the second out. From the SUV matrix, runners at 1st and 3rd with two outs are worth 0.29 and 0.12, respectively. Eliminating a runner at 2nd with one out deducts 0.44 (thus, a net decrease in moving him from 2nd to 3rd at the expense of an out = 0.44 – 0.29 = 0.15). Eliminating a runner at 1st with one out deducts 0.22 (and, since he disappears entirely due to the force, this is the net decrease). Finally, adding the second out deducts 0.16. The net results of all of this is -0.41, as shown. The **fifth batter (also bold italicized)** doubled, driving in both runners, for 2.00 runs and an SUV for being on 2nd with two outs of 0.23. Eliminating the runners at 1st and 3rd with two outs deducted 0.29 and 0.12, respectively. Thus, this batter's total SUV became 1.82. Finally, in the first example, one run was scored, so the net SUV = 1.00 – 0.49 = 0.51. In the second, three runs scored for a net of 3.00 – 0.49 = 2.51, of which 2.37 was unearned. A run scored is always worth 1.00.

A. Real Game Examples

The expanded box scores from two different games in Tables 11 and 12 illustrate full use of the SUV statistic, including pitching. The first game was a Washington National 3-0 victory over the Chicago Cubs at Wrigley Field on May 27, 2015. The second was Game 7 of the 2016 World Series where the Cubs ended their 108-year drought with an 8-7 victory over the Cleveland Indians in 10 innings. For batters, the more positive the SUV, the better. For pitchers, the more negative, the better.

A.1 Summary

Since both example games involved the Cubs, we can estimate a cumulative SUV for players who participated in both games as shown in Table 13. Since there were several, only the following four will be examined: Rizzo, Bryant, Ross and Lester (a pitcher). For a batter, any plate appearance, including walks, hit by pitch, etc., is a “play.” For a pitcher, a “play” is an inning.

Considering the three batters, we see Rizzo with a positive cumulative SUV over three times higher than the next best, which is Ross, although his average SUV is a bit less than double that of Ross. Bryant clearly is in the rear in both. If evaluating player performance over an entire season, one would have to judge Rizzo as best, although Ross, with a lower cumulative SUV due to less “plays,” still was productive when he played. Lester would be compared to other pitchers, for whom negative SUVs are desirable, and would be seen as productive both cumulatively and on average.

B. League-Dependent SUV

An interesting wrinkle is to assign SUVs by league, considering that the National still refuses to use the Designated Hitter. Reference 5 notes that “Using data from 2011-2013, the American League [AL] had an expected value of 0.4830 runs/inning ..., while the National League [NL] had 0.4468 runs/innings ...” Thus, the NL scored $0.4468/0.4830 = 0.9251$ or ~7.5% less runs than the AL. Assuming both leagues played an equal (or essentially equal) number of innings over the three seasons, the MLB average runs/inning is the average of those for each league, i.e., $MLB = (AL + NL)/2$. Since $NL = 0.9251 AL$, $AL = \frac{2}{1+0.9251} \times MLB = 0.5091$, for the MLB average of 0.49. The corresponding value for the NL is 0.4709. Rounding these to two significant figures (0.51 and 0.47), we see that the adjustment to the MLB average is ~4%, an increase for the AL and a decrease for the NL.² Again working with just two significant figures, the SUVs for the two leagues are now shown in Table 14. With these, it is possible to revise the two games to be specific to their leagues (treating the World Series game as an AL game since Cleveland was the home team and both teams use the DH).

IV. “PROOF OF PRINCIPLE:” PART 1 – HITTING AND SIMPLIFIED PITCHING

The goal of the “Proof of Principle” is to track the performance of an individual team over a substantial portion of an entire season. One-third of the 2017 season, i.e., 54 games, have been selected for the Seattle Mariners, starting with Game 002 and tracking every third game up through Game 161, as listed in Table 15. The

² $AL Adjustment = 0.51/0.49 \approx 1.04; NL Adjustment = 0.47/0.49 \approx 0.96.$

SUVs are based on the play-by-play descriptions provided in Reference 6. The SUV analyses for all 54 games are provided in Reference 7, with a roll-up of cumulative SUVs every six games. The following, accompanied by Table 16, is an example of one such analysis.

Each hitter from Segura through Valencia had the number of “opportunities” totaled in the “Ops” column, i.e., appearances at the plate as a hitter which resulted in an outcome for that hitter (or the rare case where a pinch runner made a direct change himself to the SUV). His total SUV for the game is shown in the “SUV” column, with his average SUV per Opportunity for the game calculated in the “Avg” column. For example, Cano had five opportunities with a total SUV of 2.10, for an Average of $2.10/5 = 0.420$, indicating a productive day where each appearance was worth 0.420 on average. The next three columns are labeled similarly, but include a “+” symbol to indicate that these are cumulative for the season through this game. The row “SUV” shows the total per inning (always the number of runs minus 0.49, including the “*unearned*” SUV [*italicized in the next row*]), followed by the totals for Ops and SUV for the game (42 and 1.42 in this example), the Average per Op for the team for the game ($1.42/34 = 0.034$ for this example), and the cumulatives for these through this game (1909, 8.55, and $8.55/1909 = 0.004$, respectively). Anything *italicized* indicates an SUV attributable to an error, passed ball (PB), or catcher’s interference (CI), which is tracked for the team and highlighted for that player who receives no credit toward his SUV due to the error and for whom the SUV is calculated as if the error had not occurred, i.e., he had made the out. For the Mariners in this game, there was an “unearned” SUV of 0.17 in the seventh inning, involving both Gamel and Heredia. The game and cumulative totals for these (0.17 and 16.42 in this example [*italicized*]) are also tracked. Finally, the total SUVs for the game (1.59, based on the Mariners scoring six runs over nine innings, i.e., $6 - [9][0.49] = 1.59$, equal to $1.42 + 0.17 = 1.59$) and cumulatively ($8.55 + 16.42 = 24.97$) are highlighted in **bold**. (In the rare case where a hitter batted twice in one inning, this is shown in a bolded box and included both Ops [e.g., see Game 059 in Reference 7; June 6, 2017; Minnesota-3 @ Seattle-12; Zunino batted twice in the third inning, leading off with a single but also making last out for a total SUV over two Ops of $0.39 - 0.10 = 0.29$].)

The SUVs are similarly tracked for the pitchers, although not by individual hitter faced unless the pitcher worked only part of an inning (Hernandez and Albers in the fifth, Albers and Lawrence in the sixth). Each pitcher’s “Innings Pitched” (“IP” column) are tracked for the game along with his SUV (“SUV” column) and Average per inning pitched (“Avg” column). For example, Hernandez pitched 3.33 innings, with a total SUV of 1.37 for an Average per IP of $1.37/3.33 = 0.411$, not a very productive outing. The pitcher’s cumulative totals for these are tracked in the last three columns with the “+” symbols. The “SUV” row shows the totals per inning, again amounting to the number of runs yielded, including the “unearned” SUV tracked below in *italics*, minus 0.49. The totals for IP and SUV follow, with the team’s Average per IP next, and finally the cumulatives for these three. As can be seen, the fourth inning was particularly bad for the Mariners, yielding seven runs with an SUV of $7 - 0.49 = 6.51$, of which 1.27 was attributed to the “unearned” variety (while Hernandez was pitching, and not counted against him). The opponent scored a total of eight runs, for a total SUV = $8 - (9)(0.49) = 3.59$, shown in **bold**, of which 1.27 was “unearned” (equal to $2.32 + 1.27 = 3.59$). Cumulatives for these follow (2.62 and 22.43 [“unearned”] for a total of 25.05, shown in **bold**).

Table 17 summarizes the cumulative SUVs for hitting and pitching for the 54 games analyzed. These are compared in Section 6.1 against “traditional” statistics representing the entire 2017 for the Seattle Mariners. It is important to note the following caveat. Since only 54 of the total 162 games have been analyzed for SUV, any “insights” regarding individual players should be taken with “a grain of salt” as merely illustrative as if the entire season had been analyzed for SUV. As will be shown in Section 6.1 for Ramirez, if the selected games happened to correspond to atypically better or poorer performances by the player than what transpired over the entire season, the “insights” may be biased by the limited selection. While 1/3 of the season is considered to be a significant sample for analysis, it remains possible that atypical player performance has been highlighted. All subsequent “insights” are intended to be illustrative only, not necessarily reflecting deviations from any individual player’s overall performance, either better or worse.

Table 11. Complete SUV Analysis for Washington Nationals (3) at Chicago Cubs (0), May 27, 2015

| Team | Hitter | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | Total | | |
|----------------|----------------|--------|-------|--------|-------|--------|-------|--|--------|--------|-------|-------------------------------|----------|---------------------|------------------|-------------------|-------|--------------------------------|----------|------------|----------|----------|
| | | AB | SUV | AB | SUV | AB | SUV | AB | SUV | AB | SUV | AB | SUV | AB | SUV | AB | SUV | AB | SUV | AB-R-H-RBI | SUV | |
| Washington | Span | out(K) | -0.23 | | | 1b | 0.12 | | | dp | -0.78 | | | 1b | 0.22 | | | reach 1st on error (Castro)*** | -0.16 | 5-0-2-0 | -0.83 | |
| | Desmond | 1b | 0.22 | | | out | -0.22 | | | 2b | 0.23 | | | out(K) | -0.26 | | | 1b | 0.44 | 5-0-3-0 | 0.41 | |
| | Escobar | out(K) | -0.26 | | | | | 1b | 0.39 | out | -0.33 | | | out | -0.22 | | | on after force out at 2nd | -0.41 | 5-1-1-0 | -0.83 | |
| | Harper | out(K) | -0.22 | | | | | bb | 0.63 | | | hr | 1 | Russell pitching -- | bb | 0.39 | | out(K) | -0.51 | 3-1-2-1 | 1.29 | |
| | Zimmerman | | | out(K) | -0.23 | | | holder's choice (force out at 2nd) + reach on throwing error (Russell, A) which allows run to score* | -0.35 | | | out(K) | -0.23 | Motte pitching -- | out | -0.4 | | | | | 4-0-0-0 | -1.21 |
| | Ramos | | | out | -0.16 | | | bb | 0.44 | | | out(K) | -0.16 | | | out(K) | -0.26 | | | | 3-0-0-0 | -0.14 |
| | Ugla | | | out | -0.1 | | | out(K) | -0.47 | | | reach 1st on error (Castro)** | -0.1 | | | out | -0.22 | | | | 4-0-0-0 | -0.89 |
| | Grace (8) | | | | | | | | | | | | | | | | | | | | | |
| | Janssen (8) | | | | | | | | | | | | | | | | | | | | | |
| | Moore | | | | | out | -0.23 | | out(K) | -0.45 | | | out | -0.22 | | | | | | | 3-0-0-0 | -0.90 |
| | Taylor (8) | | | | | | | | | | | | | | Wood pitching -- | | | out(K) | -0.23 | | 1-0-0-0 | -0.23 |
| | Scherzer | | | | | out(K) | -0.16 | | | | 1b | 0.39 | | | out | -0.23 | | | | | 3-0-1-0 | 0.00 |
| | Espinosa (8) | | | | | | | | | | | | | | | | hr | 1 | | | 1-1-1-1 | 1.00 |
| | R-H-E & SUV | 0-1-0 | -0.49 | 0-0-0 | -0.49 | 0-1-0 | -0.49 | | 1-1-2 | 0.19 | 0-2-0 | -0.49 | | 1-1-1 | 0.29 | 0-1-0 | -0.49 | 0-0-0 | -0.49 | 1-2-1 | 0.13 | 37-3-9-2 |
| | | | | | | | | unearned | 0.32 | | | | unearned | 0.22 | | | | | unearned | 0.38 | unearned | 0.92 |
| | | | | | | | | total | 0.51 | | | | total | 0.51 | | | | | total | 0.51 | total | -1.41 |
| Chicago | Coghlan | out(K) | -0.23 | | | out(K) | -0.4 | | | out(K) | -0.16 | | | | | | | | | | 3-0-0-0 | -0.79 |
| | Soler (8) | | | | | | | | | | | | | Grace pitching -- | 2b | 0.63 | | | | | 1-0-1-0 | 0.63 |
| | Rizzo | out(K) | -0.16 | | | 1b | 0.44 | | | out | -0.1 | | | | hbp | 0.39 | | | | | 3-0-1-0 | 0.57 |
| | Bryant | bb | 0.12 | | | out | -0.47 | | | | | out(K) | -0.23 | Janssen pitching -- | out | -0.59 | | | | | 3-0-0-0 | -1.17 |
| | Fowler | out(K) | -0.22 | | | out(K) | -0.45 | | | | | out(K) | -0.16 | | | sac | -0.3 | | | | 3-0-0-0 | -1.13 |
| | Castro | | | 1b | 0.39 | | | out(K) | -0.23 | | | 1b | 0.12 | | | out | -0.62 | | | | 4-0-2-0 | -0.34 |
| | Lake | | | out | -0.4 | | | 2b + SB (2 out) | 0.5 | | | out(K) | -0.22 | | | Score pitching -- | | out | -0.26 | | 4-0-1-0 | -0.38 |
| | Ross | | | out | -0.26 | | | out(K) | -0.37 | | | | | out | -0.23 | | | | | | 3-0-0-0 | -0.86 |
| | Montero (7) | | | | | | | | | | | | | | | | | out(K) | -0.22 | | 1-0-0-0 | -0.22 |
| | Lester | | | out | -0.22 | | | out(K) | -0.39 | | | | | | | | | | | | 2-0-0-0 | -0.61 |
| | Baxter (PH-7) | | | | | | | | | | | | | | out(K) | -0.16 | | | | | 1-0-0-0 | -0.16 |
| | Russell, J (8) | | | | | | | | | | | | | | | | | | | | | |
| | Motte (8*) | | | | | | | | | | | | | | | | | | | | | |
| | Wood (9) | | | | | | | | | | | | | | | | | | | | | |
| Herrera (PH-9) | | | | | | | | | | | | | | | | | 1b | 0.39 | | 1-0-1-0 | 0.39 | |
| Russell, A | | | | | 1b | 0.39 | | | | out(K) | -0.23 | | | out(K) | -0.1 | | | out | -0.4 | | 4-0-1-0 | -0.34 |
| R-H-E & SUV | 0-0-0 | -0.49 | 0-1-0 | -0.49 | 0-2-0 | -0.49 | | 0-1-0 | -0.49 | 0-0-0 | -0.49 | | 0-1-0 | -0.49 | 0-0-0 | -0.49 | 0-1-0 | -0.49 | 0-1-0 | -0.49 | 33-0-7-0 | -4.41 |
| Team | Pitcher | IP | H | R | ER | BB | SO | SUV | | | | | | | | | | | | | | |
| Washington | Scherzer (W) | 7 | 6 | 0 | 0 | 1 | 13 | -3.43 | | | | | | | | | | | | | | |
| | Grace | 0 | 1 | 0 | 0 | 0 | 0 | 1.02 | | | | | | | | | | | | | | |
| | Janssen (H) | 1 | 0 | 0 | 0 | 0 | 0 | -1.51 | | | | | | | | | | | | | | |
| | Storen (S) | 1 | 1 | 0 | 0 | 0 | 1 | -0.49 | | | | | | | | | | | | | | |
| | Total | 9 | 8 | 0 | 0 | 1 | 14 | -4.41 | | | | | | | | | | | | | | |
| Chicago | Lester (L) | 7 | 7 | 2 | 1 | 2 | 10 | -1.97 | | | | | | | | | | | | | | |
| | Russell, J | 0 | 0 | 0 | 0 | 1 | 0 | 0.39 | | | | | | | | | | | | | | |
| | Motte | 1 | 0 | 0 | 0 | 0 | 1 | -0.88 | | | | | | | | | | | | | | |
| | Wood | 1 | 2 | 1 | 1 | 0 | 2 | 0.13 | | | | | | | | | | | | | | |
| | Unearned | | | | | | | 0.92 | | | | | | | | | | | | | | |
| Total | 9 | 9 | 3 | 2 | 3 | 13 | -1.41 | | | | | | | | | | | | | | | |

See <http://espn.go.com/mlb/playbyplay?gameid=350527116> for complete play by play.

* Batter assumed to erase runner from 1B, advance runner to 3B, and reach 1B without error (double play not assumed)

** Batter assumed to make third out without error

*** Batter assumed to make second out without error

Table 12. Complete SUV Analysis for Chicago Cubs (8) at Cleveland Indians (7) in 10 Innings, Game 7 of 2016 World Series

| Team | Hitler | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | Total | | | | |
|-------------------|----------------|-------------------------|-------|-------------------------|-------|-----------------------|-------|------------------------|-------|--|--------|---------|---------------------|--------------------------|-------|--------|------------------|---------------------|------------------------|---|---------------------------------|---------------------------|-----------------------|---------|---------|-------|
| | | AB | SUV | AB | SUV | AB | SUV | AB | SUV | AB | SUV | AB | SUV | AB | SUV | AB | SUV | AB | SUV | AB | SUV | AB-R (0-0-0) | SUV | | | |
| Chicago Cubs | Fowler | hr | 1.00 | | | out | -0.16 | Miller pitching -- | | 1b | 0.39 | | | 1b | 0.39 | | | out | -0.39 | | | 5-1-3-1 | 1.23 | | | |
| | Schwarber | 1b (steals 2b w/2 outs) | 0.50 | | | 1b (out @ 2b) | -0.10 | | | dp | -0.78 | | | out | -0.40 | | | | | | 1b | 0.39 | 5-0-3-0 | -0.39 | | |
| | Almora (PR-10) | | | | | | | | | | | | | | | | | | | | | | 0-1-0-0 | 0.00 | | |
| | Bryant | out | -0.40 | | | | | | 1b | 0.39 | | | | dp (K + caught stealing) | -0.48 | -- | Allen pitching | | | | out (runner to 2b) | -0.18 | 4-2-1-0 | -0.55 | | |
| | Rizzo | out | -0.26 | | | | | hbp | 0.63 | 1b (runner scores + reach 2b) | 1.11 | | | | | out(K) | -0.23 | | | | bb | 0.22 | 3-1-1-1 | 1.47 | | |
| | Zobrist | out | -0.33 | | | | | out (force @ 2b) | -0.35 | out | -0.33 | | | | | out | -0.16 | | | | 2b (runner @ 1b to 3b) | 1.46 | 5-1-1-1 | 0.29 | | |
| | Russell | | | out | -0.23 | | | out fly (runner to 2b) | 0.17 | | | out | -0.23 | | | out | -0.1 | | | | | bb | 0.22 | 3-0-0-1 | -0.17 | |
| | Contreras | | | out | -0.16 | | | 2b | 1.00 | | | | | | | | | | | | | | | 2-0-1-1 | 0.84 | |
| | Ross (5) | | | | | | | | | | | hr | 1.00 | | | | | | | | bb | 0.39 | | 1-1-1-1 | 1.39 | |
| | Coghlan (PR-9) | | | | | | | | | | | | | | | | | | | | | | | | 0-0-0-0 | 0.00 |
| | Menters (9) | | | | | | | | | | | | | | | | | | | | | | 1b (all runners - 1b) | 1.00 | 1-0-1-1 | 1.00 |
| | Hayward | | | out | -0.10 | | | out | -0.33 | | | out | -0.16 | | | | | | | out (force @ 2b, steals 2b on Shaw, to 3b on E) | -0.18 | Runner pitching -- out(K) | -0.86 | 5-0-0-0 | -1.63 | |
| | Baez | | | | | out | -0.23 | | | hr | 1.00 | out(K) | -0.10 | | | | Shaw pitching -- | | | out(K) | -0.55 | out | -0.74 | 5-1-1-1 | -0.62 | |
| R-I-E & SUV | 1-2-0 | 0.51 | 0-0-0 | -0.49 | 0-1-0 | -0.49 | 2-2-0 | 1.51 | 2-3-0 | 1.51 | 1-1-0 | 0.51 | 0-1-0 | -0.49 | 0-0-0 | -0.49 | | 0-0-1 | -0.73 | 2-3-0 | 1.51 | 38-8-13-8 | 2.86 | | | |
| | | | | | | | | | | | | | | | | | | | unearned | 0.24 | | | unearned | 0.24 | | |
| | | | | | | | | | | | | | | | | | | | total | -0.49 | | | total | 3.10 | | |
| Cleveland Indians | Santana | out | -0.23 | | | 1b | 0.54 | | | bb (scores from 1b on wp w/2 outs) | 0.83 | | | out (runner to 2b) | -0.15 | | | out | -0.23 | | | | 4-1-1-1 | 0.76 | | |
| | Kipnis | out(K) | -0.16 | | | E/1b + runner to 2b** | -0.17 | Lester pitching -- | | 1b (reach 2b on E; runner to 3rd; scores from 2b on wp w/2 outs) | 1.00 | | | out(K) | -0.33 | | | out(K) | -0.16 | | | | | 5-1-1-0 | 0.18 | |
| | Lindor | E/1b* | -0.10 | | | out | -0.47 | | | | | out (K) | -0.10 | | | out | -0.23 | | out | -0.10 | | | | 5-0-0-0 | -1.00 | |
| | Napel | out (force 2b) | -0.22 | | | out | -0.45 | | | | | out(K) | -0.23 | | | out(K) | -0.16 | Edwards pitching -- | | | out(K) | -0.23 | | 5-0-0-0 | -1.29 | |
| | Ramirez | | | 1b (picked off w/0 out) | -0.23 | | | | out | -0.23 | | | out | -0.16 | | 1b | 0.12 | | | | | out | -0.16 | 5-1-2-0 | -0.66 | |
| | Chisenhall | | | 1b | 0.22 | | | | out | -0.16 | | | | | | | | | | | | | | 2-0-1-0 | 0.06 | |
| | Guyer (6) | | | | | | | | | | 1b | 0.12 | Chapman pitching -- | | 2b | 1.11 | | | | | bb (to 2nd on leadoff w/2 outs) | 0.23 | 2-3-2-1 | 1.46 | | |
| | Davis | | | dp | -0.48 | | | | out | -0.10 | | | out | -0.22 | | hr | 1.77 | | | | | 1b | 0.89 | 5-1-2-3 | 1.86 | |
| | Crip | | | | | 2b | 0.63 | | | | out | -0.23 | | | out | -0.23 | 1b | 0.12 | | | | | | 4-1-2-0 | 0.29 | |
| | Martinez (9) | | | | | | | | | | | | | | | | | | Montgomery pitching -- | | | out | -0.22 | 1-0-0-0 | -0.22 | |
| | Perez | | | | | sac | -0.18 | | | | out(K) | -0.16 | | | bb | 0.22 | | | | | | | | 1-0-0-0 | -0.12 | |
| | Naquin (PR- 7) | | | | | | | | | | | | | | | | | | | | | | | 0-0-0-0 | 0.00 | |
| | Gonzalez (8) | | | | | | | | | | | | | | | out(K) | -0.22 | | | | | | | | 1-0-0-0 | -0.22 |
| R-I-E & SUV | 0-0-1 | -0.71 | 0-1-0 | -0.49 | 1-2-1 | -0.10 | 0-0-0 | -0.49 | 2-1-1 | 1.34 | 0-1-0 | -0.49 | 0-0-0 | -0.49 | 3-4-0 | 2.51 | 0-1-0 | -0.49 | 1-1-0 | 0.51 | 40-7-11-5 | 1.10 | | | | |
| | | unearned | 0.22 | | | unearned | 0.61 | | | unearned | 0.17 | | | | | | | | | | | | unearned | 1.00 | | |
| | | total | -0.49 | | | total | 0.51 | | | total | 1.51 | | | | | | | | | | | | total | 2.10 | | |
| Chicago Cubs | Pitcher | IP | H | R | ER | BB | SO | SUV | | | | | | | | | | | | | | | | | | |
| | Hendricks | 4.67 | 4 | 2 | 1 | 1 | 2 | -1.35 | | | | | | | | | | | | | | | | | | |
| | Lester | 3.00 | 3 | 2 | 1 | 1 | 4 | -0.35 | | | | | | | | | | | | | | | | | | |
| | Chapman (W) | 1.33 | 3 | 2 | 2 | 0 | 2 | 2.29 | | | | | | | | | | | | | | | | | | |
| | Edwards | 0.67 | 1 | 1 | 1 | 1 | 1 | 0.73 | | | | | | | | | | | | | | | | | | |
| | Montgomery (S) | 0.33 | 0 | 0 | 0 | 0 | 0 | -0.22 | | | | | | | | | | | | | | | | | | |
| | Unearned | | | | | | | 1.00 | | | | | | | | | | | | | | | | | | |
| | TOTAL | 10.00 | 11 | 7 | 5 | 3 | 9 | 2.10 | | | | | | | | | | | | | | | | | | |
| | Kluber | 4.00 | 6 | 4 | 4 | 0 | 0 | 2.04 | | | | | | | | | | | | | | | | | | |
| | Miller | 2.33 | 4 | 2 | 2 | 1 | 1 | 1.01 | | | | | | | | | | | | | | | | | | |
| Allen | 2.00 | 0 | 0 | 0 | 1 | 2 | -0.76 | | | | | | | | | | | | | | | | | | | |
| Shaw (L) | 1.00 | 3 | 2 | 2 | 2 | 1 | 2.17 | | | | | | | | | | | | | | | | | | | |
| Bauer | 0.67 | 0 | 0 | 0 | 0 | 1 | -1.00 | | | | | | | | | | | | | | | | | | | |
| Unearned | | | | | | | 0.24 | | | | | | | | | | | | | | | | | | | |
| Total | 10.00 | 13 | 8 | 8 | 4 | 5 | 3.10 | | | | | | | | | | | | | | | | | | | |

See <http://www.baseball-reference.com/boxes/CLE/CLE20161028.shtml> for complete play by play.

* Batter assumed to make third out without error
 ** Batter assumed to advance runner to 2b and make second out without error

A. Comparison vs. “Traditional” Statistics

Table 18 lists the SUV statistics for hitting and pitching for the top 10 players with the most Opportunities and Innings Pitched, using a lower limit of 124 Opportunities (Dyson) and 21.00 Innings Pitched (Vincent). No contribution from Error/PB/CI is included here. The totals for each group of 10 players, along with the mean and standard deviation in each category, “+SUV” and “+Avg,” are calculated to enable a normalization of the statistics for each of the 10 players per group as follows:

$$\text{Normalized Statistic (+SUV or +Avg)} = \int_{-\infty}^x \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}} dx$$

where μ = mean and σ = standard deviation.

Table 13. SUVs for Selected Chicago Cubs Players from Two Example Games – Three Hitters and One Pitcher

| Player | Washington at Chicago | | Chicago at Cleveland | | Cumulative | | Average SUV |
|---------------|-----------------------|-------|----------------------|-------|------------|-------|-------------|
| | “Plays” | SUV | “Plays” | SUV | “Plays” | SUV | |
| Rizzo | 4 | 0.54 | 5 | 1.49 | 9 | 2.03 | 0.226 |
| Bryant | 4 | -1.10 | 5 | -0.58 | 9 | -1.68 | -0.187 |
| Ross | 3 | -0.81 | 2 | 1.41 | 5 | 0.60 | 0.120 |
| Lester | 7 | -1.76 | 3 | -0.41 | 10 | -2.17 | -0.217 |

Table 14. SUVs Adjusted for League Differences

| MLB SUVs | base→ outs↓ | 3 | 2 | 1 | 0 |
|----------|----------------|------|------|-------|-------|
| | 0 | 0.87 | 0.63 | 0.39 | -0.23 |
| 1 | 0.68 | 0.44 | 0.22 | -0.16 | |
| 2 | 0.29 | 0.23 | 0.12 | -0.10 | |

| AL SUVs | base→ outs↓ | 3 | 2 | 1 | 0 |
|---------|----------------|------|------|-------|-------|
| | 0 | 0.91 | 0.66 | 0.41 | -0.24 |
| 1 | 0.71 | 0.46 | 0.23 | -0.17 | |
| 2 | 0.30 | 0.24 | 0.12 | -0.10 | |

| NL SUVs | base→ outs↓ | 3 | 2 | 1 | 0 |
|---------|----------------|------|------|-------|-------|
| | 0 | 0.83 | 0.60 | 0.37 | -0.22 |
| 1 | 0.65 | 0.42 | 0.21 | -0.15 | |
| 2 | 0.28 | 0.22 | 0.12 | -0.10 | |

Table 15. List of 54 of 162 Games from Seattle Mariners 2017 Season Analyzed for SUV “Proof of Principle”

| Game # | Date | Opponent | | | | Mariners | | |
|--------|--------|--------------|---------|------|-------|----------|------|-------|
| | | Team | Innings | Runs | SUV | Innings | Runs | SUV |
| 002 | 4-Apr | @Houston | 8.00 | 2 | -1.92 | 9.00 | 1 | -3.41 |
| 005 | 7-Apr | @Angels | 8.00 | 5 | 1.08 | 9.00 | 1 | -3.41 |
| 008 | 10-Apr | Houston | 9.00 | 0 | -4.41 | 8.00 | 6 | 2.08 |
| 011 | 14-Apr | Texas | 9.00 | 1 | -3.41 | 8.00 | 2 | -1.92 |
| 014 | 17-Apr | Miami | 9.00 | 1 | -3.41 | 8.00 | 6 | 2.08 |
| 017 | 20-Apr | @Oakland | 8.00 | 9 | 5.08 | 9.00 | 6 | 1.59 |
| 020 | 23-Apr | @Oakland | 9.00 | 1 | -3.41 | 9.00 | 11 | 6.59 |
| 023 | 26-Apr | @Detroit | 9.00 | 1 | -3.41 | 9.00 | 2 | -2.41 |
| 026 | 30-Apr | @Cleveland | 8.00 | 12 | 8.08 | 9.00 | 4 | -0.41 |
| 029 | 4-May | Angels | 9.00 | 3 | -1.41 | 8.00 | 11 | 7.08 |
| 032 | 7-May | Texas | 9.00 | 3 | -1.41 | 8.00 | 4 | 0.08 |
| 035 | 11-May | @Toronto | 8.00 | 7 | 3.08 | 9.00 | 2 | -2.41 |
| 038* | 14-May | @Toronto | 8.67 | 3 | -1.31 | 9.00 | 2 | -2.41 |
| 041 | 17-May | Oakland | 9.00 | 0 | -4.41 | 8.00 | 4 | 0.08 |
| 044 | 20-May | White Sox | 9.00 | 16 | 11.59 | 9.00 | 1 | -3.41 |
| 047 | 24-May | @Washington | 8.00 | 5 | 1.08 | 9.00 | 1 | -3.41 |
| 050 | 27-May | @Boston | 8.00 | 6 | 2.08 | 9.00 | 0 | -4.41 |
| 053 | 30-May | @Colorado | 9.00 | 4 | -0.41 | 9.00 | 10 | 5.59 |
| 056 | 2-Jun | Tampa Bay | 9.00 | 4 | -0.41 | 8.00 | 12 | 8.08 |
| 059 | 6-Jun | Minnesota | 9.00 | 3 | -1.41 | 8.00 | 12 | 8.08 |
| 062 | 9-Jun | Toronto | 9.00 | 2 | -2.41 | 8.00 | 4 | 0.08 |
| 065 | 12-Jun | @Minnesota | 9.00 | 3 | -1.41 | 9.00 | 14 | 9.59 |
| 068 | 15-Jun | @Minnesota | 8.00 | 6 | 2.08 | 9.00 | 2 | -2.41 |
| 071 | 18-Jun | @Texas | 9.00 | 3 | -1.41 | 9.00 | 7 | 2.59 |
| 074 | 21-Jun | Detroit | 9.00 | 5 | 0.59 | 8.00 | 7 | 3.08 |
| 077 | 24-Jun | Houston | 9.00 | 5 | 0.59 | 9.00 | 2 | -2.41 |
| 080 | 28-Jun | Philadelphia | 9.00 | 5 | 0.59 | 9.00 | 4 | -0.41 |
| 083 | 2-Jul | @Angels | 9.00 | 3 | -1.41 | 9.00 | 5 | 0.59 |
| 086 | 5-Jul | Kansas City | 10.00 | 9 | 4.10 | 10.00 | 6 | 1.10 |
| 089 | 8-Jul | Oakland | 9.00 | 4 | -0.41 | 9.00 | 3 | -1.41 |
| 092 | 15-Jul | @White Sox | 9.00 | 3 | -1.41 | 9.00 | 4 | -0.41 |
| 095 | 18-Jul | @Houston | 8.00 | 6 | 2.08 | 9.00 | 2 | -2.41 |
| 098 | 21-Jul | Yankees | 9.00 | 5 | 0.59 | 9.00 | 1 | -3.41 |
| 101 | 24-Jul | Boston | 9.00 | 0 | -4.41 | 8.00 | 4 | 0.08 |
| 104 | 28-Jul | Mets | 9.00 | 7 | 2.59 | 9.00 | 5 | 0.59 |
| 107 | 31-Jul | @Texas | 9.00 | 4 | -0.41 | 9.00 | 6 | 1.59 |
| 110 | 3-Aug | @Kansas City | 8.00 | 6 | 2.08 | 9.00 | 4 | -0.41 |
| 113 | 6-Aug | @Kansas City | 8.00 | 9 | 5.08 | 9.00 | 1 | -3.41 |
| 116 | 10-Aug | Angels | 9.00 | 6 | 1.59 | 9.00 | 3 | -1.41 |
| 119 | 13-Aug | Angels | 9.00 | 4 | -0.41 | 9.00 | 2 | -2.41 |
| 122 | 16-Aug | Baltimore | 9.00 | 6 | 1.59 | 8.00 | 7 | 3.08 |
| 125 | 20-Aug | @Tampa Bay | 8.00 | 3 | -0.92 | 9.00 | 0 | -4.41 |
| 128 | 23-Aug | @Atlanta | 9.00 | 6 | 1.59 | 9.00 | 9 | 4.59 |
| 131 | 27-Aug | @Yankees | 8.00 | 10 | 6.08 | 9.00 | 1 | -3.41 |
| 134 | 30-Aug | @Baltimore | 8.00 | 8 | 4.08 | 9.00 | 7 | 2.59 |
| 137 | 3-Sep | Oakland | 9.00 | 2 | -2.41 | 8.00 | 10 | 6.08 |
| 140 | 6-Sep | Houston | 9.00 | 5 | 0.59 | 9.00 | 3 | -1.41 |
| 143 | 10-Sep | Angels | 9.00 | 5 | 0.59 | 9.00 | 3 | -1.41 |
| 146 | 13-Sep | @Texas | 9.00 | 1 | -3.41 | 9.00 | 8 | 3.59 |
| 149 | 16-Sep | @Houston | 8.00 | 8 | 4.08 | 9.00 | 6 | 1.59 |
| 152 | 20-Sep | Texas | 9.00 | 8 | 3.59 | 9.00 | 6 | 1.59 |
| 155 | 23-Sep | Cleveland | 9.00 | 11 | 6.59 | 9.00 | 4 | -0.41 |
| 158 | 26-Sep | @Oakland | 9.00 | 3 | -1.41 | 9.00 | 6 | 1.59 |

| | | | | | | | | |
|---|--------|---------|---------------|------------|--------------|---------------|------------|--------------|
| 161 | 30-Sep | @Angels | 9.00 | 4 | -0.41 | 9.00 | 6 | 1.59 |
| Totals | | | 471.67 | 261 | 29.82 | 474.00 | 260 | 27.74 |
| * Toronto won on a two-out walk-off home run, so SUV adjusted for only two outs in the ninth (i.e., -0.39 instead of -0.49) | | | | | | | | |

Table 16. SUV Analysis for Game 152, Seattle (6) vs. Texas (8), Sept. 20, 2017 (See Reference 6 for Play-by-play)

| Mariner | 1st | 2nd | 3rd | 4th | 5th | 6th | 7th | 8th | 9th | Ops | SUV | Avg | +Ops | +SUV | +Avg |
|--------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|
| Segura | 0.39 | | -0.16 | | 0.12 | | 0.44 | -0.48 | | 5 | 0.31 | 0.062 | 178 | 3.73 | 0.021 |
| Haniger | -0.40 | | 1.00 | | -0.22 | | -0.47 | -0.22 | | 5 | -0.31 | -0.062 | 129 | 2.77 | 0.021 |
| Cano | 0.44 | | -0.10 | | | 0.39 | 1.60 | | -0.23 | 5 | 2.10 | 0.420 | 200 | 9.39 | 0.047 |
| Cruz | -0.92 | | | 1.00 | | 0.63 | 0.23 | | -0.16 | 5 | 0.78 | 0.156 | 198 | 11.73 | 0.059 |
| Seager | | -0.23 | | -0.23 | | 0.87 | 0.29 | | 0.12 | 5 | 0.82 | 0.164 | 200 | 11.52 | 0.058 |
| Alonso | | 0.22 | | -0.16 | | -0.99 | -0.74 | | | 4 | -1.67 | -0.418 | 41 | 2.05 | 0.050 |
| Ruiz | | | | | | | | | -0.22 | 1 | -0.22 | -0.220 | 52 | -4.32 | -0.083 |
| Zunino | | -0.26 | | -0.10 | | -0.39 | | 0.63 | | 4 | -0.12 | -0.030 | 126 | -9.12 | -0.072 |
| Gamel | | -0.22 | | | -0.23 | | 0.39 | 1.00 | | 4 | 0.94 | 0.235 | 164 | 1.71 | 0.010 |
| Heredia | | | -0.23 | | -0.16 | | -0.40 | | | 3 | -0.79 | -0.263 | 142 | -5.52 | -0.039 |
| Valencia | | | | | | | | -0.42 | | 1 | -0.42 | -0.420 | 157 | -1.37 | -0.009 |
| SUV | -0.49 | -0.49 | 0.51 | 0.51 | -0.49 | 0.51 | 1.51 | 0.51 | -0.49 | 42 | 1.42 | 0.034 | 1909 | 8.55 | 0.004 |
| Error/PB/CI | | | | | | | 0.17 | | | | 0.17 | 1.59 | | 16.42 | 24.97 |
| | | | | | | | | | | | | | | | |
| Pitcher | 1st | 2nd | 3rd | 4th | 5th | 6th | 7th | 8th | 9th | IP | SUV | Avg | +IP | +SUV | +Avg |
| Hernandez | -0.49 | -0.49 | -0.49 | 2.84 | | | | | | 3.33 | 1.37 | 0.411 | 27.00 | -0.72 | -0.027 |
| Albers | | | | 2.40 | -0.49 | 1.02 | | | | 1.67 | 2.93 | 1.758 | 13.67 | 2.82 | 0.206 |
| Lawrence | | | | | | -0.51 | -0.49 | | | 2.00 | -1.00 | -0.500 | 11.33 | -4.47 | -0.394 |
| Simmons | | | | | | | | -0.49 | | 1.00 | -0.49 | -0.490 | 3.00 | -1.73 | -0.577 |
| Diaz | | | | | | | | | -0.49 | 1.00 | -0.49 | -0.490 | 19.67 | 2.07 | 0.105 |
| SUV | -0.49 | -0.49 | -0.49 | 6.51 | -0.49 | 0.51 | -0.49 | -0.49 | -0.49 | 9.00 | 2.32 | 0.258 | 444.67 | 2.62 | 0.006 |
| Error/PB/CI | | | | 1.27 | | | | | | | 1.27 | 3.59 | | 22.43 | 25.05 |

Table 17. Cumulative Mariner SUVs for Hitting and Pitching through 54 of 162 Games (Ranked by Most Opportunities and Innings Pitched)

| Mariner | +Ops | +SUV | +Avg | Pitcher | +IP | +SUV | +Avg |
|--------------------|------|--------------|--------------|--------------------|--------|--------------|--------------|
| Cano | 214 | 8.17 | 0.038 | Miranda | 50.00 | 8.27 | 0.165 |
| Cruz | 212 | 13.03 | 0.061 | Paxton | 47.33 | -3.95 | -0.083 |
| Seager | 208 | 14.06 | 0.068 | Gallardo | 33.33 | 3.14 | 0.094 |
| Segura | 182 | 3.23 | 0.018 | Bergman | 27.33 | -8.67 | -0.309 |
| Gamel | 176 | 2.56 | 0.015 | Hernandez | 27.00 | -0.72 | -0.027 |
| Valencia | 162 | 0.59 | 0.004 | Gaviglio | 26.00 | 0.80 | 0.031 |
| Heredia | 145 | -7.27 | -0.050 | Moore | 22.00 | 1.54 | 0.070 |
| Haniger | 144 | 1.20 | 0.008 | Diaz | 22.00 | 0.35 | 0.016 |
| Zunino | 134 | -8.16 | -0.061 | Ramirez | 21.67 | 6.60 | 0.305 |
| Dyson | 124 | 0.71 | 0.006 | Vincent | 21.00 | -3.33 | -0.159 |
| Motter | 91 | -2.98 | -0.033 | Albers | 18.00 | 3.07 | 0.171 |
| Ruiz | 56 | -4.57 | -0.082 | Altavilla | 15.00 | 1.60 | 0.107 |
| Alonso | 52 | 4.03 | 0.078 | Overton | 14.67 | 4.24 | 0.289 |
| Martin, L | 37 | -4.20 | -0.114 | Pagan | 14.33 | -2.69 | -0.188 |
| Powell | 17 | -0.77 | -0.045 | Zych | 13.00 | -6.07 | -0.467 |
| Freeman | 13 | -2.67 | -0.205 | Lawrence | 12.33 | -4.96 | -0.402 |
| Smith | 11 | -0.12 | -0.011 | Iwakuma | 11.67 | -4.37 | -0.375 |
| Vogelbach | 11 | -0.17 | -0.015 | De Jong | 11.67 | 5.34 | 0.458 |
| Beckham | 11 | -2.36 | -0.215 | Rzepczynski | 10.00 | -2.23 | -0.185 |
| Pitcher (NL) | 9 | -1.24 | -0.138 | Pazos | 8.00 | 3.71 | 0.464 |
| Gosewisch | 8 | -2.19 | -0.274 | Gonzales | 6.33 | 1.11 | 0.175 |
| Hanneman | 7 | -0.35 | -0.050 | Leake | 5.67 | -2.43 | -0.429 |
| Espinosa | 3 | 0.79 | 0.263 | Scribner | 5.33 | -1.04 | -0.195 |
| SUV | 2027 | 11.32 | 0.006 | Whalen | 5.33 | 2.32 | 0.435 |
| <i>Error/PB/CI</i> | | <i>16.42</i> | <i>27.74</i> | Phelps | 5.00 | 1.19 | 0.238 |
| | | | | Cishek | 4.33 | -1.30 | -0.300 |
| | | | | Simmons | 3.00 | -1.73 | -0.577 |
| | | | | Fien | 2.33 | 4.41 | 1.890 |
| | | | | Garton | 2.00 | 0.64 | 0.320 |
| | | | | Martin, C | 2.00 | 1.67 | 0.835 |
| | | | | Marshall | 1.00 | -0.49 | -0.490 |
| | | | | Curtis | 1.00 | -0.49 | -0.490 |
| | | | | Cloyd | 1.00 | -0.49 | -0.490 |
| | | | | Freeman | 1.00 | 0.51 | 0.510 |
| | | | | SUV | 471.67 | 5.55 | 0.012 |
| | | | | <i>Error/PB/CI</i> | | <i>24.27</i> | <i>29.82</i> |

These normalized statistics, representing the percentiles of the normal distribution where the statistics occur, are calculated for both “+SUV” and “+Avg” for the players in each group. Within each group, these two normalized statistics for each player are then averaged (“Both” column) and used to rank the players from first through tenth. Note that, for batters, higher values are desirable. For pitchers, the lower values are desirable. The reason for considering both “+SUV” and “+Avg” is that the former reflects longevity (most Opportunities or Innings Pitched) over a season while the second reflects expected performance per Opportunity or Inning Pitched. Combined, both aspects are reflected. This is akin to giving additional weight to the 0.300-hitter who had 150 hits in 500 at-bats over the one with 30 hits in 100 at-bats.

As an example calculation, consider Seager, who has a +SUV = 14.06 and +Avg = 0.068. When normalized to the mean +SUV = 2.81 and mean +Avg = 0.011 (with respective standard deviations of 7.41 and 0.042), his normalized +SUV and +Avg become as follows:

$$\text{Normalized + SUV} = \int_{-\infty}^{14.06} \frac{1}{(7.41)\sqrt{2\pi}} e^{-\left(\frac{[14.06-2.81]^2}{2[7.41]^2}\right)} dx = 0.936$$

$$\text{Normalized + Avg} = \int_{-\infty}^{0.068} \frac{1}{(0.042)\sqrt{2\pi}} e^{-\left(\frac{[0.068-0.011]^2}{2[0.042]^2}\right)} dx = 0.915$$

These indicate that his +SUV occurs at the 93.6%ile and +Avg at the 91.5%ile, both the highest among the 10 batters. The average of the two is 0.925, which ranks him first overall among the batters, just slightly above Cruz at 0.903. Since lower values are optimal for pitchers, Bergman ranks first with 0.033, significantly ahead of the next pitcher, Vincent, at 0.195. Given his lowest +SUV = -8.67 and lowest +Avg = -0.309 among the 10 pitchers with at least 21.00 Innings Pitched, this comes as no surprise.

What is especially interesting, and the goal of developing the SUV statistic, are insights into players' performance that may not be readily indicated by the myriad of other statistics currently being used. Tables 19 and 20 list the season statistics taken from Reference 6 (and reproduced in Reference 7) for the top 10 batters and pitchers from the SUV lists, respectively. To characterize player performance based on such multiple statistics, the approach taken is similar to that for the two SUV statistics, "+SUV" and "+Avg," i.e., the players are ranked by normalization of the statistics for selected categories, then these normalized values are averaged to yield one overall result, used to rank the players (included in Tables 18 and 19, respectively).

For batting, a combination of longevity (Runs, Hits, RBIs, and WAR [Wins Against Replacement]) and expected performance per "at-bat (AB)" statistics (Runs/AB, Hits/AB [Batting Average], OBP [On-Base Percentage] and SLG [Slugging Percentage]), i.e., a total of eight statistics, are used. For pitching, four longevity (Hits, Earned Runs, Bases-on-Ball + Hits-By-Pitch, and WAR) and two expected performance per Inning Pitched statistics (Earned Run Average and Walks+Hit-Batters per IP), i.e., a total of six statistics, are used. Note that, for pitchers, all but the WAR statistic indicate better performance with lower values. Therefore, to incorporate WAR consistently with the rest, its normalized value is subtracted from 1.00 (since we are dealing with probabilities), such that the lower value ("1-WAR") represents better performance.

Within the constraints of the comparison (SUV analysis is based on only one-third, i.e., 54 games, of the season vs. Reference 6's complete season; and the subjectivity of which statistics to select for the comparison and use of normalization and subsequent averaging to yield a "performance measure" that can be compared to the SUV), the results provide insights that might not readily be found from the current myriad of statistics. Among the batters, Seager and Cruz stood out as the top performers, with a fairly wide margin over the next lower player (Cano); while Zunino and Heredia were the poorest, significantly below the next higher player (Dyson). When the full season "traditional" statistics are used, Cruz stands out at the top and Heredia at the bottom, similar to the SUV results, with Seager and Zunino falling in the middle. Again, this comparison is arbitrary, and the SUV analysis uses only 54 of the 162 games, but if one envisions the SUV results to be representative of a full-season performance, they indicate that Seager performed much better than his "traditional" statistics would seem to indicate. Meanwhile, Zunino did not perform well, despite fairly good "traditional" statistics.

For pitchers based on their SUV, Bergman stood out at the top, with Vincent and Paxton next and well above the rest of the group; while Ramirez and Miranda were the poorest, well below the next higher player (Gallardo). Based on the full season's "traditional" statistics, Vincent comes out on top, followed by Diaz and Ramirez (the bottom performer based on the SUV), with Bergman and Paxton in the middle. Gallardo and Miranda are at the bottom, consistent with their SUV ranks. However, there is quite a discrepancy for Ramirez – a good performer according to the "traditional" statistics, but a poor one according to SUV. Ignoring the possibility (likelihood [see footnote]) that this discrepancy is the result of Ramirez' games included for the SUV just happening to be his worst, this suggests that he does not perform well despite good "traditional" statistics.³ Meanwhile, Bergman performs much better than his "traditional" statistics would seem to indicate.

³ In fact, review of the four games where Ramirez pitched (#s 113, 128, 143 and 149) among the 54 selected for the SUV analysis indicates that he performed quite poorly relative to what would have been expected if all of his games were included. Over those four games, he pitched 21.67 innings, yielding 27 hits, 16 earned runs, and six walks (no-hit batters), corresponding to an ERA = 6.65 and WHBIP = 1.52 (WAR was not tracked). If his season statistics were apportioned by the ratio of 21.67 innings to his total of 62 innings, the expected hits, earned runs, walks (plus hit-batters), ERA and WHBIP would have been 19.92, 9.44, 5.59, 3.92 and 1.18, respectively. All but the walks (plus hit-batters) over those four games were at least 29% higher than would have been expected, especially the earned runs and ERA (70% higher). Therefore, it appears the four games out of the 54 selected for the SUV analysis just happened to be poor ones for Ramirez, atypical of his overall performance. Analysis of all 162 games for SUV would be expected to bring these into better alignment.

Table 18. Cumulative Mariner SUVs for Top 10 Hitters and Pitchers through 54 of 162 Games (Ranked First by +Avg then by Normalized Composite)

| Mariner | +Ops | +SUV | +Avg | | Pitcher | +IP | +SUV | +Avg |
|------------|--------------|-------|--------|-----------|------------|--------------|-------|--------|
| Seager | 208 | 14.06 | 0.068 | | Bergman | 27.33 | -8.67 | -0.309 |
| Cruz | 212 | 13.03 | 0.061 | | Vincent | 21.00 | -3.33 | -0.159 |
| Cano | 214 | 8.17 | 0.038 | | Paxton | 47.33 | -3.95 | -0.083 |
| Segura | 182 | 3.23 | 0.018 | | Hernandez | 27.00 | -0.72 | -0.027 |
| Gamel | 176 | 2.56 | 0.015 | | Diaz | 22.00 | 0.35 | 0.016 |
| Haniger | 144 | 1.20 | 0.008 | | Gaviglio | 26.00 | 0.80 | 0.031 |
| Dyson | 124 | 0.71 | 0.006 | | Moore | 22.00 | 1.54 | 0.070 |
| Valencia | 162 | 0.59 | 0.004 | | Gallardo | 33.33 | 3.14 | 0.094 |
| Heredia | 145 | -7.27 | -0.050 | | Miranda | 50.00 | 8.27 | 0.165 |
| Zunino | 134 | -8.16 | -0.061 | | Ramirez | 21.67 | 6.60 | 0.305 |
| Totals | 1701 | 28.12 | 0.017 | | Totals | 297.67 | 4.03 | 0.014 |
| Mean | 170.10 | 2.81 | 0.011 | | Mean | 29.77 | 0.40 | 0.010 |
| Std Dev | 33.50 | 7.41 | 0.042 | | Std Dev | 10.65 | 5.01 | 0.171 |
| Normalized | Both | +SUV | +Avg | Rank | Normalized | Both | +SUV | +Avg |
| Seager | 0.925 | 0.936 | 0.915 | 1 | Bergman | 0.033 | 0.035 | 0.031 |
| Cruz | 0.903 | 0.916 | 0.889 | 2 | Vincent | 0.195 | 0.228 | 0.161 |
| Cano | 0.756 | 0.765 | 0.746 | 3 | Paxton | 0.242 | 0.192 | 0.291 |
| Segura | 0.545 | 0.522 | 0.568 | 4 | Hernandez | 0.413 | 0.411 | 0.414 |
| Gamel | 0.512 | 0.486 | 0.538 | 5 | Diaz | 0.504 | 0.496 | 0.513 |
| Haniger | 0.446 | 0.414 | 0.478 | 6 | Gaviglio | 0.540 | 0.532 | 0.548 |
| Dyson | 0.421 | 0.388 | 0.453 | 7 | Moore | 0.613 | 0.590 | 0.637 |
| Valencia | 0.408 | 0.382 | 0.433 | 8 | Gallardo | 0.698 | 0.708 | 0.688 |
| Heredia | 0.079 | 0.087 | 0.072 | 9 | Miranda | 0.880 | 0.942 | 0.818 |
| Zunino | 0.056 | 0.069 | 0.043 | 10 | Ramirez | 0.925 | 0.892 | 0.958 |

I. Working with the SUV: Part 2 – Fielding and Advanced Pitching

Having examined, with proof of principle, SUV for hitting and simplified pitching, the focus now is turned to defense, which includes fielding and advanced pitching, again based on the “run expectancy” concept, transformed into the SUV statistic, from before. There is an important change to Tables 7 and 8 for defensive tracking, also applied to the enhanced pitching analysis, namely the reversal of all the SUV signs, as shown in Table 21. This enables “positive” defensive outcomes (outs) to be assigned positive SUVs, while “negative” outcomes (reaching base or advancing) are assigned negative SUVs. The assignment of defensive SUVs is somewhat more involved than that for hitting. Specific assignments, most frequently encountered, are presented below.

A. Pitchers

Pitchers accrue the full SUV for any play which results in the following: a hit, walk (including intentional), hit batter, balk, wild pitch and strikeout (unless the third strike is dropped and the put out is made at first base, discussed below with the catcher). For outs (other than strikeouts), the pitcher accrues half the full SUV for the play, the rest apportioned to the fielders, as discussed below. Successful stolen bases, negative outcomes, accrue half to the pitcher, while successful pickoffs accrue not only half to the pitcher but also the additional accrual for an “assist,” discussed below. On all other outs, the pitcher accrues as any other fielder (in addition to the half accrual as a pitcher).

Table 19. “Traditional” Statistics for 2017 Season for Top 10 Mariner Hitters from SUV Analysis (Subsequently Ranked by Normalized Composite of “Traditional” Statistics)

| Mariner | AB | R | H | RBI | R/AB | H/AB (BA) | RBI/AB | OBP | SLG | WAR | |
|----------|------------|--------------|--------|-------|-------|-----------|-----------|--------|-------|-------|-------|
| Zunino | 387 | 52 | 97 | 64 | 0.134 | 0.251 | 0.165 | 0.331 | 0.509 | 3.3 | |
| Valencia | 450 | 54 | 115 | 66 | 0.120 | 0.256 | 0.147 | 0.314 | 0.411 | 1.0 | |
| Cano | 592 | 79 | 166 | 97 | 0.133 | 0.280 | 0.164 | 0.338 | 0.453 | 3.4 | |
| Segura | 524 | 80 | 157 | 45 | 0.153 | 0.300 | 0.086 | 0.349 | 0.427 | 3.2 | |
| Seager | 578 | 72 | 144 | 88 | 0.125 | 0.249 | 0.152 | 0.323 | 0.450 | 2.5 | |
| Gamel | 509 | 68 | 140 | 59 | 0.134 | 0.275 | 0.116 | 0.322 | 0.413 | 1.0 | |
| Dyson | 346 | 56 | 87 | 30 | 0.162 | 0.251 | 0.087 | 0.324 | 0.350 | 2.6 | |
| Haniger | 369 | 58 | 104 | 47 | 0.157 | 0.282 | 0.127 | 0.352 | 0.491 | 3.0 | |
| Cruz | 556 | 91 | 160 | 119 | 0.164 | 0.288 | 0.214 | 0.375 | 0.549 | 4.1 | |
| Heredia | 386 | 43 | 96 | 24 | 0.111 | 0.249 | 0.062 | 0.315 | 0.337 | 1.1 | |
| Mean | 469.70 | 65.30 | 126.60 | 63.90 | 0.139 | 0.268 | 0.132 | 0.334 | 0.439 | 2.52 | |
| Std Dev | 93.28 | 15.12 | 30.00 | 30.05 | 0.018 | 0.019 | 0.046 | 0.019 | 0.067 | 1.12 | |
| Rank | Normalized | Cumulative | R | H | RBI | R/AB | H/AB (BA) | RBI/AB | OBP | SLG | WAR |
| 1 | Cruz | 0.929 | 0.955 | 0.867 | 0.967 | 0.907 | 0.851 | 0.964 | 0.982 | 0.951 | 0.922 |
| 2 | Cano | 0.712 | 0.818 | 0.905 | 0.865 | 0.376 | 0.743 | 0.757 | 0.576 | 0.583 | 0.785 |
| 3 | Segura | 0.639 | 0.834 | 0.845 | 0.265 | 0.766 | 0.952 | 0.156 | 0.776 | 0.429 | 0.729 |
| 4 | Haniger | 0.573 | 0.315 | 0.226 | 0.287 | 0.834 | 0.767 | 0.459 | 0.819 | 0.782 | 0.666 |
| 5 | Seager | 0.507 | 0.671 | 0.719 | 0.789 | 0.213 | 0.160 | 0.671 | 0.280 | 0.566 | 0.493 |
| 6 | Zunino | 0.471 | 0.190 | 0.162 | 0.501 | 0.395 | 0.180 | 0.767 | 0.432 | 0.853 | 0.758 |
| 7 | Gamel | 0.418 | 0.571 | 0.672 | 0.435 | 0.379 | 0.644 | 0.362 | 0.263 | 0.348 | 0.087 |
| 8 | Valencia | 0.301 | 0.227 | 0.350 | 0.528 | 0.148 | 0.256 | 0.626 | 0.147 | 0.337 | 0.087 |
| 9 | Dyson | 0.295 | 0.269 | 0.093 | 0.130 | 0.890 | 0.191 | 0.161 | 0.298 | 0.091 | 0.529 |
| 10 | Heredia | 0.103 | 0.070 | 0.154 | 0.092 | 0.065 | 0.155 | 0.063 | 0.160 | 0.063 | 0.102 |

B. Fielder

The philosophy here is that, if there is an assist on an out, the “assister” must perform two actions successfully (catch and throw), while the “put-outer” need perform only one successful action (make the put out). Therefore, the half of the SUV not accrued by the pitcher on an out is split between the assister (2/3) and put-outer (1/3). If there are multiple assists in making an out, the 2/3 is evenly split by the assisters. Outs made exclusively by one fielder (e.g., pop fly outs or unassisted ground outs) accrue the full remaining half SUV to the fielder.

C. Errors

When an error occurs, the pitcher is credited with the SUV that would have accrued had the out been made, with the difference between the actual SUV and that which would have accrued to the pitcher now accrued to the fielder. For example, on a lead-off error by the shortstop, the total SUV = -0.39. Had the out been made, the pitcher’s SUV would have been 0.23/2 = 0.115. Therefore, the pitcher accrues 0.115 while the fielder accrues -0.39 – 0.115 = -0.505.

Obviously, there will be unique situations not covered by the above, but the philosophy described here would also apply. Special treatment is performed on double (and triple) plays, best described via the following examples.

Table 20. “Traditional” Statistics for 2017 Season for Top 10 Mariner Pitchers from SUV Analysis (Subsequently Ranked by Normalized Composite of “Traditional” Statistics)

| | Pitcher | IP | H | ER | BB+HBP | ERA | WHBIP | WAR |
|------|------------|------------|-------|-------|--------|-------|-------|-------|
| | Miranda | 160.00 | 140 | 91 | 68 | 5.12 | 1.30 | 0.8 |
| | Paxton | 136.00 | 113 | 45 | 40 | 2.98 | 1.13 | 3.8 |
| | Gallardo | 130.67 | 138 | 83 | 62 | 5.72 | 1.53 | -0.2 |
| | Hernandez | 86.67 | 86 | 42 | 32 | 4.36 | 1.36 | 0.8 |
| | Gaviglio | 62.33 | 63 | 32 | 23 | 4.62 | 1.38 | 0.2 |
| | Ramirez | 62.00 | 57 | 27 | 16 | 3.92 | 1.18 | 0.7 |
| | Diaz | 66.00 | 44 | 24 | 35 | 3.27 | 1.20 | 0.9 |
| | Vincent | 64.67 | 62 | 23 | 13 | 3.20 | 1.16 | 1.4 |
| | Moore | 59.00 | 60 | 35 | 9 | 5.34 | 1.17 | 0.0 |
| | Bergman | 54.00 | 61 | 30 | 18 | 5.00 | 1.46 | 0.2 |
| | Mean | 88.13 | 82.40 | 43.20 | 31.60 | 4.35 | 1.29 | 0.86 |
| | Std Dev | 38.97 | 35.32 | 24.22 | 20.25 | 0.97 | 0.14 | 1.14 |
| Rank | Normalized | Cumulative | H | ER | BB+HBP | ERA | WHBIP | 1-WAR |
| 1 | Vincent | 0.214 | 0.282 | 0.202 | 0.179 | 0.118 | 0.186 | 0.318 |
| 2 | Diaz | 0.300 | 0.139 | 0.214 | 0.567 | 0.133 | 0.264 | 0.486 |
| 3 | Ramirez | 0.302 | 0.236 | 0.252 | 0.221 | 0.328 | 0.221 | 0.556 |
| 4 | Paxton | 0.368 | 0.807 | 0.530 | 0.661 | 0.078 | 0.128 | 0.005 |
| 5 | Moore | 0.431 | 0.263 | 0.367 | 0.132 | 0.845 | 0.205 | 0.775 |
| 6 | Gaviglio | 0.503 | 0.291 | 0.322 | 0.336 | 0.609 | 0.745 | 0.719 |
| 7 | Bergman | 0.529 | 0.272 | 0.293 | 0.251 | 0.748 | 0.894 | 0.719 |
| 8 | Hernandez | 0.543 | 0.541 | 0.480 | 0.508 | 0.504 | 0.702 | 0.521 |
| 9 | Miranda | 0.789 | 0.949 | 0.976 | 0.964 | 0.785 | 0.538 | 0.521 |
| 10 | Gallardo | 0.921 | 0.942 | 0.950 | 0.933 | 0.920 | 0.958 | 0.824 |

Table 21. Final SUVs after Minor Adjustments (Including Reduction to One Significant Figure, for Illustration Only) – Negation of Values from Table 7 for Fielding and Advance Pitching

| base→ outs↓ | 3 | 2 | 1 | 0 |
|----------------|-------|-------|-------|------|
| 0 | -0.87 | -0.63 | -0.39 | 0.23 |
| 1 | -0.68 | -0.44 | -0.22 | 0.16 |
| 2 | -0.29 | -0.23 | -0.12 | 0.10 |

| base→ outs↓ | 3 | 2 | 1 | 0 |
|----------------|------|------|------|-----|
| 0 | -0.9 | -0.6 | -0.4 | 0.2 |
| 1 | -0.7 | -0.4 | -0.2 | 0.2 |
| 2 | -0.3 | -0.2 | -0.1 | 0.1 |

D. “Simple” Double Play

The simplest of all double plays would be a lineout with the runner caught off base. For example, after a lead-off walk (SUV = -0.39, all to the pitcher), a line out to the first baseman who doubles up the runner accrues a total SUV = $-(-0.39) + 0.23 + 0.16 = 0.78$. This is actually treated as two separate but consecutive plays. First is the line out retiring the batter. This has an SUV = 0.23, with half (0.115) going to the pitcher and half (0.115) to the first baseman. Next is the tag out by the first baseman of the runner, with a total SUV = $-(-0.39) + 0.16 = 0.55$. Again, half accrues to the pitcher and half to the first baseman, i.e., $0.55/2 = 0.275$ each. Thus,

the pitcher's total is $0.115 + 0.275 = 0.39$ (the expected half of the total for the pitcher), as is that for the first basemen. The next simplest double play would be one of the grounder variety. Again, after a lead-off walk, assume a grounder to the shortstop results in a 6-4-3 double play. Again, this is treated as two separate but consecutive plays. First is the force out at second ($SUV = -[-0.39] + 0.23 = 0.62$), which accrues half to the pitcher ($0.62/2 = 0.31$), $2/3$ of half to the shortstop as assister ($0.62/2 \times 2/3 = 0.207$) and $1/3$ of half to the second baseman as put-outer ($0.62/2 \times 1/3 = 0.103$). Next is the put out at first base (0.16), with half to the pitcher, i.e., $0.16/2 = 0.08$, bringing his total to $0.31 + 0.08 = 0.39$ (the expected half of the total $SUV = -[-0.39] + 0.23 + 0.16 = 0.78$); $2/3$ of half to the second baseman as assister, i.e., $0.16/2 \times 2/3 = 0.053$, bringing his total to $0.103 + 0.053 = 0.156$; $1/3$ of half to the first baseman as put-outer, i.e., $0.16/2 \times 1/3 = 0.027$. Thus, the totals for the four players involved are 0.39 (pitcher) + 0.207 (shortstop) + 0.156 (second baseman) + 0.027 (first baseman) = 0.78 .

E. "Complex" Double Play

Add a base runner at second to the previous example for the 6-4-3 double play. The double play results in two outs with a runner on third base. For the first (force) out at second (crediting the runner reaching third base), the total $SUV = -0.68 - (-0.63) + 0.39 + 0.23 = 0.57$. This is split as above, i.e., pitcher = $0.57/2 = 0.285$, shortstop = $0.57/2 \times 2/3 = 0.19$ and second baseman = $0.57/2 \times 1/3 = 0.095$. For the second out at first base (with the runner staying at third base), the total $SUV = -0.29 - (-0.68) + 0.16 = 0.55$. Split again as above, the pitcher receives $0.55/2 = 0.275$ (bringing his total to $0.285 + 0.275 = 0.56$), the second baseman $0.55/2 \times 2/3 = 0.183$ (bringing his total to $0.095 + 0.183 = 0.278$) and the first baseman $0.55/2 \times 1/3 = 0.092$. The total SUV for the double play is $0.57 + 0.55 = 1.12$. The pitcher's total (0.56) is the expected half, and the $SUVs$ for the fielders = 0.19 (shortstop) + 0.278 (second baseman) + $0.092 = 0.56$, the remaining half.

F. Triple Play

Consider a most complex 5-4-3 triple play with the bases loaded, with a grounder to the third baseman, who steps on third (first out), throws to second (second out), who then throws to first (third out). This must be treated in two parts - first as if there was no runner on third; next with apportionment among the fielders (and pitcher) for erasing the runner at third without scoring.

F.1 Without Runner at Third

For an unassisted force-out at third, $SUV = -(-0.63) + 0.23 = 0.86$, half each to the pitcher and third baseman ($0.86/2 = 0.43$). For an assisted force-out at second, $SUV = -(-0.39) + 0.16 = 0.55$, half to the pitcher ($0.55/2 = 0.275$, bringing his total so far to $0.43 + 0.275 = 0.705$), $2/3$ of half to the third baseman ($0.55/2 \times 2/3 = 0.183$, bringing his total to $0.43 + 0.183 = 0.613$) and $1/3$ of half to the second baseman ($0.55/2 \times 1/3 = 0.092$). For an assisted force-out at first, $SUV = 0.10$, half to the pitcher ($0.10/2 = 0.05$, bringing his total so far to $0.705 + 0.05 = 0.755$), $2/3$ of half to the second baseman ($0.10/2 \times 2/3 = 0.033$, bringing his total to $0.092 + 0.033 = 0.125$) and $1/3$ of half to the first baseman ($0.10/2 \times 1/3 = 0.017$). Therefore, the sub-total becomes: $SUV = 0.755$ (pitcher) + 0.613 (third baseman) + 0.125 (second baseman) + 0.017 (first baseman) = 1.51 .

F.2 Contribution from Runner at Third

The elimination of the runner at third has a total $SUV = -(-.87) = 0.87$, half of which goes to the pitcher ($0.87/2 = 0.435$, bringing his final SUV to $0.755 + 0.435 = 1.19$). The remaining half ($0.87/2 = 0.435$) is apportioned among the three fielders based on their $SUVs$ without the runner at third (from previous subsection) as follows:

$$\frac{0.87}{2} \times \frac{0.183 (3B) + 0.125 (2B) + 0.017 (1B)}{0.183 + 0.125 + 0.017} =$$

$$0.245 (3B) + 0.167 (2B) + 0.023 (1B) = 0.435$$

Now, assembling the results without and with the contribution from the runner at third yields the following total $SUVs$: Pitcher = **1.19**; third baseman = $0.613 + 0.245 = \mathbf{0.858}$; second baseman = $0.125 + 0.167 = \mathbf{0.292}$; first baseman = $0.017 + 0.023 = \mathbf{0.04}$. These sum to $1.19 + 0.858 + 0.292 + 0.04 = \mathbf{2.38}$, i.e., three outs eliminating a bases loaded situation, i.e., $-(-0.87) - (-0.63) - (-0.39) + 0.23 + 0.16 + 0.10 = \mathbf{2.38}$.

G. Real Game Example

The following describes how a typical game is analyzed, based on Game 005, April 7, Seattle-1 @ L.A. Angels-5, shown in Table 22. Inning three (which contains an error) and inning six (which contains a double play) are tracked defensively. In inning three, Gallardo yields two singles from the start, with $SUVs$ of -0.39 and $-0.63 - (-0.39) - 0.39 = -0.63$, respectively, fully attributed to him. These are reflected in the "SUV" and "Gallardo" columns, each consisting of one "opportunity" (as shown in the "Play" column under "Ops Sum). The total $SUVs$ are shown in the "Play" column under "SUV Sum." Next is a strikeout, also attributed fully to Gallardo, which represents an $SUV = -0.44 - (-0.63) - 0.22 - (-0.39) + 0.23 = 0.59$. Next is an atypical intentional walk, which advances both runners (perhaps it is not so atypical considering it was issued to Mike Trout, likely after falling behind in the count). Again, Gallardo accrues the full $SUV = -0.68 - (-0.44) - 0.44 - (-0.22) - 0.22 = -0.68$. An error at third (yellow highlight) allows a run to score and keeps the bases full, an $SUV = -1.00 - (-0.68) - 0.68 - (-0.44) - 0.44 - (-0.22) - 0.22 = -1.00$. Had the error not occurred,

and the attempted force out at second been made, the SUV would have been $-1.00 - (-0.68) - 0.29 - (-0.44) - (-0.22) - 0.12 + 0.16 = 0.09$, half of which would have accrued to Gallardo. Thus, Gallardo receives $0.09/2 = 0.045$ while Seager accrues $-1.00 - 0.045 = -1.045$. Gallardo strikes out the next batter, accruing the full SUV $= -0.29 - (-0.68) - 0.23 - (-0.44) - 0.12 - (-0.22) + 0.16 = 0.86$. The final out is a force out at second on a grounder to third. This yields an SUV $= 0.29 + 0.23 + 0.12 + 0.10 = 0.74$, as all three base runners are erased as well as the batter. Half is attributed to Gallardo, i.e., $0.74/2 = 0.37$, while the remaining half is apportioned between Segura ($0.74/2 \times 2/3 = 0.247$) and Cano ($0.74/2 \times 1/3 = 0.123$). The totals for the inning in the "Inning" columns under "Ops Sum" and "SUV Sum" are 10 and -0.51, respectively.

Inning six is also interesting, since it contains a double play involving the pitcher, as well as a pitching change. After yielding lead-off homer (SUV = -1.00) and no out single (SUV = -0.39), Gallardo is replaced by Fien, who induces a 3-6-1 double play. The first out is a force at second (SUV = $-[-0.39] + 0.23 = 0.62$), half to Fien ($0.62/2 = 0.31$), 2/3 of half to Valencia ($0.62/2 \times 2/3 = 0.207$) and 1/3 of half to Segura ($0.62/2 \times 1/3 = 0.1033$). The second out eliminates the batter for an SUV = 0.16, split between Fien in his role as a pitcher ($0.16/2 = 0.08$) and both Segura as an assister ($0.16/2 \times 2/3 = 0.0533$, bringing his total to $0.1033 + 0.0533 = 0.157$) and Fien as a put-out ($0.16/2 \times 1/3 = 0.027$, bringing his total to $0.31 + 0.08 + 0.027 = 0.417$). Fien strikes out the last batter for an SUV = 0.10, bringing the inning totals to six opportunities with an SUV of -0.49. Following the play-by-play are the defensive (including pitching) game summary and cumulative including all preceding games (just one in this case). The opportunities, total SUV and average SUV per opportunity for each player are tracked and summed, with any error, passed ball, or catcher interference SUV shown in yellow. Offensive statistics for the same game are next extracted from Reference 7, both for the game itself and cumulatively. Finally, the combined defensive and offensive opportunities, SUV and average SUV per opportunity are tabulated for the game itself and cumulatively. Note especially the difference for the pitchers relative to Reference 7, where, instead of opportunities, their innings pitched were tracked. Also, their SUV accrual now differs from Reference 7, where they were assigned the full SUV for each play with reversed signs (now positives were then negatives and vice-versa) to facilitate combining offensive and defensive (including pitching) SUVs.

V. "PROOF OF PRINCIPLE:" PART 2 – FIELDING AND ADVANCED PITCHING

The "Proof of Principle" parallels that from Section 4, again tracking the same 54 games, with cumulatives every six games. However, now the focus is on the Mariners' defense (fielding and pitching, with more advanced treatment for pitching as described in Subsection 5.1.1). The offensive statistics from Reference 7, developed previously, are extracted for each game for combination with the new defensive statistics (the "simplified" pitching statistics from before are now replaced).

The 54-game SUV statistics for defense, including pitching, and combined offense and defense for the top 10 players with the most defensive and pitching Opportunities and top 12 for the combined group are presented in Table 23. For defense, a lower limit of 73 Opportunities (Haniger) was selected. For pitching, the lower limit was 89 Opportunities (Vincent). For combined, the lower limit was 136 Opportunities (Alonso), which added both Alonso and Zunino to the group carried over from the top 10 defensive players. Following the approach developed in Subsection 4.1, whereby the total, mean and standard deviation for each of the three groups are calculated, "+SUV" and "+Avg" are calculated on a normalized basis for each group. Again, within each group these two normalized statistics for each player are then averaged ("Both" column) and used to rank the players from first through tenth (twelfth for combined). The reason for considering both "+SUV" and "+Avg" is again the same as in Subsection 4.1 - the former reflects longevity (most Opportunities) over a season while the second reflects expected performance per Opportunity. Combined, both aspects are reflected.

A. Comparison vs. "Traditional" Statistics

As discussed in Part 1, the goal of developing the SUV statistic is to obtain insights into players' performance that may not be readily indicated by the myriad of other statistics currently being used.⁴ Table 24 presents the season statistics for the top 10 fielders from the SUV lists based on compilations from Reference 6. To characterize player performance based on such multiple statistics, the approach taken is again the same as in Subsection 4.1, i.e., the players are ranked by normalization of the statistics for selected categories, then these normalized values are averaged to yield one overall result, used to rank the players. A combination of longevity (R-tot [Total Zone Total Fielding Runs Above Average⁵] and R-drs [Defensive Runs Saved Above Average⁶]) and expected performance statistics (Fielding Percentage [Sum of Put Outs and Assists divided by Chances], R-tot/yr [R-tot per 1200 innings, or approximately 135 games] and R-drs/yr [R-drs per 1200 innings, or approximately 135games]), i.e., a total of five statistics, are used.

⁴ The caveat from Subsection 4.1 regarding the analysis of only 54 of the total 162 games with regard to generating "insights" also applies here.

⁵ Defined in Reference 6 as "the number of runs above or below average the player was worth based on the number of plays made."

⁶ Defined in Reference 6 as "the number of runs above or below average the player was worth based on the number of plays made [as compiled by *Baseball Info Solutions*]."

Table 22. SUV Defensive Analysis for Game 005, Seattle (1) @ L.A. Angels (5), April 7, 2017 (See Reference 6 for Play-by-play)

| Play-by-Play | SUV | Segura | Haniger | Cano | Cruz | Seager | Valencia | Dyson | Zunino | Heredia | Gallardo | Fien | Overton | Ops Sum | | SUV Sum | |
|-------------------|-------|--------|---------|--------|--------|--------|----------|--------|--------|---------|----------|--------|---------|---------|--------|---------|--------|
| | | SS (6) | RF (9) | 2B (4) | DH (0) | 3B (5) | 1B (3) | CF (8) | C (2) | LF (7) | P (1) | P (1) | P (1) | Play | Inning | Play | Inning |
| 1B | -0.39 | | | | | | | | | | -0.390 | | | 1 | | -0.39 | |
| 2B | -1.11 | | | | | | | | | | -1.110 | | | 1 | | -1.11 | |
| SF-8 | 0.29 | | | | | | | 0.145 | | | 0.145 | | | 2 | | 0.29 | |
| 5-3 | 0.37 | | | | | 0.123 | 0.062 | | | | 0.185 | | | 3 | | 0.37 | |
| 5-3 | 0.33 | | | | | 0.110 | 0.055 | | | | 0.165 | | | 3 | 10 | 0.33 | -0.51 |
| K | 0.23 | | | | | | | | | | 0.230 | | | 1 | | 0.23 | |
| 3 | 0.16 | | | | | | 0.080 | | | | 0.080 | | | 2 | | 0.16 | |
| 3 | 0.10 | | | | | | 0.050 | | | | 0.050 | | | 2 | 5 | 0.10 | 0.49 |
| 1B | -0.39 | | | | | | | | | | -0.390 | | | 1 | | -0.39 | |
| 1B | -0.63 | | | | | | | | | | -0.630 | | | 1 | | -0.63 | |
| K | 0.59 | | | | | | | | | | 0.590 | | | 1 | | 0.59 | |
| IBB | -0.68 | | | | | | | | | | -0.680 | | | 1 | | -0.68 | |
| E-5 | -1.00 | | | | | -1.045 | | | | | 0.045 | | | 2 | | -1.00 | |
| K | 0.86 | | | | | | | | | | 0.860 | | | 1 | | 0.86 | |
| 5-4 | 0.74 | | | 0.123 | | 0.247 | | | | | 0.370 | | | 3 | 10 | 0.74 | -0.51 |
| 9 | 0.23 | | 0.115 | | | | | | | | 0.115 | | | 2 | | 0.23 | |
| BB | -0.22 | | | | | | | | | | -0.220 | | | 1 | | -0.22 | |
| 1B (runner to 3B) | -0.68 | | | | | | | | | | -0.680 | | | 1 | | -0.68 | |
| 4 | 0.65 | | | 0.325 | | | | | | | 0.325 | | | 2 | | 0.65 | |
| K | 0.51 | | | | | | | | | | 0.510 | | | 1 | 7 | 0.51 | 0.49 |
| 1B | -0.39 | | | | | | | | | | -0.390 | | | 1 | | -0.39 | |
| DP 8-3 | 0.78 | | | | | | 0.092 | 0.298 | | | 0.390 | | | 3 | | 0.78 | |
| 5 | 0.10 | | | | | 0.050 | | | | | 0.050 | | | 2 | 6 | 0.10 | 0.49 |
| HR | -1.00 | | | | | | | | | | -1.000 | | | 1 | | -1.00 | |
| 1B | -0.39 | | | | | | | | | | -0.390 | | | 1 | | -0.39 | |
| DP 3-6-1 | 0.78 | 0.157 | | | | | 0.207 | | | | | 0.417 | | 3 | | 0.78 | |
| K | 0.10 | | | | | | | | | | | 0.100 | | 1 | 6 | 0.10 | -0.51 |
| 1B | -0.39 | | | | | | | | | | | -0.390 | | 1 | | -0.39 | |
| HR | -1.61 | | | | | | | | | | | -1.610 | | 1 | | -1.61 | |
| 1-3 | 0.23 | | | | | | 0.038 | | | | | 0.192 | | 2 | | 0.23 | |
| 6-3 | 0.16 | 0.053 | | | | | 0.027 | | | | | 0.080 | | 3 | | 0.16 | |
| K | 0.10 | | | | | | | | | | | 0.100 | | 1 | 8 | 0.10 | -1.51 |
| 8 | 0.23 | | | | | | | 0.115 | | | | | 0.115 | 2 | | 0.23 | |

| | | | | | | | | | | | | | | | | | | |
|----------------------|-------------|---------------|----------------|---------------|---------------|---------------|-----------------|---------------|---------------|----------------|-----------------|--------------|-----------------|----------------------|---------------|----------------|---------------|------|
| 1B | -0.22 | | | | | | | | | | | | | -0.220 | 1 | | -0.22 | |
| K (runner steals 2B) | 0.15 | | | | | | | | 0.075 | | | | | 0.075 | 2 | | 0.15 | |
| K | 0.33 | | | | | | | | | | | | | 0.330 | 1 | 6 | 0.33 | 0.49 |
| | Team | Segura | Haniger | Cano | Cruz | Seager | Valencia | Dyson | Zunino | Heredia | Gallardo | Fien | Overtone | Ops Sum | | SUV Sum | | |
| | | SS (6) | RF (9) | 2B (4) | DH (0) | 3B (5) | 1B (3) | CF (8) | C (2) | LF (7) | P (1) | P (1) | P (1) | Play | Inning | Play | Inning | |
| Game Ops | 58 | 2 | 1 | 2 | 0 | 5 | 8 | 3 | 1 | 0 | 25 | 7 | 4 | 58 | 58 | -1.045 | | |
| Game SUV | -1.08 | 0.210 | 0.115 | 0.448 | 0.000 | -0.515 | 0.610 | 0.558 | 0.075 | 0.000 | -1.770 | -1.112 | 0.300 | | | -0.035 | -1.08 | |
| Game SUV/Op | -0.019 | 0.105 | 0.115 | 0.224 | | -0.103 | 0.076 | 0.186 | 0.075 | | -0.071 | -0.159 | 0.075 | Defensive SUV | | | | |

Table 22. Continued

| | Team | Segura | Haniger | Can | Cruz | Seager | Valencia | Dyson | Zunino | Heredia | Gallardo | Fien | Overtone | Ops Sum | | SUV Sum | |
|--------------------------|-------|--------|---------|--------|--------|--------|----------|--------|--------|---------|----------|--------|----------|----------------------|--------|---------|--------|
| | | SS (6) | RF (9) | 2B (4) | DH (0) | 3B (5) | 1B (3) | CF (8) | C (2) | LF (7) | P (1) | P (1) | P (1) | Play | Inning | Play | Inning |
| Cumulative Ops | 125 | 5 | 2 | 10 | 0 | 11 | 18 | 6 | 3 | 0 | 25 | 7 | 4 | 125 | 125 | -1.550 | |
| Cumulative SUV | 0.84 | 0.353 | 0.195 | 1.038 | 0.000 | -0.543 | 1.082 | 0.903 | 0.252 | 0.000 | -1.770 | -1.112 | 0.300 | | | 24.184 | 22.634 |
| Cumulative SUV/Op | 0.181 | 0.071 | 0.098 | 0.104 | | -0.049 | 0.060 | 0.151 | 0.084 | | -0.071 | -0.159 | 0.075 | Defensive SUV | | | |

| Offensive SUV | Team | Segura | Haniger | Can | Cruz | Seager | Valencia | Dyson | Zunino | Heredia |
|--------------------|--------|--------|---------|--------|-------|--------|----------|-------|--------|---------|
| Game Ops | 35 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 |
| Game SUV | -3.79 | -0.370 | -0.730 | -0.360 | 0.410 | -1.070 | -0.050 | 0.110 | -0.630 | -1.100 |
| Game SUV/Op | -0.108 | -0.093 | -0.183 | -0.090 | 0.103 | -0.268 | -0.013 | 0.028 | -0.158 | -0.367 |

| | |
|-------------------|-------|
| Err/PB/CI | 0.38 |
| with above | -3.41 |
| w/o above | -3.79 |

| Offensive SUV | Team | Segura | Haniger | Can | Cruz | Seager | Valencia | Dyson | Zunino | Heredia |
|--------------------------|--------|--------|---------|--------|--------|--------|----------|--------|--------|---------|
| Cumulative Ops | 73 | 9 | 9 | 8 | 8 | 8 | 8 | 8 | 8 | 3 |
| Cumulative SUV | -8.16 | -1.460 | -0.850 | -0.110 | -1.220 | -0.950 | 0.450 | -0.920 | -1.600 | -1.100 |
| Cumulative SUV/Op | -0.112 | -0.162 | -0.094 | -0.014 | -0.153 | -0.119 | 0.056 | -0.115 | -0.200 | -0.367 |

| | |
|-------------------|-------|
| Err/PB/CI | 1.34 |
| with above | -6.82 |
| w/o above | -8.16 |

| Combined SUV | Team | Segura | Haniger | Can | Cruz | Seager | Valencia | Dyson | Zunino | Heredia | Gallardo | Fien | Overtone |
|-----------------|------|--------|---------|-----|------|--------|----------|-------|--------|---------|----------|------|----------|
| Game Ops | 93 | 6 | 5 | 6 | 4 | 9 | 12 | 7 | 5 | 3 | 25 | 7 | 4 |

| | | | | | | | | | | | | | |
|--------------------|--------|--------|--------|-------|-------|--------|-------|-------|--------|--------|--------|--------|-------|
| Game SUV | -4.87 | -0.160 | -0.615 | 0.088 | 0.410 | -1.585 | 0.560 | 0.668 | -0.555 | -1.100 | -1.770 | -1.112 | 0.300 |
| Game SUV/Op | -0.052 | -0.027 | -0.123 | 0.015 | 0.103 | -0.176 | 0.047 | 0.095 | -0.111 | -0.367 | -0.071 | -0.159 | 0.075 |

| Combined SUV | Team | Segura | Haniger | Canero | Cruz | Seager | Valencia | Dyson | Zunino | Heredia | Gallardo | Fien | Overton |
|--------------------------|-------------|---------------|----------------|---------------|-------------|---------------|-----------------|--------------|---------------|----------------|-----------------|-------------|----------------|
| Cumulative Ops | 198 | 14 | 11 | 18 | 8 | 19 | 26 | 14 | 11 | 3 | 25 | 7 | 4 |
| Cumulative SUV | -7.32 | -1.107 | -0.655 | 0.928 | -1.220 | -1.493 | 1.532 | -0.017 | -1.348 | -1.100 | -1.770 | -1.112 | 0.300 |
| Cumulative SUV/Op | -0.037 | -0.079 | -0.060 | 0.052 | -0.153 | -0.079 | 0.059 | -0.001 | -0.123 | -0.367 | -0.071 | -0.159 | 0.075 |

Table 23. SUV Defense (Fielding and Advanced Pitching) and Combined (Hitting Plus Fielding for Fielders Only) Statistics for Top 10 Players Based on Most Opportunities (54 Games)

| Defense | +Ops | +SUV | +Avg | | Pitching | +Ops | +SUV | +Avg | | Combined | +Ops | +SUV | +Avg | |
|-------------------|---------------|--------------|--------------|-------------|-------------------|---------------|---------------|--------------|-------------|-------------------|--------------|---------------|---------------|-------------|
| Dyson | 77 | 9.948 | 0.129 | | Bergman | 108 | 2.385 | 0.022 | | Seager | 351 | 25.575 | 0.073 | |
| Heredia | 97 | 11.220 | 0.116 | | Vincent | 89 | -2.055 | 0.023 | | Cruz | 213 | 13.110 | 0.062 | |
| Haniger | 73 | 7.880 | 0.108 | | Paxton | 195 | -6.178 | 0.032 | | Cano | 390 | 23.022 | 0.059 | |
| Gamel | 84 | 8.275 | 0.099 | | Diaz | 99 | -5.217 | 0.053 | | Alonso | 136 | 7.222 | 0.053 | |
| Cano | 176 | 14.852 | 0.084 | | Hernandez | 121 | -8.388 | 0.069 | | Dyson | 201 | 10.658 | 0.053 | |
| Seager | 143 | 11.515 | 0.081 | | Moore | 95 | -7.577 | 0.080 | | Haniger | 217 | 9.080 | 0.042 | |
| Motter | 101 | 7.773 | 0.077 | | Gaviglio | 116 | -9.317 | 0.080 | | Gamel | 260 | 10.836 | 0.042 | |
| Segura | 143 | 9.886 | 0.069 | | Gallardo | 149 | -12.298 | 0.083 | | Segura | 325 | 13.116 | 0.040 | |
| Valencia | 306 | 13.264 | 0.043 | | Miranda | 228 | -22.133 | 0.097 | | Valencia | 468 | 13.854 | 0.030 | |
| Alonso | 84 | 3.192 | 0.038 | | Ramirez | 99 | -10.630 | 0.107 | | Motter | 192 | 4.793 | 0.025 | |
| Totals | 1284 | 97.81 | 0.076 | | Totals | 1299 | -81.41 | 0.063 | | Heredia | 242 | 3.951 | 0.016 | |
| Mean | 128.40 | 9.78 | 0.084 | | Mean | 129.90 | -8.14 | 0.060 | | Zunino | 178 | -6.758 | -0.038 | |
| Std Dev | 71.20 | 3.27 | 0.030 | | Std Dev | 46.88 | 6.51 | 0.039 | | Totals | 3173 | 128.46 | 0.040 | |
| Normalized | Both | +SUV | +Avg | Rank | Normalized | Both | +SUV | +Avg | Rank | Normalized | Both | +SUV | +Avg | Rank |
| Heredia | 0.762 | 0.670 | 0.855 | 1 | Bergman | 0.964 | 0.947 | 0.982 | 1 | Seager | 0.923 | 0.960 | 0.886 | 1 |
| Dyson | 0.728 | 0.520 | 0.935 | 2 | Vincent | 0.826 | 0.825 | 0.827 | 2 | Cano | 0.846 | 0.926 | 0.766 | 2 |
| Cano | 0.720 | 0.939 | 0.500 | 3 | Paxton | 0.692 | 0.618 | 0.765 | 3 | Cruz | 0.702 | 0.611 | 0.792 | 3 |
| Seager | 0.575 | 0.702 | 0.448 | 4 | Diaz | 0.624 | 0.673 | 0.575 | 4 | Dyson | 0.598 | 0.498 | 0.698 | 4 |

| | | | | | | | | | | | | | | |
|-----------------|--------------|-------|------------------|-----------|------------------|--------------|-------|------------------|-----------|-----------------|--------------|-------|------------------|-----------|
| Haniger | 0.534 | 0.281 | $\frac{0.78}{7}$ | 5 | Hernandez | 0.447 | 0.485 | $\frac{0.40}{8}$ | 5 | Segura | 0.572 | 0.612 | $\frac{0.53}{2}$ | 5 |
| Gamel | 0.503 | 0.323 | $\frac{0.68}{4}$ | 6 | Moore | 0.422 | 0.535 | $\frac{0.31}{0}$ | 6 | Gamel | 0.528 | 0.506 | $\frac{0.55}{0}$ | 6 |
| Valencia | 0.470 | 0.857 | $\frac{0.08}{3}$ | 7 | Gaviglio | 0.366 | 0.428 | $\frac{0.30}{5}$ | 7 | Alonso | 0.520 | 0.341 | $\frac{0.69}{9}$ | 7 |
| Segura | 0.408 | 0.513 | $\frac{0.30}{3}$ | 8 | Gallardo | 0.273 | 0.261 | $\frac{0.28}{5}$ | 8 | Valencia | 0.515 | 0.645 | $\frac{0.38}{5}$ | 8 |
| Motter | 0.335 | 0.270 | $\frac{0.40}{1}$ | 9 | Ramirez | 0.233 | 0.351 | $\frac{0.11}{5}$ | 9 | Haniger | 0.488 | 0.424 | $\frac{0.55}{2}$ | 9 |
| Alonso | 0.040 | 0.022 | $\frac{0.05}{9}$ | 10 | Miranda | 0.095 | 0.016 | $\frac{0.17}{5}$ | 10 | Motter | 0.284 | 0.243 | $\frac{0.32}{6}$ | 10 |
| | | | | | | | | | | Heredia | 0.220 | 0.213 | $\frac{0.22}{6}$ | 11 |
| | | | | | | | | | | Zunino | 0.012 | 0.020 | $\frac{0.00}{4}$ | 12 |

Table 24. “Traditional” Complete Season Fielding Statistics for Top 10 Mariner Fielders from SUV Analysis (Subsequently Ranked by Normalized Composite of “Traditional” Statistics)

| Defense | Chances | Put Outs | Assists | Errors | Fielding %age | R-tot | R-tot/yr | R-drs | R-drs/yr | |
|------------|------------|----------|---------|--------|---------------|---------------|----------|----------|----------|----------|
| Alonso | 251 | 236 | 11 | 4 | 0.984 | -3 | -11 | 0 | 0 | |
| Cano | 603 | 254 | 339 | 10 | 0.983 | -3 | -3 | 0 | 0 | |
| Dyson | 250 | 236 | 11 | 3 | 0.988 | 11 | 15 | 15 | 20 | |
| Gamel | 251 | 239 | 7 | 5 | 0.980 | -2 | -2 | -8 | -8 | |
| Haniger | 226 | 213 | 6 | 7 | 0.969 | 3 | 5 | 7 | 10 | |
| Heredia | 278 | 270 | 6 | 2 | 0.993 | 1 | 1 | 6 | 8 | |
| Motter | 273 | 159 | 110 | 4 | 0.985 | -6 | -11 | -2 | -4 | |
| Seager | 454 | 130 | 310 | 14 | 0.969 | 8 | 7 | -2 | -2 | |
| Segura | 451 | 136 | 298 | 17 | 0.962 | -4 | -4 | -3 | -3 | |
| Valencia | 990 | 912 | 67 | 11 | 0.989 | 1 | 2 | 1 | 1 | |
| Mean | | | | | 0.980 | 0.6 | -0.1 | 1.4 | 2.2 | |
| Std Dev | | | | | 0.010 | 5.441 | 7.992 | 6.433 | 8.230 | |
| Normalized | Cumulative | | | | Rank | Fielding %age | R-tot | R-tot/yr | R-drs | R-drs/yr |
| Dyson | 0.937 | | | | 1 | 0.777 | 0.972 | 0.971 | 0.983 | 0.985 |
| Heredia | 0.700 | | | | 2 | 0.893 | 0.529 | 0.555 | 0.763 | 0.760 |
| Haniger | 0.635 | | | | 3 | 0.131 | 0.670 | 0.738 | 0.808 | 0.828 |
| Valencia | 0.571 | | | | 4 | 0.803 | 0.529 | 0.604 | 0.475 | 0.442 |
| Seager | 0.493 | | | | 5 | 0.134 | 0.913 | 0.813 | 0.299 | 0.305 |
| Cano | 0.408 | | | | 6 | 0.621 | 0.254 | 0.358 | 0.414 | 0.395 |
| Alonso | 0.359 | | | | 7 | 0.645 | 0.254 | 0.086 | 0.414 | 0.395 |
| Motter | 0.283 | | | | 8 | 0.691 | 0.113 | 0.086 | 0.299 | 0.226 |
| Gamel | 0.279 | | | | 9 | 0.491 | 0.316 | 0.406 | 0.072 | 0.108 |
| Segura | 0.212 | | | | 10 | 0.037 | 0.199 | 0.313 | 0.247 | 0.264 |

Within the constraints of the comparison (SUV analysis is based on only one-third, i.e., 54 games, of the season vs. Reference 6’s complete season; and the subjectivity of which statistics to select for the comparison and use of normalization and subsequent averaging to yield a “performance measure” that can be compared to the SUV), the results provide insights that might not readily be found from the current myriad of statistics. Among the fielders, Heredia, Dyson and Cano stood out as the top performers, with a fairly wide margin over the next player (Seager); while Alonso was the poorest, significantly below the previous player (Motter). When the full season “traditional” statistics are used, Dyson stands out at the top and Segura at the bottom, similar to the SUV results, with Heredia a somewhat distant second to Dyson and Cano now falling in the middle. Again, this comparison is arbitrary, and the SUV analysis uses only 54 of the 162 games, but if one envisions the SUV results to be representative of a full-season performance, they indicate that Dyson performed well, somewhat better than his “traditional” statistics would seem to indicate. Meanwhile, Segura did not perform well, somewhat below his middling “traditional” statistics.

For pitchers based on their SUV, Bergman stood out at the top, with Vincent next and well above the rest of the group; while Miranda was the poorest, noticeably below the next higher player (Ramirez). The rankings are quite similar to those from Part 1, which used a simpler approach to assessing pitcher SUV, with no pitcher displaced by more than one position from his previous ranking. Based on the full season’s “traditional” statistics, Vincent comes out on top, followed by Diaz and Ramirez (the bottom performer based on the SUV), with Bergman and Paxton in the middle. Gallardo and Miranda are at the bottom, consistent with their SUV ranks. The discrepancy for Ramirez was previously noted and analyzed, so is not repeated here.

VI. CONCLUSION

This effort began as a desire to return to the simplicity of an earlier era when a few statistics were all that were used to characterize player performance. Today's myriad of statistics provides unique insights into the game, but may often pose contradictions for players making it difficult to determine just who performs best. With this in mind, I explored the possibility of using a single statistic, based on the concept of "run expectancy," to provide an accurate measure of an individual's performance for a team sport, namely major league baseball. What has evolved is the Situational Underlying Value (SUV) statistic that can be used for hitting and fielding (and combined) for position players, and pitching as a single, overarching statistic. Results from a series of "proof of principle" exercises suggest reasonable alignment with what might be expected by combining the myriad of current statistics, with insights perhaps not available from the difficulty to combine them on an equal footing. The SUV statistic eliminates this difficulty by placing everything on the same playing field, that being an extension of the "run expectancy" concept.

In future installments, the SUV statistic will be demonstrated for its utility for professional football and men's college basketball. The reader interested in the complete analysis of the 54 games for the "proof of principle" contained herein is directed to Reference 7, where the complete analyses are provided.

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APPENDIX

Tables 25 through 28 provide a useful template for tracking the SUV offensively and defensively for a major league game in real-time. It uses the one significant figure versions of the SUV tables from Tables 7 and 21. They assume an interleague game with the National League team at home, therefore no designated hitter (although an entry is provided should one be allowed). The AL team scored single runs in the even innings (a total of four); NL team scored single runs in the odd innings, with a two-out walk-off sacrifice fly winning the game in the ninth (five runs total). Since the template needs to be flexible to accommodate the vagaries of any particular game, Table 29 provides a blank that can be filled in to parallel Tables 25 through 28 as needed. The abbreviations used are as follows: AL/NL = American/National League; V/H = Visitor/Home; Off/Def = Offense/Defense; 1B (3), 2B (4), 3B (5), SS (6), LF (7), CF (8), RF (9), DH (0), P (1), and C (2) are the player positions (numbers); PH = Pinch Hitter.

A. "Saves" Redefined

Too often, "closers" earn "Saves" for what should be routine "mopping up," such as starting the ninth inning with a 3-run lead. To better define what a "Save" should be, the SUV proves quite useful (reference Table 7 or 21). Using the SUV chart, let's define the Save as follows. Consider a reliever entering in the 9th inning (or later, if his team is visiting and has taken the lead). If he enters with none on, none out, the expected runs (total SUV) is the sum of the None column, i.e., 0.49. If he enters with one out and a runner at least on first, the minimum SUV is $0.22 + 0.16 + 0.10 = 0.48$. With two outs and two on, at least first and second, we have $0.23 + 0.12 + 0.10 = 0.45$. Assume a lead of no more than 2 runs. The difference between the two-run lead and these SUVs will be 1.51, 1.52 or 1.55, i.e., < 1.6 when rounded. So, define a Save for a pitcher entering in the ninth (or later) as a difference between his team's lead and an SUV of < 1.6 . This would eliminate the Save for a pitcher entering in the ninth with a three-run lead, unless there were multiple men on base (e.g., none out and first and second = $3 - [0.63 + 0.39 + 0.23 + 0.16 + 0.10] = 1.49$; one out and bases loaded = $3 - [0.68 + 0.44 + 0.22 + 0.16 + 0.10] = 1.40$).

For entering in the eighth inning, just add 0.49 to each of the SUVs for the ninth or later, i.e., 0.98 (0 out), 0.97 (1 out), and 0.95 (2 outs). Now, with a lead of three runs (or less), the required difference between lead and SUV would be $3 - 0.98 = 2.02$, $3 - 0.97 = 2.03$, or $3 - 0.94 = 2.06$, or < 2.1 when rounded. With a four-run lead, there would have to be more men on base than the minimum. The pattern (adding on $1 - 0.49 = 0.51$ per inning, assuming one more run allowed in the lead) continues for entering in the 7th or 6th inning (anything earlier is not a Save situation), i.e., (1) for the 7th, 2.53, 2.54, or 2.57, or < 2.6 ; (2) for the 6th inning,

3.04, 3.05, or 3.08, or < 3.1 . Therefore, to get a Save, a pitcher must enter with no more than the listed difference between his team's lead and the SUV for the situation AND finish the game without relinquishing the lead at any time, with the differences as follows:

6th inning < 3.1 7th inning < 2.6 8th inning < 2.1 9th inning or later < 1.6 .

Table 25. SUV Example Template for American League Visitor on Offense vs. National League Home

| AL-V-Off | RF-V (9) | CF-V (8) | LF-V (7) | SS-V (6) | 3B-V (5) | 2B-V (4) | 1B-V (3) | C-V (2) | DH-V (0) | P1-V (1) | Ops | Sums |
|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----|----------|
| 6 | 0.2 0 | | | | | | | | | | 1 | |
| 1B | | 0.2 0 | | | | | | | | | 1 | |
| K | | | 0.3 0 | | | | | | | | 1 | |
| 4-3 | | | | 0.2 0 | | | | | | | 1 | 0.5 0 |
| HR | | | | | 1.0 0 | | | | | | 1 | |
| 3 | | | | | | 0.2 0 | | | | | 1 | |
| 7 | | | | | | | 0.2 0 | | | | 1 | |
| 2B | | | | | | | | 0.2 0 | | | 1 | |
| 5-3 | | | | | | | | | 0.3 0 | | 1 | 0.5 0 |
| K | 0.2 0 | | | | | | | | | | 1 | |
| 3-1 | | 0.2 0 | | | | | | | | | 1 | |
| 2 | | | 0.1 0 | | | | | | | | 1 | 0.5 0 |
| BB | | | | 0.4 0 | | | | | | | 1 | |
| 1B (+3 B) | | | | | 0.9 0 | | | | | | 1 | |
| DP 6-4-3 | | | | | | 0.7 0 | | | | | 1 | |
| 6-3 | | | | | | | 0.1 0 | | | | 1 | 0.5 0 |
| 8 | | | | | | | | 0.2 0 | | | 1 | |
| 9 | | | | | | | | | 0.2 0 | | 1 | |
| BB | 0.1 | | | | | | | | | | 1 | |

| | | | | | | | | | | | | | | | | | | | | | |
|-----------------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|----------|-----------|-----------|----------|----------|-----------|----------|-----------|-----------|----------|----------|-------|-----------|
| | 0 | | | | | | | | | | | | | | | | | | | | |
| 1B | | | 0.2 0 | | | | | | | | | | | | | | | | | 1 | |
| K | | | | | -0.4 0 | | | | | | | | | | | | | | | 1 | -0.5 0 |
| 2B | | | | | | | 0.6 0 | | | | | | | | | | | | | 1 | |
| Sac 1-3 | | | | | | | | | | -0.1 0 | | | | | | | | | | 1 | |
| SF 7 | | | | | | | | | | | 0.1 0 | | | | | | | | | 1 | |
| BB | | | | | | | | | | | | 0.1 0 | | | | | | | | 1 | |
| 1B | | | | | | | | | | | | | 0.2 0 | | | | | | | 1 | |
| HB P | | | | | | | | | | | | | | | 0.3 0 | | | | | 1 | |
| 4 | -0.7 0 | | | | | | | | | | | | | | | | | | | 1 | 0.5 0 |
| K | | | -0.2 0 | | | | | | | | | | | | | | | | | 1 | |
| 9 | | | | | -0.2 0 | | | | | | | | | | | | | | | 1 | |
| 1-3 | | | | | | | -0.1 0 | | | | | | | | | | | | | 1 | -0.5 0 |
| BB | | | | | | | | | 0.4 0 | | | | | | | | | | | 1 | |
| DP 3-6- 1 | | | | | | | | | | -0.8 0 | | | | | | | | | | 1 | |
| HR | | | | | | | | | | | | 1.0 0 | | | | | | | | 1 | |
| 7 | | | | | | | | | | | | | | -0.1 0 | | | | | | 1 | 0.5 0 |
| 5-3 | | | | | | | | | | | | | | | | -0.2 0 | | | | 1 | |
| K | -0.2 0 | | | | | | | | | | | | | | | | | | | 1 | |
| 6-3 | | | -0.1 0 | | | | | | | | | | | | | | | | | 1 | -0.5 0 |
| Ops | 5 | 0 | 5 | 0 | 4 | 0 | 4 | 0 | 4 | 0 | 4 | 0 | 4 | 0 | 4 | 0 | 4 | 0 | 0 | 38 | |
| SUV | -1.2 0 | 0.0 0 | -0.1 0 | 0.0 0 | -1.0 0 | 0.0 0 | 0.7 0 | 0.0 0 | 2.2 0 | 0.0 0 | -1.6 0 | 0.0 0 | 0.8 0 | 0.0 0 | 0.1 0 | 0.0 0 | -0.4 0 | 0.0 0 | 0.0 0 | -0.50 | |

Table 26: SUV Example Template for National League Home on Defense vs. American League Visitor

| NL-H-Def | RF-H (9) | CF-H (8) | LF-H (7) | SS-H (6) | 3B-H (5) | 2B-H (4) | 1B-H (3) | C-H (2) | PH1-H | PH2-H | Ops | Sums |
|-----------|----------|----------|----------|----------|----------|----------|----------|---------|-------|-------|-----|-------|
| 6 | | | | 0.10 | | | | | | | 2 | |
| 1B | | | | | | | | | | | 1 | |
| K | | | | | | | | | | | 1 | |
| 4-3 | | | | | | 0.07 | 0.03 | | | | 3 | 0.50 |
| HR | | | | | | | | | | | 1 | |
| 3 | | | | | | | 0.10 | | | | 2 | |
| 7 | | | 0.10 | | | | | | | | 2 | |
| 2B | | | | | | | | | | | 1 | |
| 5-3 | | | | | 0.10 | | 0.05 | | | | 3 | -0.50 |
| K | | | | | | | | | | | 1 | |
| 3-1 | | | | | | | 0.07 | | | | 2 | |
| 2 | | | | | | | | 0.05 | | | 2 | 0.50 |
| BB | | | | | | | | | | | 1 | |
| 1B (+3 B) | | | | | | | | | | | 1 | |
| DP 6-4-3 | | | | 0.17 | | 0.15 | 0.03 | | | | 4 | |
| 6-3 | | | | 0.03 | | | 0.02 | | | | 3 | -0.50 |
| 8 | | 0.10 | | | | | | | | | 2 | |
| 9 | 0.10 | | | | | | | | | | 2 | |
| BB | | | | | | | | | | | 1 | |
| 1B | | | | | | | | | | | 1 | |
| K | | | | | | | | | | | 1 | 0.50 |
| 2B | | | | | | | | | | | 1 | |

| | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------|----------|----------|----------|---------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|---------------|---------------|---------------|------|----------|---------------|
| Sac 1-3 | | | | | | | | | | | | | 0.0 2 | | | | | 0.0 8 | | | | 2 | |
| SF 7 | | | | - 0.0 5 | | | | | | | | | | | | | | - 0.0 5 | | | | 2 | |
| BB | | | | | | | | | | | | | | | | | | - 0.1 0 | | | | 1 | |
| 1B | | | | | | | | | | | | | | | | | | - 0.2 0 | | | | 1 | |
| HB P | | | | | | | | | | | | | | | | | | - 0.3 0 | | | | 1 | |
| 4 | | | | | | | | | | | | | | | | | | 0.7 0 | | | | 1 | - 0.5 0 |
| K | | | | | | | | | | | | | | | | | | | | 0.2 0 | | 1 | |
| 9 | 0.1 0 | | | | | | | | | | | | | | | | | | | 0.1 0 | | 2 | |
| 1-3 | | | | | | | | | | | | 0.0 2 | | | | | | | 0.0 8 | | 2 | 0.5 0 | |
| BB | | | | | | | | | | | | | | | | | | | | - 0.4 0 | | 1 | |
| DP 3-6- 1 | | | | | | | 0.1 7 | | | | | | 0.2 0 | | | | | | | 0.4 3 | | 3 | |
| HR | | | | | | | | | | | | | | | | | | | | - 1.0 0 | | 1 | |
| 7 | | | | | 0.0 5 | | | | | | | | | | | | | | | 0.0 5 | | 2 | - 0.5 0 |
| 5-3 | | | | | | | | | 0.0 7 | | | | 0.0 3 | | | | | | | 0.1 0 | | 3 | |
| K | | | | | | | | | | | | | | | | | | | | 0.2 0 | | 1 | |
| 6-3 | | | | | | | 0.0 3 | | | | | | 0.0 2 | | | | | | | 0.0 5 | | 3 | 0.5 0 |
| Ops | 2 | 0 | 1 | 1 | 2 | 0 | 5 | 0 | 2 | 0 | 2 | 0 | 11 | 0 | 1 | 0 | 28 | 0 | 10 | 0 | 65 | | |
| SU V | 0.2 0 | 0.0 0 | 0.1 0 | - 0.0 5 | 0.1 5 | 0.0 0 | 0.5 0 | 0.0 0 | 0.1 7 | 0.0 0 | 0.2 2 | 0.0 0 | 0.5 8 | 0.0 0 | 0.0 5 | 0.0 0 | - 1.2 3 | 0.0 0 | - 0.1 8 | 0.0 0 | 0.50 | | |

Table 27. SUV Example Template for National League Home on Offense vs. American League Visitor

| (9) | CF-H(8) | LF-H(7) | SS-H(6) | 3B-H(5) | 2B-H(4) | 1B-H(3) | C-H(2) | P1-H(1) | PH1-H | P2-H(1) | PH2-H | Err/CI/PB |
|-----|---------|---------|---------|---------|---------|---------|--------|---------|-------|---------|-------|-----------|
| 0 | 1.10 | 0.00 | -0.60 | -0.40 | -0.20 | 0.05* | -0.35* | -0.20 | | | | |
| 0 | 1.00 | -0.10 | -0.20 | -0.20 | -0.10 | 0.40 | 0.60 | -0.10 | | | | |
| 0 | -0.30 | -0.20 | -0.20 | -0.50 | -0.20 | 0.20 | 0.40 | | 1.00 | | | |
| 0 | -0.60 | | | | | | | | | | | |
| | | | | | | | | | | | | 0.40 |

Returnee Youth Student Migrants in Nepal

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Abstract- Youth student migration is rapidly growing in the recent years in Nepal. Every year thousands of students leave the country to pursue their higher education to the different developed countries across the world. However, they undergo through the financial, social, cultural and personal challenges during their educational journey in the international universities and colleges. Despite these adversities, few of them return to Nepal with experiences and some achievements. Additionally, this study outlines the returnee youth students and their achievement after completion of study abroad. Considering the youth trend of study abroad, this study addresses the research question: how do the Nepali students narrate their stories of their achievement and outcome of study abroad?

For this, I employed narrative inquiry assuming that the stories of student mobility and its outcome challenge the educational and employment aspirations of youth in Nepal. I used the Lee's theory of migration where the push and pull factors are mainly concerned in the student migration trend. Hence, this research has illuminated leaving trend of the young talent from the developing countries and it showed the success story of young talent who came after their higher education from the developed countries.

Key words; Returnee student migrants, Youth talents, mobility, achievement, developing countries etc.

I. INTRODUCTION

Context

The university students who are living and enrolled in the student visa outside their countries are called the student migration. In this context, Guruz (2008) defines that student migration is the trend where students pursue their higher study in an global international institution. In the recent decades, thousands of foreign students have been going to the abroad for their higher education. It has been becoming the growing trend in the developing countries like Nepal because thousands of foreign students were in the international universities to pursue their higher education. In this context, Ghimire (2016) who calculates that the number of going abroad student is triggered which increased from 11,912 in 2011/12 to 33,000 students obtained the No Objection Certificate (NOC) in 2015/16. Thus, they spend millions of dollars on their tuition fees in the international institutions. They move out of their country for the purpose of study however, settles down after the completion of their study. The scholar, Costello (2015) noted that study abroad is an academic experience where students physically leave their home

countries to engage in college study, part time job and cultural interaction after they reach abroad.

Students' migration is getting popular these days particularly from the developing countries such as Nepal, India, Bhutan etc. in comparison to the developed countries such as the USA, the UK, and Australia. The developed countries have attracted the international students since they are ranked as the best universities globally. The job opportunities and getting the quality education are the significant factors to motivate the international youth migration (Human Development Report, 2009). Furthermore, the student migration is an activity where migrant students will have an economic, as well as legal difficulty abroad (Batista-Pinto, 2010). However, the increasing demand of the quality higher education of the international degree has become the central point in attracting the international students.

The migrant student always faces the economic problem as they need to pay the large sum of the money to the international universities. Despite being that, the international students leave their home countries with the hope of getting skills, knowledge, and other valuable resources which can be useful to them after returning their home country. Some of them are able to stay and work after the completion of their studies (Rosenzweig, 2008). They have an opportunity to work after the completion of their study. It may provide an opportunity to garner the international work experiences to the international students. They also can earn money during their post-study work period abroad. But most of the students migrant return home soon after they have achieved their goals abroad (Ammassari, 2004). They earned their degree which enables them to gain the knowledge and skills. They moreover become self dependent improved professional skills and intercultural competencies after having the international degree.

II. METHODOLOGY

I adopted the qualitative approach in order to conduct this research. In this regard, I applied a qualitative approach where we assumed the reality about student migration and their situation after their return from the study abroad is multiple and subjective as argued by Castellan (2010). In this context, I applied the naturalist and subjectivity strategies and explored reality through participant's views, their own background, and experiences (Creswell, 2003). In order to conduct this research, I employed narrative inquiry assuming that the stories of student mobility and its outcome challenge the educational and employment aspirations of youth in Nepal. I took their interview to disclose behavior, interest, and actions in a natural setting (Stake, 2005). I took participants namely Ujjwal, Rojina, Samir and Rajat who were

already went abroad and returned after their completion of their degree abroad.

Thus, personal interview was a suitable method for me to explore the in-depth information to conduct this research. I found that interview was in-depth along with observation. I designed the interview theme to gain the context, content, and process of the student migration and the situation of the returnee students. In the beginning, I requested my research participants through a telephone conversation and explained a brief overview of the purpose of the research. In addition, before an interview, I established rapport, build trust, requested permission to record the conversation (notes were taken as back-up) and start an interview with the permission. As soon as I returned from fieldwork, I transcribed the interviews in the same order that we conducted (Peräkylä, 1997). For this, I reviewed all our notes immediately after each interview.

III. MY PARTICIPANTS;

Ujjwal

Ujjwal, master degree holder from the UK, succeed to establish his own higher secondary school, teaching in his own institution. He was born in Umlabari, Morang, Nepal and belongs to the middle class family.

Rojina

Rojina, UK graduate in Bio-chemistry has established herself as a science teacher in the reputed school at Kathmandu. She also established her in school in Kathmandu. .

Samir

Samir, UK graduate in business administrative has been running his own management company for some years in Kathmandu.

Rajat

Rajat, returned to Nepal from the Australia, has completed his MBA, started his own Hotel and restaurant in Thamel, Kathmandu, Nepal.

IV. EDUCATION MIGRATION IS BRAIN DRAIN OR BRAIN GAIN

Educational migrant has both the positive and negative aspect. There are two distinct groups defining the educational migration. Some scholars define that brain drain as the movement of skilled and educated individuals from one country to another in search for a better job, improved career prospects and therefore an overall better life (Omet & Saif, 2008). Straubhaar (2000) stress that the effects of the mobility of the highly skilled can create even larger negative effects to the origin of the country where the country of production is losing both it's minds' and human capital to other nations. In the same context, Kone & Özden, (2017) explain that high skilled migrants come from every corner of the world, especially from poorer, smaller, and isolated economies, and move to larger, wealthier, English-speaking OECD countries. Even, it can be found that the highly educated immigrants from the developing countries are involved into low-skilled occupations

abroad that may result brain waste (Kone & Ozden, 2017 cited in Mattoo, Neagu, and Özden, 2008). Similarly, brain drain" designates the international transfer of resources in the form of human capital, i.e. the migration of relatively highly educated individuals from developing to developed countries (Beine et al, 2001). However, the brain drain reduces economic growth through the depletion of a source country's human capital assets and additionally through unrecompensed investments in education.

Similarly, the other perspective, brain gain, where highly skilled people are themselves established academically and financially in the developed country, thus, they can contribute to the home countries (Candan & Hunger, 2013). In the same way, McGill (2013) states that the academic mobility of highly-skilled individual has brought the broad phenomenon of youth students departing their country of origin and gaining a higher level of skill from abroad. The knowledge and skills can also be passed through the mobility of academic staff and students because of the globalization of education. The highly educated and skilled international students are the sources of the both the academic and investment in the home countries (World Bank, 2015). The international degree provides opportunities with different effect whereby their home country could take advantage of the embodied knowledge (Mayer, 1996 as Cited in Mugimu, 2010). The young talent students from the developing countries are attracted towards the economic opportunities and quality of education of the developed countries in the world. Return migrants may also be beneficial to their home country as they bring with them not only financial savings, but also a set of newly acquired productive skills (either through formal schooling or on-the job learning) that positively contribute to a country's stock of human capital (Batista, Lacuesta and Vicente, 2007).

Hence, it can be defined that student migration has become the key concern of both the economic and social development because of its quality education and its recognized degree. However, the move to pursue their higher education abroad, they trained and equipped with the knowledge and skills abroad. It is good news to hear that they return to their home country after getting international degree and key skills from study abroad. They can independently settle down themselves in their country of origin. Moreover, the internationalization of education benefits a lot to the domestic students and teachers by promoting the practical international degree and cultures from foreign students who can broaden their knowledge and perspectives when learning abroad.

V. ABROAD EXPERIENCE OF RETURNEE STUDENT

Study abroad has brought more valuable experiences in their life. It has been observed that most of the returnee student has become professionally successful in the origin country. My participant, Ujjwal Upprety, who works in Dikshya Secondary School, Koteshwer, Kathmandu, , as a Program Co-coordinator. He shared that *During my student period in the UK, I had to both study and work in the UK during student visa. I also had earned some money during the post study work period. I also had both the UK graduate degree as well as sums of money for my coming future.*

According to Ujjawal , he studied really hard to achieve the higher grades in the UK, thus, he worked even harder to find a

good job. He experienced different types of job that also taught me a lot. He used to work for 12 hours a day in the restaurant even though the students were allowed to work only 20 hours a week in order to support their tuition fees. He even used to fall asleep in the class room due to the long work hours in the restaurant. The hard working caused his back pain which became a problem for his study. Somehow, Ujjwal completed his degree and applied for the post study work visa for another two years. He worked hard for two years of post-study work period and earned some money for his future. However, the job was difficult for him. Finally, after the completion of post study work visa, he came back to Nepal and bought some partial share of the school I met him. Then, he started teaching in this school as a regular fulltime teacher. In the same way, Rojina shared that;

I explored her new career after I graduated from the UK. I really learnt more practical lesson in the university along with the useful job experiences.

According to Rojina, she had explored new career options and she was also impressed by other people and interested in learning new things about new cultures from other countries. She was also excited about the great experiences as she had learned many things that have had a large impact on her life. She believed that this will help her in the long term both personally and professionally. The highly skill students are key for formation of human resources for the country of origin (Brown, 2002). She argued that the outstanding education which was provided with the best lecturers and the ultimate education package from the UK universities had really impressed her. At the same time, the university provided her endless means to apply that acquired knowledge in real life through placements, work experience and voluntary work.

In the same way, Lowell (2002) defines that when emigrants maintain ties to their home country through backward connections, then, human and financial networks spillover to the source country that often yield significant benefits to the source country. Similarly, Samir shared that;

I had improved my English language along with the interpersonal skill abroad. I had more English friends during my student life where I used to speak in English language. Besides learning at class, I used to speak in working places abroad. Samir experienced that he had improved his spoken English skills because he had used English language both in the class and the work. Similarly, Birkin et al. (2014) state that abroad experience is the transferrable skills that have value in a wide range of jobs, including foreign language acquisition, communication and interpersonal skills, cultural sensitivity, self-directed learning, community-building, and contributing to social cohesion(p.9). He moreover had learnt interpersonal skills, cultural sensitivity, foreign language acquisition, lifelong academic and the practical self-directing learning from the university during his student period abroad.

In the same way, Rajat shared his experiences; *I became self-dependent and determined person after completing my education abroad. I got an opportunity to experience things I had never done before in my life which made me more experienced and self-dependent in my life.*

According to him, he has also talked about the benefits of abroad going students as he outlined such as academic achievement and commitment, developed the professional carried

development, return on huge investment which he really had experienced in her life. He himself realized that the abroad study context emerges as a powerful context for the enhancement of self-efficacy beliefs and perceptions (Cubillos & Ilvento, 2013). The degree and experiences can be used to settle down own business in the origin of the country. He again shared that;

I was connected with the diverse culture and language. I moreover became independent after I graduated abroad.

In addition, he believed that in order to connect with the international friends, it can be beneficial to create public network which is very useful in the upcoming future. In the same way, he also realized that studying abroad really brings him out his independent nature. Thus, it is indeed true that students who study abroad become explorers of their new nation and really discover the curiosity and excitement that they harbor. He also accepted that being in a new place by him which was an overwhelming time, and it tested his ability to adapt to diverse situations while being able to solve financial, study and job-related problems.

They believed that they had gained better transnational competence meaning language, cultural and technical skills than the other people (Hawkins & Cummings, 2000). They thought that it is their biggest advantages of going abroad for study. It is an opportunity to meet new lifelong friends from different backgrounds.

Ujjwal, who completed his graduation from the United Kingdom, felt lucky to have international degree as well as got the UK work experiences. He graduated and got 2 years of work study visa to stay there. He is really happy to share his experiences to me during our second meeting. *He said:*

I was lucky to say that I had completed my graduate degree from the United Kingdom. I also learnt practical knowledge through the use of ICT in the course of getting his graduate degree. During studying abroad period, he had opportunities to attend school and live with students from different countries in the world. This gave him the opportunity to be familiar and create lasting relationships with fellow students. Hence, he had explored new career and he was also impressed by other international friends and interested about learning new things about new cultures from other countries. Similarly, Hunger (2002) states that if those students got knowledge and skills from abroad and return to their home country or through creating transnational networks, they can play a significant role in the development processes in the developing countries.

Rojina, who completed her graduate degree from the UK has also benefited students to create lots of opportunity to discover while acknowledging the world and understanding of a different culture from her friends all over the world. Moreover, she developed the valuable personal attributes such are self-direction or self-authorship (King, Baxter & Magolda, 2005). She shared that; *The outstanding education which is provided me with the best lecturers and the ultimate education package from the UK universities had really impressed me.* At the same time the university provided him endless means to apply that acquired knowledge in real life through placements, work experience and voluntary work. She further said:

I became hardworking, self dependent and open minded after returning from the UK.

Thus, she realized that the independence and open-mindedness are powered by the experience of studying abroad (Hadis, 2005). She explained that he worked for 12 hours a day in a restaurant even though the students were allowed to work only for 20 hours in a week in order to support his tuition fees. She even used to fall asleep in the class room due to the long hours work in the restaurant. Thus, she is now able to do some business indecently and came back to Nepal and bought some partial share in a school.

VI. STUDENT EMPOWER THEMSELVES WITH ACHIEVED CAPITALS

Study abroad empowers young students to become self confident after they return from international universities. They gain practical education as well as the work experience which will make them more mature in their life. In the same way, Ujjwal share that;

Although I came from the eastern part of Nepal, I became confident and self dependent after my UK education. I struggled to pursue my higher education in Nepal and completed my master degree and returned to Nepal, which will empower me confident and self dependent According to Ujjwal, he was originally from Urlabari, Morang, which is located in the eastern Nepal. He completed his schooling from Urlabari and completed his college education from Kathmandu. He believes that higher education can bring changes to his life. That is why he started planning the journey to the UK for his further study. Meanwhile, it was easy to enter the UK in the student visa category because he had a good academic record and good knowledge of English language. Thus, he got the UK student visa in 2010 and got enrolment in master's degree in creative writing. Youth empowerment is to build young people's skills and capacity so they feel like they are able to influence the social and political systems that affect their lives (Raffle & Leach, 2015). After getting his degree, he has become self confident and depended in his own. He feels proud of him due to his abroad degree and work experiences. Similarly, Rojina shared that; *I got international degree and the work experience which helps me to enrich professional carrier after returning to Nepal.*

Young students expect independency, freedom, getting quality and useful academic degree and the job after their graduation from higher education abroad (Horkai, 2008). Rojina experienced that the international degree are valuable in her life. She settled in her home country after getting an international degree. In addition, she also believed the benefits of abroad going students to be; academic achievement and commitment, developing the professional career, return on huge investment which she had experienced in her life. She became a self-dependent and a determined person after completing her education abroad. She had an opportunity to experience things she had never done before in her life which made her more experienced and self-dependent in her life. She again shared that; *I really became self-dependent and confident. I learned new skills and methods using modern technology from abroad. I am now confident at my job to share my knowledge to my students and friends.*

Youth have the power to influence the country for its betterment. Youth empowerment inspires to achieve the skills and ability to bring the changes into their lives and of other people.

Hence, youth empowerment encourages bringing the changes within the people and the nation. Similarly, Ledford, Lucas, Dairaghi and Ravelli (2013) discussed the result of the youth empowerment as the young people become clear of their mission of the organization and improve a great deal to bring success to the organization. The higher education can assist to empower the young people of the nation. In this context Gillies (2015) states that people with university or career-oriented education qualifications have better prospects for employment than young people who leave school before they have completed high school. Hence, it can be said that student mobility has become the key concern of both the economic and social development because of its quality education and its recognized degree. Youth have opportunities to learn, interact, and demonstrate their talent abroad. Besides, youth can have opportunities to work along with their study. They gain practical knowledge during their student life. In the same way, Gautam (2017) stated that youth mobility has always been destined to live and struggle to urban areas both for education and job opportunities. Due to the improvement of their career, youth are motivated to leave the country for their higher education abroad. It is also indeed true that the skills that they have been equipped are really useful for the development of the individual career. It is indeed true that Education plays vital role to produce a more responsive intellectual workforce who can challenge this changing societies (Seltzer, 1996).

They used to work hard during their student life. Their hard work really taught them to become hardworking and devoted towards their duty. In this context Gillies (2015) states that people with university or career-oriented education qualifications have better prospects for employment than young people who leave school before they have completed high school. In the same way, study abroad experiences which had an impact upon their lives after the return due to the practical education abroad. Therefore, study abroad always empowers the youth to become independent in their life.

VII. STUDENT MIGRATION IS BRAIN GRAIN NOT BRAIN DRAIN

Due to the departure of the young talent students to the foreign land, the country has not only lost the talented youths but also the huge investment. As we all know that Youths are the pillar of the nation to build the country. Hence, this study also shows the possible "brain drain" situation of the country due to the student mobility towards the developed countries. However, this paper claims that most of participants had gained more valuable experiences along with the international degree, thus, they are to enhance their professional carrier after they returned to their origin of the country, The study abroad will definitely provide the quality education as well as the international work experiences to those who have gone there to pursue their higher education abroad. Once they are being qualified, they can lead the country to change economic, education and political situation of the country.

Therefore, study abroad is more likely towards the brain grain instead of brain drain situation. Similarly, Samir shared that; *I used to present more presentation in the class room, so that, I am now confident to speak in front of the public.* He has built up the confident to speak in front of the public. He learnt speaking skills along with confident in his carrier. He has become the director of

the management company in Nepal now. He is the leader of the company in origin of the country now due to the skills and knowledge he has gained from the study abroad. Ritzen and Marconi (2010) state that the trends of studying abroad represent one of the important sources of high-skilled migration. The skills and knowledge can enrich those youth to become the leaders of the nations. Similarly, youths play vital role to bring their changes from the dependence to independence and interdependence in their life. They leave their home country for their higher education. They struggle to achieve international degrees and get better job in and beyond the country.

Therefore, they change their life from the dependence to independence. In the same way, Rajat shat that; *after I completed my study abroad, I felt more secured and confident in my life. I moreover started speaking English fluently which also established me as the successful businessman.* He said that study abroad create lots of opportunities to discover them while acknowledging the world and an understanding of a different culture from his friends from all over the world. In addition, they improved inter-personal development skills and knowledge of international culture which are the key skills to learn from the study abroad. They feel more secured and found confident in their life after returning home country. Most of the participants are found self confident and determined after returning to their home country. It is also observed that having international University degree and returned with an international work experiences made them achieving the professional skills and knowledges for their carrier. They were able to achieve the success establishing himself as an entrepreneur in his homeland.

VIII. CONCLUSION

Study abroad is the global phenomenon. Although, there is loss of human capital for the developing countries, the returnee students are able to garner the self confident in their carrier in the home countries. The student leaves their home countries by paying high amount of money in order to get the quality education from the developing countries. The developing countries are losing their human capital due the lack of the quality education, and the better economic opportunities in their home countries. The developed countries are attracting the students from the developing countries due to their recognized degree, attractive salary on the part time job and well equipped universities. Hence, the international students are able to make their better carrier after their graduation abroad. They not only became self confident but also financially sounds after they return to their home countries. The returnee students are examples of being successful after having skills and knowledge abroad. Similarly, having self confident,, inter-personal development skills and knowledge, open mindedness, better communication skills and knowing other's cultures are key to develop their carrier after abroad degree to the international students.

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Psychosocial Burden among Caregivers of Children with Nephrotic Syndrome in Najaf Province

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Abstract

Caregivers for children with Nephrotic syndrome reported a more negative impact and poor mental health. They seem to be at great risk of depression, tension, anxiety and distress; many caregivers have been able to overcome the constant challenge of using their patience and accepting the consequences of coping well with adversity. This study focuses on assessing Psychosocial Burden among caregiver of children with Nephrotic syndrome within a hospital in Najaf Province. **Methodology:** A descriptive cross-sectional study carried out in al-Najaf City hospitals (AL-Sadder Medical City, AL-Zahra'a teaching hospital) from (23 September 2018) to (1 September 2019), A non-probability (Purposive Sample) of (115) to determine the burden of Nephrotic syndrome on caregivers and to determine the level of psychosocial burden in relation to the effect of raising a child with Nephrotic syndrome. The instrument was presented to (21) experts from several universities to be valid, the reliability of the instrument was determined through the implicated the Cronbach's Alpha, the reliability of this instrument was ($r = 0.81$). **Results:** The results of the study revealed that caregivers of children with Nephrotic syndrome experienced a moderate level of psychosocial burden. There were statistically significant differences between the psychosocial burden of caregivers and childhood syndrome, while there was a significant difference between the psychosocial burden and some social characteristics And demographic for child caregivers (age, level of education and monthly income). **Conclusions:** The study concluded that the caregivers of children with Nephrotic syndrome are affected by psychological distress more than half of them. Caregivers of children with Nephrotic syndrome are affected by psychosocial burdens at a moderate level of more than half of them. All social and demographic characteristics of caregivers do not affect caregiver's psychosocial burden except age, monthly income, level of education, and psychological distress. **Recommendations:** The study recommend that family support be provided to families with children with Nephrotic syndrome, especially psychological and educational, about the clinical behavior of early Nephrotic syndrome for early detection and family-to-community education programs for community-based services and community mental health programs.

Key words:- Psychosocial burden, Caregivers of children, Nephrotic syndrome.

• Introduction

Nephrotic syndrome is an acquired disease. If left untreated, is responsible for a change in renal function. The Nephrotic syndrome can be caused by renal failure even when managed correctly. Occasionally, insufficient response occur and acute or chronic renal failure is developed (1).

One of the most common diseases during childhood is Nephrotic syndrome. In children, it is about 15% higher than in adults. Where most of Nephrotic syndrome's patient suffers from the relative kind (Steroid Sensitive Minimal Change Disease). The rating of Nephrotic syndrome relapse is around (30-40%). Such as any disease that affects the patient the Nephrotic syndrome is negatively affected the body causing biological, behavioral, and social changes. These changes negatively affect the psychological well-being, personal and social growth of patient, as well as affect the psychological and social status and family coping (2).

When parents receive the news of the diagnosis and prognosis of a chronic disease of their children, they initially experience a moment of shock. Such discovery represents an event of strong emotional impact, and consequently of sadness and anxiety due to the fear of the unknown. Families often do not feel prepared to face the situation. However, they gradually begin to accept and adapt to the new condition of their child (3).

Nephrotic syndrome predictable to affect the physical and psychosocial status of children for short- and long-term, mainly child severely affected with recurrent relapse, steroid dependency, or else steroid resistance. Steroids and other immunosuppressive are used to treat this condition, which also has special negative effects on the physical and mental health of children (4).

Childhood Nephrotic syndrome is a chronic child health disorder that, optimally, is managed by a collaborative team able to deliver continuing care. Children patient and their caregivers need teaching concerning the management of this prolonged illness, with the appropriate direction of treatments, observance to nutritional limitations, and essential for therapeutic checking. A primary twelve week (glucocorticoid therapeutic) treatment has been presented to reduction following Nephrotic syndrome relapse rates in steroid-responsive children. Taking care for a child with a chronic illness is a major challenge for any family and parents often have to give up work to do so (5).

During a chronic illness in a child, caregiver participate in activities in various areas of childcare, including assistance in the area of bio-medical, bodily rehabilitation, mental, societal and organized health. Furthermore, the caregiver is direct involved in long-period therapies, coordinating the delivery of health services, and managing the social, economic and emotion challenge associated with a chronically ill child. These responsibilities are essential to provide patients with chronic diseases by the care that the child needed and to reduce the deficiency of autonomy and independent of the children. Though, this activity must have bodily, mental and financial implications to the caregiver (4).

Nephrotic syndrome usually impacts very young children, these lead to immediate burdens on caregivers of a child with Nephrotic syndrome. The family burden has particular important effect on their life because of the effective social support systems. Earlier research point to that family anxiety can cause an undesirable effect on the child's conduct, psychological and social changes (8).

Nephrotic syndrome affected the child physical social and mental status, therefore, not only the medical but also the psychological and social burdens are common for children, fathers, and mothers, plus other caretakers. It is well documented that prolonged disease in children may cause(psychological suffering and social stress for the children themselves and their families), but some scientific studies have been discuss out in this part (7)

Objectives of the Study:-

1. To asses psychosocial burdens among caregivers of children with Nephrotic syndrome.
2. To find the association among caregiver's psychosocial burdens and their demographic data (gender, age, level of education, occupation, the degree of relatives, educational level, residency area, income, and SES scale).

• Methodology

Descriptive(cross-sectional) study is a conduct through this research to determine the psychosocial burden among caregivers of patient with Nephrotic syndrome. during a period of time 23 September 2018 to1 September 2019, A purposive (non-probability) sample was selected (115) from Al-Sadder medical city and Al-Zahra'a Maternity hospital in al- Najaf province. the instrument was presented to (21) experts from several universities to be valid, the reliability of the instrument was determined through the implicated the Cronbach's Alpha, the reliability of this instrument was ($r = 0.81$), The data analyzed was conducted through the application of descriptive statistics (frequencies , percentages , mean of scores , Standard deviation) and inferential statistics (Chi-squared test) , the data was collected by utilizing the questionnaire which included four parts:-

Part 1: Child's Socio-Demographic Characteristics including case number, sex, age of the child, children number, order of children in the family, education of child, live father and live mother. In the social and economic situation.

Part 2: Child's clinical Characteristic include (4) items, number of Nephrotic syndrome children in the family, duration of illness, age of the child at diagnosis, and treatment place.

Part 3:Caregiver Questionnaire include a socio-demographic characteristics sheet consists of seven items, which included degree of relative , caregiver's age, Mothers age at child's birth, , number of family , marital status , Residency area , the Socioeconomic Status Scale (SES).

Part 4:Consist of the General Health Questionnaire (GHQ-12)and Zarit Burden Interview (ZBI).

- **Result:**

Table (1) Distribution of the Caregivers by their Socio-Demographic Characteristics through Frequency and Percentage.

| No. | Caregiver Characteristic | Frequency | Percent | |
|-----|--------------------------------|---------------|---------|-------|
| 1. | Degree Of Relative | Father | 57 | 51.4 |
| | | Mother | 54 | 48.6 |
| | | Total | 111 | 100.0 |
| 2. | Age Of Caregiver/Years | 19 – 24 Years | 12 | 10.8 |
| | | 25 - 31 Years | 17 | 15.3 |
| | | 32 – 38 Years | 60 | 54.1 |
| | | 34 - 45 Years | 16 | 14.4 |
| | | 46 & Above | 6 | 5.4 |
| | | Total | 111 | 100.0 |
| 3. | Family Members | 1-3 | 2 | 1.8 |
| | | 4 - 6 | 48 | 43.2 |
| | | 7 - 10 | 47 | 42.3 |
| | | 11+ | 14 | 12.6 |
| | | Total | 111 | 100.0 |
| 4. | Level Of Socio-Economic Status | - Low | 46 | 41.4 |
| | | - Moderate | 45 | 40.5 |
| | | - High | 20 | 18.0 |
| | | Total | 111 | 100.0 |
| 5. | Marital Status | Married | 109 | 98.2 |
| | | Widowed | 2 | 1.8 |
| | | Total | 111 | 100.0 |
| 6 | Residency Area | Urban | 67 | 60.4 |
| | | Rural | 44 | 39.6 |
| | | Total | 111 | 100.0 |
| 7 | Caregiver Occupation | Employed | 36 | 42.3 |
| | | Free Work | 27 | 24.3 |
| | | Unemployed | 1 | .9 |
| | | Housewife | 47 | 32.4 |
| | | Total | 111 | 100.0 |

| | | | | |
|---|-----------------------|----------------------------|-----|-------|
| 8 | Caregivers' Education | Unable To Read And Write | 22 | 19 |
| | | Able To Read And Write | 15 | 8 |
| | | Primary School Graduated | 28 | 13.5 |
| | | Secondary School Graduated | 12 | 25.2 |
| | | Institute | 10 | 10.8 |
| | | Collage | 23 | 9.0 |
| | | Master And Doctor Degree | 1 | 20.7 |
| | | Total | 111 | 100.0 |
| 9 | Monthly Income | Insufficient | 36 | 32.4 |
| | | Barely Sufficient | 18 | 16.2 |
| | | Sufficient | 57 | 51.4 |
| | | Total | 111 | 100.0 |

This table shows the caregiver demographic data that the most frequent age group is (32-38) years (54.1%), Regarding gender, male is more than female (51.4%.) Also, the study sample's majority are alive in urban residential area (60.4%), With regard to the marital status, the major of the study participant is married (98.2%),(25.2%) are primary school graduated, (51.4%) of most participants monthly income Are Sufficient , (43.2%) of them have (4-6) family number ,and Regarding occupation status the majority of male about (42.3%) are employee.

Table (2) Relationship between the Caregiver’ Psychosocial Burdens and their Demographic data.

| No. | Caregiver Demographic Data | Chi-Square Value | D.F. | P-Value | |
|-----|------------------------------|------------------|---------------------|---------|------------|
| 1 | Degree Of Relative | Father | 1.040 | 2 | .595 NS |
| | | Mother | | | |
| 2 | Age (Year) | 21 - 27 | 16.296 ^a | 8 | .038 S |
| | | 28 - 35 | | | |
| | | 36 - 42 | | | |
| | | 43 - 50 | | | |
| | | 51+ | | | |
| 3 | Mothers Age At Child's Birth | <= 20 | 2.085 ^a | 6 | .912 NS |
| | | 21 - 30 | | | |
| | | 31 - 40 | | | |
| | | 41 - 50 | | | |
| 4 | Level Of Socio-Economic | - Low S.E.S | 5.742 ^a | 4 | .219 NS |
| | | - Moderate | | | |
| | | - High | | | |
| 5 | Marital Status | Single | 1.334 ^a | 4 | .856 NS |
| | | Married | | | |
| | | Widowed | | | |

| | | | | | |
|---|---|-------------------|---------------------|----|------------|
| 6 | Residency Area | Urban | 4.207 ^a | 2 | .122 NS |
| | | Rural | | | |
| 7 | Caregiver Occupation | Employed | 4.949 ^a | 6 | 0.55 NS |
| | | Free Work | | | |
| | | Unemployed | | | |
| | | Housewife | | | |
| 8 | Caregiver Level Of Education | Illiterate | 29.637 ^a | 12 | .003 S |
| | | Literate | | | |
| | | Primary School | | | |
| | | Secondary School | | | |
| | | Institute | | | |
| | | Collage | | | |
| | Do You Enough Monthly Income For Family Needs | - Insufficient | 10.767 ^a | 4 | .029 S |
| | | Barely Sufficient | | | |
| | | Sufficient | | | |

Degree of freedom (D f) , A probability value (P-value) , Significant(S) ,Non- significant(NS)
 , High significant (HS)

The table shows that there are important relationships among caregiver (psychosocial burden) and (caregiver's age, Socio-Economic Status p-value 0.019, caregiver Level of Education p-value 0.003). while there is no significant remaining of demographic.

• **Discussion:**

This study is conducted at two areas at al-Najaf hospital. The findings explain the age of the caregivers, more than half (54.1%) are with age ranging from (32 - 38) years old. In relation to gender, the majority of caregivers were males (51.4%). Furthermore, the study results indicated that (24.3%) of caregivers with free work and home wife (42.3%) and (60.4%) of them from urban residency. Concerning subject's level of education, (25.2%) of them are graduates from the primary school. The great majority of caregivers were of first degree in their relation with their patients. This study finds that above half of family caregivers was of the age (32-38) years and the majority of them were males, this results can be interpreted as: the male with this age was more productive and can tolerate to providing care for relatives. This is agreed by a study done in by (8) who reported that the population of the male subjects was higher compared to the female.

The result also shows the level psychological distress ranges between mild, moderate and severe. the majority of caregiver's psychological distress (72 %) was moderate. The current study explains that Nephrotic syndrome is a stress for each the child and his/her caregiver. This finding is consistent with numerous of the study result. Study finds that all caregiver for children with Nephrotic syndrome suffered from psychological depression (4) reveals that symptoms of depression are much higher in caregiver for a child with Nephrotic syndrome.

The current study finds no significant among the (degree of the relative, age of Mother at child's birth, Level of Socio-Economic Status, Marital status, residence, caregiver occupation) and the burdens. But it reported a significant association among the (age of career, caregiver Level of Education and income) with burdens, where the high burdens were noticed among males. our

justification is that males are responsible for the financial state and more expose to societal problem . The current finding is reinforced by the research conducted by(4), which found great importance Relationship between the sex of the patient and the sex of caregiver With the level of burdens.

- **Conclusion:**

According to the discussion and interpretation of the results of the study we can conclude caregivers of children with Nephrotic syndrome are affected by psychosocial burdens at a moderate level of more than half of them. All social and demographic characteristics of caregivers do not affect caregiver's psychosocial burden except age, monthly income, level of education, and psychological distress.

- **Recommendations**

An educational program can be created for family members who provide care to careers of children with Nephrotic Syndrome to support those who face the burden by providing knowledge about Nephrotic syndrome and treatment, problem-solving education, communication assistance and provide coping skills. Special attention is to be dedicated to improving the mothers' perception and knowledge for their Nephrotic syndrome children to note the behaviors and cognition that may worse condition and improve child care and factor affect child care. Prepare a trained health professional to contract efficiently with the adverse outcomes of caregivers and recover the emotional state.

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Physical Inactivity Status and BMI Level among Community in Salak, Sepang, Selangor, Malaysia

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Abstract- Physical inactivity has a major health impact on the world. It is now identified as the fourth leading risk factor for global mortality. Being physically inactive or sedentary activity increases the risk of being overweight. Overweight and obesity are also major risk factors for a number of chronic diseases. This study aims to assess the physical inactivity status and body mass index level among residences in Salak, Sepang, Selangor.

A cross sectional study was done among Malaysian, aged more than 18-year-old. Respondents that fulfill the inclusion & exclusion criteria were interviewed with validated questionnaires and data were analyze using SPSS.

The prevalence of physical inactivity was 14.4%. Majority was among the age group of 50-59 years (25%), female (15.3%), married (14.4%), primary education (75%), unemployed (30.8%) and those who have monthly household income more than RM 5000 (16.4%). No time and tired were among the top barrier factors toward physically active. Majority of the respondents were also overweight or obese.

The awareness on physical activity should be strengthened by various means. Being physically fit is associated with many health benefits. Therefore, regardless of environment setting and barriers, creative solutions should be executed in order for a community to lead an active lifestyle.

Index Terms- Physical inactivity, BMI level, Overweight, Obese, Sub urban, Selangor.

I. INTRODUCTION

Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure. The energy expenditure can be measured in kilocalories. Physical activity in daily life can be categorized into occupational, sports, conditioning, household, or other activities. Exercise is a subset of physical activity that is planned, structured, and repetitive and has as a final or an intermediate objective the improvement or maintenance of physical fitness.¹

Physical inactivity is now identified as the fourth leading risk factor for global mortality, and it is estimated to be the main cause for approximately 21–25% of breast and colon cancers, 27% of diabetes and approximately 30% of ischemic heart disease burden.² Therefore, the elimination of physical inactivity would remove between 6% and 10% of the major non-communicable diseases (NCDs), type 2 diabetes, breast and colon cancers, and increase life expectancy.³

In 2011, a study estimated that 1 in 5 people are insufficiently physically active. The sample recruited almost 300,000 individuals older than 15 years, from 76 different countries.⁴ In Canada, physical inactivity represents 3.7% of the overall health care costs, whereas in China, more than 15% of both medical and non-medical costs are attributable to physical inactivity, per year.^{5,6} The National Health Morbidity Survey (NHMS) conducted in 2015 showed that the prevalence of physical inactivity was 33.5%.⁷ Although the benefits of physical activity and exercise are widely acknowledged, older individuals remain sedentary.⁸

It has been reported that one additional hour of sedentary activity increases the risk of being overweight (13%) and developing high abdominal fat (26%).⁹ In a Canadian population study, the prevalence of obesity was significantly higher in people who watched television for more than 21 hours per week, and lower in people who watched television for fewer than 5 hours per week (from 25% to 14% in men and from 24% to 11% in women), regardless of leisure-time and physical activity.¹⁰

In relation to that, lower leisure-time physical activity (LTPA) and higher body mass index (BMI) are found to be independently associated with risk of heart failure (HF).¹¹ Overweight and obesity are also major risk factors for a number of chronic diseases, including diabetes, cardiovascular diseases and cancer.¹² A study by Australian Institute of Health and Welfare reported that 14% of

disease burden due to overweight and obesity in the year 2020 could be avoided if the population at risk in 2011 reduced their body mass index.¹³

Thus, this study was conducted to determine the physical inactivity status and correlation with BMI level among residences in Salak, Sepang, Selangor. Therefore, findings can be used to increase the awareness on the importance of physically active and relationship with BMI level.

II. RESEARCH ELABORATIONS

A descriptive cross-sectional study was carried out in a residential area in Salak, Sepang, Selangor, which consisted of approximately 250 populations with majority is Malay. The neighborhood comprises of single and double storey houses with total of 130 houses.

The housing area has been stratified earlier before systematic random sampling was conducted to choose the respondents' houses, followed by simple random sampling to select the respondent within the household. All Malaysian who were living in the area for at least six months, aged more than 18 years, not mentally retarded, deaf and mute, were selected as respondents. Respondents who refused to participate in the survey or were not there during the survey after three visits, will be considered as non-respondents

Data was collected through face to face interview using a validated questionnaire from National Health Morbidity Survey 2015 [7]. The data has been analyzed using descriptive statistics to get the frequency and relative frequency (percentage) for physical inactivity and Body Mass Index level, and also sociodemographic variables. The body mass index (BMI), was calculated and classified based on Clinical Practice Guideline (CPG) on primary & secondary prevention of cardiovascular diseases into Normal (BMI <23kg/m²), Overweight (BMI 23-27kg/m²) and Obese (BMI ≥ 28 kg/m²).¹⁴

The correlation was determined by Pearson correlation coefficient. The level of significance was set at $p < 0.05$ and confidence level at 95%.

III. FINDINGS

A total of 125 participants participated in this study, giving an overall response rate of 86.2%.

Table 1. Prevalence of physical inactivity status among respondents

| Physical activity status | n | % |
|--------------------------|------------|--------------|
| Active | 107 | 85.6 |
| Inactive | 18 | 14.4 |
| Total | 125 | 100.0 |

The prevalence of physically inactive is 14.4% (Table 1).

Table 2. Prevalence of physical inactivity by socio-demography

| Socio-demography | Physical activity status | | TOTAL n (%) | p value |
|-----------------------|--------------------------|-------------------|----------------|---------|
| | Active n (%) | Inactive n (%) | | |
| Age | | | | |
| < 20 | 3 (100) | 0 | 3 (100) | 0.572 |
| 20-29 | 23 (85.2) | 4 (14.8) | 27 (100) | |
| 30-39 | 30 (85.7) | 5 (14.3) | 35 (100) | |
| 40-49 | 25 (92.6) | 2 (7.4) | 27 (100) | |
| 50-59 | 18 (75.0) | 6 (25.0) | 24 (100) | |
| ≥ 60 | 8 (88.9) | 1 (11.1) | 9 (100) | |
| Gender | | | | |
| Male | 46 (86.8) | 7 (13.2) | 53 (100) | 0.745 |
| Female | 61 (84.7) | 11 (15.3) | 72 (100) | |
| Marital status | | | | |
| Single | 25 (83.9) | 5 (16.1) | 31 (100) | 0.688 |

| | | | | |
|--------------------------------------|-----------|-----------|----------|-------|
| Married | 77 (85.6) | 13 (14.4) | 90 (100) | |
| Widow / Divorce | 4 (100) | 0 | 4 (100) | |
| Level of education | | | | |
| Primary | 1 (25.0) | 3 (75.0) | 4 (100) | 0.000 |
| Secondary | 48 (94.1) | 3 (5.9) | 51 (100) | |
| Tertiary | 58 (82.9) | 12 (17.1) | 70 (100) | |
| Occupation | | | | |
| Government/semi-gov. | 30 (85.7) | 5 (14.3) | 35 (100) | 0.498 |
| Private | 33 (86.8) | 5 (13.2) | 38 (100) | |
| Self-employed | 15 (93.8) | 1 (6.2) | 16 (100) | |
| Housewife | 6 (85.7) | 1 (14.3) | 7 (100) | |
| Unemployed | 9 (69.2) | 4 (30.8) | 13 (100) | |
| Retiree | 7 (77.8) | 2 (22.2) | 9 (100) | |
| Student | 7 (100) | 0 | 7 (100) | |
| Household monthly income (RM) | | | | |
| < RM 5,000 | 51 (87.9) | 7 (12.1) | 58 (100) | 0.383 |
| ≥ RM 5,000 | 56 (83.6) | 11 (16.4) | 67 (100) | |

The higher prevalence is among the age group of 50-59 years (25%), female (15.3%), married (14.4%), primary education (75%), unemployed (30.8%) and those who have monthly household income more than RM 5000 (16.4%) (Table 2).

Table 3. Factors of physical inactivity among the residents

| Barrier factors | n | % |
|-------------------------|-----------|------------|
| No time | 8 | 44.5 |
| Tired | 6 | 33.4 |
| No motivation/ interest | 3 | 16.5 |
| Health problems | 1 | 5.6 |
| Total | 18 | 100 |

Among the factors of physical inactivity among the respondents are no time (44.5%) and tired (33.4%) (Table 3).

Table 4. Prevalence of BMI among the residents

| BMI level (kg/m ²) | Frequency, (n) | Percentage, (%) |
|--------------------------------|----------------|-----------------|
| < 23 | 21 | 16.8 |
| 23 - 28 | 67 | 53.6 |
| > 28 | 37 | 29.6 |
| TOTAL | 125 | 100 |

Majority (85.2%) of the respondents have BMI level at least 23 kg/m² (Table 4).

Table 5. Association between physical activity status and BMI level

| Physical activity status | BMI level (kg/m ²) | | Total n (%) | P value |
|--------------------------|--------------------------------|---------------|------------------|--------------|
| | < 23 n (%) | ≥ 23 n (%) | | |
| Active | 18 (16.8) | 89 (83.2) | 107 (100) | 0.738 |
| Inactive | 3 (16.7) | 15 (83.3) | 18 (100) | |

Fisher's test = 0.785

Among the residents who are physically inactive, 83.3% have BMI level more than 23 kg/m². However, statistically there is no significant association between physical activity status and BMI level among the residents ($p > 0.05$) (Table 5). Pearson's correlation coefficient (Table 6) also shows no significant correlation between physical activity and BMI level (Pearson's $r = -0.085$).

Table 6. Correlation between physical inactivity and Body Mass Index

| Correlation | | BMI |
|-------------------|---------------------|--------|
| Physical activity | Pearson correlation | -0.085 |
| | P value | 0.348 |
| | N | 125 |

IV. DISCUSSION

Our study has shown that the prevalence of physical inactivity (14.4%) was lower as compared to a study conducted by Lian et al., whose findings show that more than 60% of Malaysians were physically inactive.¹⁵ This could be due to the awareness on the benefits of physical activity with easier access to internet technologies as the information can now be accessed at home or away 24-h a day seven days a week, at the convenience of the individual.¹⁶ Moreover, this improvement is also in light of intensive efforts by the Malaysian government to promote healthy lifestyles over the past 10 years.¹⁷

The same study also stated there was a significant increasing trend of activity from the age group of 45 – 49 years old until the age of 75 years old and above (30%).¹⁷ Whereas, our data showed the highest prevalence of physical inactivity were in group age of 50 – 59 years old (25%), but dropped at the age of more than 60 years old (11.1%). This might be due to a sedentary lifestyle, rather than biological aging.¹⁸ Those who were 50-59 years old are in the phase of retirement transition, which was consistent with our result that showed the highest prevalence of physical inactivity by occupation were among the retirees and unemployed residents (30.8% and 22.2%, respectively). As older people no longer need to spend time at work due to retirement, they tend to reduce their involvement in physical activities as compared to younger individuals.¹⁹

The residents who are in 50-59 years old also marked as the third highest prevalence of overweight (58.3%) and obesity (29.2%). It is positively supported by Huidong et al., who found that in urban and rural men and women in China, BMI, waist circumference, and percentage body fat were each associated inversely with physical activity level but positively with sedentary leisure time.²⁰ An increased level of physical activity was also significantly associated with a lower risk of overweight and obesity after adjusting it for age ($p = < 0.001$).²¹

The common contributing factors for physical inactivity in our study were 'having no time', 'tired' and 'no motivation/ interest'. These were consistent with previous studies, which reported that 'not having enough time' as the most common barrier to do physical activity in Malaysia.^{22,23} Lack of time amongst respondents may be partly due to increasing financial responsibilities for males from extended families (Samir et al., 2011).²⁴

This was quite consistent with our findings, where majority of our residents were employed and have monthly household income of more than RM5000. The employment was a strong predictor of physical inactivity, where those who are working full time or part-time

are more likely to be inactive ($P < 0001$) and workers are more or less forced to sit almost the whole working day without proper break and increases sedentary components.^{25, 26}

Female are found to be more inactive (15.3%) as compared to male (13.2%), which was consistent with a study as reported by Mohd Zikrullah, et al. where females are more inactive (66.7%) than males (46.5%).²⁷ The prevalence of females who were inactive could be associated with their roles as housewives, in which our finding showed 14.3% of housewives were physically inactive. Female housewives were too busy carrying out their responsibilities and roles such as taking care of house (87.6%) and taking care and tidying the house (96.8%).²⁸

In terms of psychosocial, females do not perceive that they have as diverse a network of support or motivation from significant others to perform their physical activity when compared to male.²⁹ 'No motivation/interest' listed as the third contributors of physical inactivity (16.5%) in our study with higher prevalence of inactivity among single residents (16.1%), which were consistent with a previous study that reported higher prevalence among female and single residents (11.3% and 19.2%, respectively).³⁰ Having partner is important in giving support and help to be consistent in living a healthier life.³¹

Physical inactivity may lead to increase in BMI as reported 77% respondents who were physically inactive were overweight.³² Although our study showed no correlation between physical inactivity and BMI ($p > 0.05$), a previous study has suggested that physical activity alone cannot maintain BMI and body fat percent, but it can reduce the risk of overweight and high body fat percent in the population.³³

V. CONCLUSION

The prevalence of physical inactivity among the residents of was relatively lower with the most common factor contributing to physical inactivity was 'no time'. However, there was no significant correlation between physical inactivity and Body Mass Index.

In future, it is important to strengthen the program on physical activity as a healthy life style, together with other components such as good nutrition and no smoking. Also, further studies are needed to collect more data and develop guidelines for preventing and managing physical inactivity among working adult.

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Literature review of the Impact of the Use of Quantitative techniques in administrative Decision Making: Study (Public and private sector institutions)

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Abstract- There are a weak proportion of private and public institutions that use quantitative techniques in decision making and problem solving, so the objective of this literature review is to clarify the impact of using quantitative techniques for decision making and problem solving in public and private sector institutions. The paper analyzed previous related research papers related to using quantitative techniques in decision making and problem solving in different organizations. The results show that the use of quantitative techniques is important in making administrative decisions and solving problems resulting in the development of the institution and making appropriate decisions.

Index Terms- Quantitative Techniques; Decision Making; Organization

I. INTRODUCTION

The various Organizations tend to use different and sophisticated methods to develop their activities and benefit from modern technologies (Anyanwakoro, 2009).

Any institution must take a set of decisions, and as long as there is a decision there are certainly alternatives that the decision-maker to choose between them to choose the best ones, and there are alternatives, there is a need for advance information is available and on a continuous basis, and there must be pre-plans to work and must be available pre-programs as well as potentials Material and human, and a variety of exercises, understanding and full understanding of what is available and this is what we call decision-making. If we have the ability to make decision it will be easy to make a decision about random (Hwang & Yoon, 2012).

The process of decision-making is difficult and complicated, but it is necessary to have a decision. Many different means have been developed to make the decision-making process easy in practical life, in personal decisions and decisions related to governments and institutions. Good and appropriate decisions are always welcomed and praised. Decision-making affects governments, institutions and individuals (Oyelere&Anene, 2007).

Decision-making is one of the most important processes within different organizations where decision-makers choose

between alternatives and work to make the right decisions that achieve the objectives of the institution (Prasad, 2004).

Decisions can be based on quantitative techniques. There are some situations that require the submission of quantitative elements in order to be supportive of judgment and taking appropriate decisions. Many of the decisions that must be taken in the organizations require many specific conditions that threaten to evaluate and choose among the alternatives and are able to make the appropriate decisions, hence the quantitative methods (Orga&Ogbo, 2012). Quantitative methods are used in different institutions, whether government, public sector or private sector, to help make appropriate and timely decisions. Decision makers must have knowledge of quantitative methods in decision making (Idemobi, 2012).

Enterprises and businesses have become more complex, competitors have increased, services and products have diversified, and the volunteers have changed. Businesses need to be effectively managed so that they can achieve the desired objectives. As a result, appropriate and correct decisions are more important than in previous times (Murdock, 2014).

Otherwise, Decision makers have great potential to access data. However, they must have the ability to convert data into information to take advantage of. This is one of the reasons why quantitative methods are of interest (Murdock, 2014).

Quantitative methods help to devise solutions and methods for decision making and crisis management. The most important quantitative tools are: indices, operations research, linear programming, role representation and results (Waters, 2011).

In addition to the above, the concepts of quantitative methods and their role in decision-making can be used to assist institutions and decision-makers and enable them to make the right decisions.

In our analysis, we will focus on three central questions:

- RQ1: To what extent have public and private sector institutions used quantitative techniques for decision making and problem solving, and how has this developed over time?
- RQ2: Which types of quantitative techniques that public and private sector institutions used for decision making and problem solving?

- RQ3: what the impact of using quantitative techniques for decision making and problem solving in public and private sector institutions?

This paper is organized as follows: Section 2 will provide a background on using quantitative techniques for decision making and problem solving in public and private sector institutions. Section 3 is a related work on using quantitative techniques for decision making and problem solving and the findings of these previous researches. Section 4, will outline methodology and analysis. Section 5 will discuss the results; the conclusion is found in Section 6.

1. Background

1.1 Quantitative techniques Concepts

Quantitative methods are defined as statistical techniques that lead to a numerical analysis of the variables that affect the decision-making process and the evaluation of different solutions and alternatives, leading to the adoption of appropriate decisions that achieve the objectives of the organizations” (Taha, 2006).

Quantitative methods are a scientific approach to managerial decision making where raw data is processed and processed to obtain valuable information (Render, stair, Jr and Hanaa, 2008:2).

Quantitative methods include transforming the qualitative description of the decision-making process into a quantitative form, identifying variables and developing alternative options and solutions that lead to appropriate decisions (Lucey, 2007). It includes both statistical and programmatic methods that assist in making managerial decisions. Quantitative methods include the use of symbols, numbers and mathematical expressions in order to be able to express quantitative problems and to be able to provide suitable solutions and alternatives that lead to appropriate decisions that achieve the objectives of the institutions. Quantitative methods focus on the use of observation and scientific methods for decision making. Quantitative methods are necessary to provide solutions and possibilities that support the adoption of appropriate decisions (Anderson *et al.*, 2003). Quantitative techniques enable systematic and scientific study in any decision-making process as they analyze the factors and variables that fully reflect the situation and improve the decision-making process. Quantitative methods specify many different alternatives to enable decision-makers to choose the appropriate decision (Reddy, 2010). The proper application and use of quantitative methods leads to optimal use of resources and reduces the waste of available resources (Song, 2008).

Problem solving, decision making and relationship (Y.-y. Wu, D.-j. Yu, 2011):

- Problem Solving is a set of activities designed to systematically analyze a situation, create, apply, and evaluate solutions.
- Decision-making is a mechanism for making choices at every step of the problem-solving process.

Decision-making is part of solving the problem and decision-making occurs in every step of the coin solving the problem.

The most important characteristics of quantitative methods are (Marwaha, 2017):

- Attention to the problems or the system as a whole since activity in any part of the organization has an impact on the activities of the rest of the other parts. Any decision in a part must identify all the possible interactions of that part and determine its effects on the organization as a whole.
- Application of scientific methods in solving problems
- The use of computer in solving complex mathematical models
- Provide quantitative information for management to make use of appropriate decisions

1.2 Role of quantitative techniques in decision making

Decision-making is the basis of the administrative process in any institution, and resolution is a solution chosen from among several solutions (Render, stair, Jr and Hanaa, 2008).

Components of Quantitative Methodology for Problem Solving and Decision Making (Render, stair, Jr and Hanaa, 2008):

- Define the problem
- Build the model
- Obtain data entered
- Develop solutions
- Test solution
- Analysis of the results
- Apply results

Quantitative Methods Models

Quantitative methods are used as a mathematical input that helps decision-makers make effective decisions on a variety of means, the most important of which are the following (Render, stair, Jr and Hanaa, 2008):

- Probability theory
- Regression Models
- Theory of Decision Analysis
- Forecasting Models
- Linear programming
- Nonlinear programming
- Simulation Models
- Network Models

The importance of quantitative methods

The importance of quantitative methods is summarized (Eraydın & Ayda, 2011):

- A tool for quantitative decision making using modern scientific methods
- Quantitative methods of scientific methods are helpful in making decisions in a more precise and far-fetched manner than randomization resulting from trial and error
- This science seeks to search for new rules and foundations for administrative work, in order to reach the best levels in terms of total quality
- Helps to deal with complex problems analysis and solution, which are difficult to address in the normal image

- Helps to save the cost of solving various problems by reducing the time needed to solve

The use of quantitative methods in the decision-making related to solving the problems that exist in the work and institutions as they are effective to solve administrative problems, quantitative methods are important in decision-making, the reason is to (Zaborek, 2009):

- **Good control**

Use of quantitative techniques, Decision makers can move towards important factors to make sound decisions that meet the organization's objectives.

- **Better coordination**

Quantitative techniques are more useful in maintaining the status of the organization.

- **Better system**

Quantitative techniques focus on the use of modern methods of problem solving and decision-making, which analyzes data and building data repositories, which leads to the development of institutions and improved decision-making for the benefit of the organization.

- **Better decisions**

Quantitative techniques work to make the right decisions in a timely manner, leading to the development of the institution and achieve its objectives.

1.3 Importance of decisions taken by quantitative techniques

Quantitative methods have proven their importance in addressing the problems related to administrative decisions related to industrial processes and business, and the importance of decisions taken according to quantitative methods is attributed to the following reasons (Goczek, 2010):

1.3.1 Facilitate decision making

Quantitative methods facilitate the decision-making process and support decision-makers, enabling them to make appropriate decisions. The decision-making tree technology focuses on the systematic analysis of the problem. These techniques work to make decisions in correct ways and in different circumstances and support appropriate and timely decision-making. There are many problems that require appropriate decisions such as sales and service delivery where these problems can be addressed by making appropriate decisions using quantitative methods.

1.3.2 Scientific analysis

It provides a thorough analysis of the causes and results and evaluates the risks that exist in business. This is done through an objective and analytical approach. Quantitative techniques support decision makers through the use of logical thinking.

1.3.3 Identify resources

Quantitative techniques are useful for optimal use of enterprise resources.

1.3.4 Increase profit

There is a strong importance to quantitative methods in the preparation of alternative solutions that support the achievement of goals and profit by identifying the required resources and time and different methods leading to the adoption of appropriate decisions.

1.3.5 Cost reduction

Quantitative methods work to reduce cost.

1.3.6 Prediction

Quantitative methods for forecasting demand are used to support planning.

1.4 Use quantitative methods in business processes

There are many uses of quantitative methods, which are used to make decisions in business enterprises where problems related to routine work, quantitative methods are used in industry, agriculture and many other fields (Caniato, 2011):

1.4.1 Planning

Quantitative techniques are applied in the planning process where they are used to construct factories, locate and scale the plant and develop services and products.

1.4.2 Purchasing

Quantitative techniques are used to evaluate and develop vendors, develop logistics and develop sales.

1.4.3 Manufacturing

Quantitative methods contain many questions, for example how to monitor quality, what production plans are.

1.4.4 Marketing

Quantitative methods can be used to solve many marketing problems such as price competition, sales and planning problems.

1.4.5 Human resource management

Decision-making related to the planning process is supported by quantitative methods, where it develops many factors of interest such as wage structure, job evaluation and competency assessment.

1.4.6 Research and Development

The use of quantitative techniques is useful in processes related to research, for example research to create new products and services and to open new markets.

1.5 Classification of quantitative techniques

Quantitative techniques are defined as a set of methods that are used to analyze and formulate problems that need to be decided, and are classified as follows:

1.5.1 Mathematical techniques

Quantitative techniques use mathematics, differentiation, integration and numerical data, and also include the use of permutations, theorems and matrices.

1.5.2 Statistical techniques

Statistical techniques are techniques that are used to perform a statistical investigation in relation to a particular phenomenon, including all statistical methods that begin from data collection and analysis and until such data are interpreted. Important statistical techniques include ratio analysis, classification, data collection, probability, regression and correlation.

1.5.3 Programming techniques

The software technologies focus on building models, and decision makers use them and apply them in business to make appropriate decisions, where a model of the problem is used and applied to it to reach the appropriate decision, and the software techniques that are used linear programming, simulation and network programming.

II. RELATED WORK

There have been many studies and scientific research on the levels of several countries at the reality of the use of quantitative methods in decision-making and problem solving, the most important:

According to Acevedo (2014) Quantitative methods are used to obtain the best decisions that achieve the greatest chance of success and achievement of the goals. However, different areas of decision making, the use of quantitative methods leads to good results in decision-making.

Murdock (2014) conducted a study on the use of quantitative methods in decision making in the field of business. The results of the study showed that quantitative techniques use tests and experiments and collect data, making them suitable for making the right decisions that achieve the objectives of business enterprises in various fields.

Ighomereho (2013) Quantitative techniques are techniques used to make decisions and solve problems. It is a set of scientific and programmable rules that enable decision-makers at all levels to make the right decisions.

Ahsan (2012) conducted a study entitled "The reality of the use of quantitative techniques in making administrative decisions in the fuel sector in the state of Skikda, Algeria" In order to assess the degree of knowledge of managers in quantitative techniques. Among the results of the study was that the degree of knowledge of managers in using quantitative techniques was medium, and the extent of their use of quantitative techniques in administrative decision making is weak. One of the most important methods used is statistical analysis and prediction models; Areas of use of quantitative methods were the field of resource allocation, investment assessment, and demand forecasting and inventory management. The main obstacles to the use of quantitative techniques are the lack of training programs, the lack of specialized sections for quantitative techniques; data are not available for the application of quantitative techniques.

Orga and Ogbo, (2012) worked on the application of quantitative techniques in business management in Nigeria. It was pointed out that the theory of probability has wide application in small businesses.

Okechukwu et al., (2012) conducted a study entitled "Evaluation of criteria for quantitative and qualitative decision-making in Nigeria". The paper aimed to assess the level of managers' use of quantitative methods in problem solving and decision-making. Among the methods mentioned in the paper were analyses of decoupling, critical path analysis, decision tree, correlation and regression analysis, simulation and transport models. In the process of using quantitative methods. The study recommended the need to qualify and train managers in the decision-making process based on quantitative methods because of the impact of these methods on improving the efficiency and efficiency of decision-making.

Hasona (2012) conducted a study entitled "The Challenges of Using Quantitative Methods and Their Relationship to the Quality of Administrative Decisions a Field Study of Banks Operating in Palestine". The study aimed to identify the obstacles to the use of quantitative methods and their relation to the quality of administrative decisions in the banks operating in Palestine by identifying the level of knowledge of managers in quantitative methods and the extent of their need to use these methods and their degree of application in their work. The study aimed to identify the most important quantitative methods used in Palestine. Make decisions and identify the sources of knowledge.

More so, Murugesan (2011), Quantitative techniques are used to qualify variables in different disciplines. This means that mathematics, statistics and operations research can be applied to understanding and solving problems.

Zainab (2009) did a study with title "Quantitative Methods in Decision Making: A Decision Tree Style Model". The study aimed at measuring the contribution of quantitative methods in administrative decision making by focusing on the decision tree. The study concluded that it is not necessary to draw the decision tree in stable and separate stages, but the administration can draw the final tree at the beginning and then follow the solution and selection. The importance of using the decision tree in institutions and the criterion for judging the success or failure of the administration is through the ability of the administration to reach sound decisions and find solutions to the administrative problems facing organizations.

Kansjol et al (2009) conducted a study with the title of: "Models and Quantitative Methods in Decision Making and Decision Making". The study aimed at identifying the importance of using quantitative methods in decision making and identifying many difficulties facing this process. A project case was reviewed through the decision tree of one of the specialized services specialized in road transport operations in Algeria. The results of the study showed that there is no ideal way to make decisions that suit all situations and situations. Problem solving and decision-making, along with the use of quantitative methods, requires creative thinking from the decision-maker.

Bosharb et al (2009) conducted a study with the title of: "Operational research and its importance in the management decisions". The study aimed at clarifying the importance of operations research as a mathematical input at the level of the

Algerian administration, and the importance of operations research as a sports portal. It is concerned with providing assistance to managers and officials in making administrative decisions. Decisions based on quantitative methods and mathematical models in choosing the optimal alternative to solve administrative problems are rational decisions. And effective, and the study showed in the results that there is no clear integration between specialists in quantitative methods and management.

Sayd(2009) made study with the Title of: "Quantitative input methods and their importance in rationalizing administrative decisions", the study aimed at showing the importance of quantitative input in the management decisions in Algerian institutions. The results of the study showed that the models and methods of the quantitative approach do not take into account the human emotions and self-desires in practice. There are many problems that are characterized by diversity, complexity and instability. The use of quantitative methods requires the skill and efficiency of choosing the appropriate method, ie, the precision in the use of qualitative methods and models that enables the decision maker to use his expertise and efficiency.

Fethi&Pasiouras (2009) made study with the Title of "Assessing Bank Performance Using Process Research and Artificial Intelligence". The study aimed to provide a comprehensive overview of 179 published studies from 1998 to 2008 from different countries of the world. The study of operations and artificial intelligence was used in evaluating the performance of banks. Many of the applications of operational research methods which were widely applied in the field of banking , And applications of other techniques used in recent years to predict banks' bankruptcy, banks' performance, banks' creditworthiness, and poor performance of banks. The authors found few studies that proposed a mix of forecasting models.

Lee et al (2008) conducted a study entitled "Operations research as a practical management tool for decision-making". The aim of the study is to support the idea of relying on quantitative methods as well as intuition in the decision-making process as an integrated model and not only to rely on intuition in the decision-making process in American institutions. Operations research is one of the most important administrative tools used by profit and non- Ford, Samsung and the US Armed Forces. Hence, this study is to emphasize the importance of using operational research as a tool for decision making. The study showed many results, including decision making, one of the most important administrative skills for the ability to exploit the most available resources And to make every effort to achieve optimal performance with high efficiency. Small and less complex institutions rely on decision making on the intuition and minimum use of quantitative methods to achieve the objectives of the organization. Institutions operating in the more complex and larger environment use both quantitative and qualitative methods, and there is a need to use intuition and personal experience to make economic and peaceful decisions.

Ayash (2008) The study aimed to identify the extent to which the NGOs applied quantitative methods in solving problems, making decisions and sources of knowledge in these methods. The study also aimed to identify the obstacles that prevent the use of quantitative methods. The study concluded

that the knowledge of employees in non- The study revealed that education and study are the main way to obtain specialized knowledge using and applying quantitative methods. The most applied models are financial models and project management if specialists are available in these methods. The awareness of the importance of using quantitative methods in decision-making and staff training on the application of quantitative methods and the need to increase interest in teaching quantitative methods in universities.

Rahim & Selim (2008) conducted a study entitled "The use of quantitative methods in rationalizing and making decisions to grant credit in commercial banks". The aim of this study is to provide a modern approach in rationalizing the decision making of credit granting to commercial banks by using the priority objectives programming model, based on a hypothetical case study. The aim of the program is to plan a plan for the problems of multi-standard decision or objectives, where the target function is set to minimize deviations from the objectives. The process of trade-off and selection of loans is based on the Bank's strategy and the extent of its preference for one criterion over another. Is characterized by a practical flexibility to make changes and transfers in the pattern of priorities or model parameters, especially in an economy characterized by rapid and random shifts.

Masreque (2006) conducted a study entitled "Methods of research operations and their applications in decision-making and problem solving in industrial or service institutions in the Syrian Arab Republic". The study included a sample of (21) institutions of public and private institutions working in the fields of industrial and service. The study found that 90.8% (19 out of 21) of the institutions surveyed applied one of the methods of operations research to assist in decision making. The most important methods used are: statistical analysis, financial models, revenue and cost analysis. The application of operations research methods is limited to limited areas, mainly: project scheduling, accounting procedures, and resource allocation. And that the main obstacles to the use and application of methods of research operations in the Syrian institutions are: that the main decisions are taken by the higher guardians, and the lack of computer and the availability of specialists.

Gedily(2004) made study with the Title of: "The reality of using quantitative methods in problem analysis and decision making - a field study of the governmental sector in the Gaza Strip", The purpose of the study is to demonstrate the extent to which quantitative methods and methods are used in problem analysis, decision making in the Palestinian government sector, and the role that quantitative methods, especially the different process research methods, can play in problem analysis and decision making in the government sector. Of the use of quantitative methods in the Palestinian government sector. 240 questionnaires were distributed randomly to the specific categories of department managers, heads of departments and others who participate in decision-making in the various ministries. The number of forms used for analysis was (82.8%) in decision-making positions, the majority of users of quantitative methods use a limited number of these methods and may be due to lack of knowledge In other quantitative methods, the study shows that the most important obstacles to the use of quantitative methods are: lack of specialized persons, lack of encouragement

from supervisors in work, lack of adequate funds and lack of accurate data.

Al-Hindi & Al-Hamali(2003) The study aimed to identify the reality of the use of quantitative methods in decision making by government agencies in Riyadh by identifying the level of knowledge of managers in quantitative methods, and the extent to which they need to be used in their work. The aim was to identify the most important quantitative methods used in decision making, And to identify the sources of knowledge and the desire to know the quantitative methods and identify the methods of decision-making in government agencies, and the study has reached a number of results and indicators that reflect the reality of manager's use of quantitative methods. The study sample has medium knowledge of quantitative methods and the majority uses statistical analysis considerably in their work, and there is a large proportion of the study sample has a desire to know and quantitative methods used in their business.

According to Nickels, McHuhg and McHugh (2002), Good decision-making depends on the appropriate data. It is essential that decision-makers have the ability to analyze and analyze important data so that they can choose the best decision from the set of alternatives to achieve the organization's goals.

Furthermore, Chen& Wei (2002) conducted a study titled "Applied Operations Research in Taiwan". The study included 2000 industrial and service establishments. The study found that about three quarters (76.7%) of the establishments used methods of operational research and management science. And that: the analysis of return and cost, statistical analysis and prediction are the most widely used methods. Project management, production management, operations and marketing management are the most frequently used areas of operational research and management science. And that the two main reasons for not using operational research methods and management science are that they are not necessary and not known. And that the most important constraints to use are: lack of data, and the difficulty of identifying the problem and non-realistic models.

Ahmed (1998) prepared a study entitled "The reality of using quantitative methods in decision-making". It is a field study of industrial and service establishments in the Hashemite Kingdom of Jordan. The study included a sample of (150) establishments from industrial and service establishments with a minimum of three organizational levels registered at the Jordanian Chamber of Commerce and Industry, which is expected to use quantitative analysis methods , And the study found that (32.2%) of the institutions of the study sample applied quantitative methods to assist in decision-making. And those quantitative methods are not well known to the vast majority of decision makers in the sample study institutions. And that the most important sources of access to this knowledge are university study, practice and application. The most important methods used are: statistical analysis, inventory models, and linear programming. The main obstacles to the use of quantitative methods in Jordanian industrial and service institutions are: lack of knowledge of these methods, lack of specialists, and inadequate and accurate data required.

Kao, Lee & Chen (1997) made a study with the title of "an overview of the application of operational research in Taiwanese companies".The study concluded that the analysis of computer decision, statistical prediction, other probability

models, network analysis and linear programming are the most widely used methods, and that production and operations function are the most widely used methods of research operations, followed by information systems. And that about one-third of the institutions under study had never used operational research methods. The main reasons were: lack of knowledge of operational research and unnecessary. The lack of data is the most important impediment to use, followed by the communication gap, lack of resources, and very complex methods. And that senior management support is very important for the wider use of operational research in institutions.

Ehie& Smith (1994) conducted a study titled "Operational Research in Nigeria".The study included 954 industrial organizations. The study concluded that statistical analysis, decision analysis, simulation and network analysis are the most important methods used. Production scheduling, capital allocation, project planning and workforce planning are the areas where operational research methods are used. The lack of trained personnel, the need to develop appropriate information programs, and the lack of adequate and accurate data are the most difficult to use in operational research methods.

III. METHODOLOGY

In order to satisfy the objectives of this paper, a literature review approach is adopted. The primary step of a literature review issues assortment of relevant literature. For this purpose, we scanned Scopus and Web of Science (WoS) databases. To be sure that the search does not exclude possible helpful findings from different fields, we did not limit the search to a specific field or index. In addition, besides journal articles, we also included conference papers as recommended source for literature reviews.

1.6 Analysis

After collecting the data from the previous studies and analyzing them, we found that most of the results from the previous research indicate that the percentage of the use of quantitative methods in making decisions in institutions is weak due to the lack of sufficient knowledge about the use of quantitative methods in managers and responsible persons Decision-making, problem-solving, lack of training, quantitative awareness, use and importance.

IV. RESEARCH FINDINGS

The use of quantitative techniques is necessary in various organizations in order to take appropriate decisions and solve problems, which leads to the achievement of the objectives of the Organization and its development.

V. CONCLUSION

The use of quantitative techniques has been developed in many fields as it has many benefits in terms of making the right decisions at the right times and its usefulness in solving problems which supports institutions and achieves their objectives. It also supports decision makers from the ability to analyze data and use them in comparing different alternatives, this study found that the

use of quantitative techniques in government and private institutions helps them to develop and solve many different problems and make good decisions for institutions.

VI. RECOMMENDATIONS OF THE STUDY

In light of the results of the study, and emphasizing the importance of using quantitative methods in decision-making and problem solving in public and private sector institutions, the study suggested the following recommendations:

Develop awareness of the importance and advantages of using quantitative methods in decision making by holding seminars, lectures and open meetings between academics and decision makers in institutions, in which practical cases that illustrate the methods used and the benefits achieved as a result of using these methods should be published.

Interested in the training of relevant employees in using quantitative methods and increase their knowledge of the fields of computer use and related programs in order to ensure the formation of integrated teams.

Increase the number of specialists in quantitative methods and create their own departments or administrative units to serve as planning and control groups.

Providing an integrated information system as a vital component of the use of quantitative methods. Integrated management information systems provide the right data and information in a timely manner for decision-making. They provide the necessary support for the decision-making process through special decision models through their programming, Decision support.

Increasing the awareness of institutions in their external environment, so that they can adapt and continue, and this requires increasing administrative awareness and developing methods and procedures in a way that increases the speed, ease and accuracy of decisions taken.

Developing administrative methods related to reducing the degree of centralization and routines and organizing channels of communication in order to organize the information network within the organization.

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The Differences Proliferation Value of Argyrophilic Nucleolar Organizing Region (AgNOR) in Benign, Borderline, and Malignant Phyllodes Tumours of the Breast

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Abstract- Phyllodes tumours is biphasic, because it is composed of neoplastic stromal cells and evolution containing epithelium. However, this stromal tumour is more cellular and increased. This tumours are far less common than fibroadenoma and de novo arising, and not from previous fibroadenoma tumours. The bad changes are the feared malignant are increased stromal cellularity, anaplasia, high mitotic activity, rapidly increasing tumour size, and infiltrative edges. The incidence of phyllodes is <1% of all breast neoplasm in 0,1-0,5%, with the most incidence occurring at the age of 30 to 40 years.

Objective: This study was aimed to analyze the expression of AgNOR in benign, borderline, and malignant phyllodes tumours of the breast.

Methods: This is an observational analytic study with cross sectional approach, involving 35 paraffin block samples from phyllodes tumours. In this study we found mean AgNOR (mAgNOR) in 35 samples, consist of 15 samples of benign phyllodes tumours, 8 sample of borderline tumours, and 12 samples of malignant phyllodes tumours. The specimen of this study were embedded in paraffin and each section was cut from each block. Then AgNOR staining were done. The dots of AgNOR was counted in 100 nuclei and calculated to acquired mAgNOR count in each case. mAgNOR counts among 3 groups of cases were analyzed using statistic software.

Result: There were differences proliferation value of AgNOR between benign, borderline, and malignant phyllodes tumours.

Conclusion: The mAgNOR value malignant phyllodes tumours has the highest mean value, followed by borderline phyllodes tumours, and benign phyllodes tumours have the lowest mAgNOR values.

Index Term: AgNOR, Phyllodes Tumours.

I. INTRODUCTION

Phyllodes tumours is a rare fibroepithelial tumours of the breast. Phyllodes tumours account for 0,3-0,9% of all primary tumours of the breast.¹ Phyllodes tumours is the term for the biphasic neoplasm originally named cystosarcoma phyllodes by Johannes Muler in 1838, a term that is to be avoided because

of its malignant connotations. Phyllodes tumours occurs in middle-aged and older woman. Very few patients are younger than 25 years age, which is in striking contrast with the age distribution of fibroadenoma. However, phyllodes tumours can certainly occur in young adults and even in adolescents, and therefore, the diagnosis cannot be excluded on the basis of age.¹⁻³ This tumours increased in Asian countries, in Singapore this tumours occurred 6,92% of all malignancies in the breast and occur at a younger ages, 25-30 years old. Although rarely found, there have been reports of phyllodes tumours in men. The frequency of these tumours events based on changes in histopathological features (gradations) is 75% benign, 16% borderline, and 9% malignant. Although it has been reported, there is rarely a synchronous or metachronous presence in this tumours.^{4,7} Until now, it also difficult to diagnose phyllodes tumours because of subclassification resembling fibroadenomas. Because of the interest in cell proliferation, the value of Argyrophilic Nucleolar Organizing Region (AgNOR) has been evaluated in various lesions. Studies have shown significant differences in AgNOR scores for benign and malignant tumours of the breast. The usefulness of AgNOR scores lies in the assessment of tumour proliferation rates and in understanding cell kinetics and tumours.^{8,9,11} AgNOR staining is a technique for detecting argyrophilia nucleolar regulatory proteins (NORs) associated. NOR is a ribosomal DNA loop responsible for transcription of ribosomal RNA on the short arm of the acrocentric human chromosome.⁸ AgNOR is clearly seen in coloring as a blackish brown spot with 1000x magnification. This is the advantages of using network parts where clarity is only achieved at only 1000x magnification and the things of cutting influential network. AgNOR proliferation index is the percentages of cells that have a certain amount of AgNOR in each nucleus, this is considered a reflection of cells proliferation.^{8,10,12} Therefore the mean AgNOR (mAgNOR) can be a better and more consistent indicator of changes in breast tumour proliferation.

II. MATERIAL AND METHODS

This is an observational analytic study, using a cross sectional approach. This study was conducted at the Department of Anatomical Pathology Faculty of Medicine Universitas Sumatera Utara, Department of Anatomical Pathology in H. Adam Malik Medan General Hospital, and Department of Anatomical Pathology in Pirngadi Medan Hospital. The research was held from November 2017 until May 2019, after approved by the Universitas Sumatera Utara and H. Adam Malik General Hospital Health Research Ethics Committee. All samples were obtained through surgical procedure. Inclusion criteria were phyllodes cases with adequate clinical data, available and undamaged formalin-fixed paraffin embedded tissue block with sufficient tumor tissue. Detailed clinical data were obtained from medical records or pathology archives consisting of age, sex, and size of the tumor. Histological type were determined independently by researchers through hematoxylin and eosin stained slides examination.

Histochemistry protocol and interpretation

The tissue sections were deparaffinized and rehydrated before pretreatment. AgNOR staining of section was done using routinely processed formalin-fixed, paraffin-embedded section from blocks in pathology files cut at 5-6µm. The basic staining procedures of ploton et al.¹³ As used by Crocker was followed, with specific changes given in the result section. Section were deparaffinized in xylene. Section were hydrated through 100% and 95% ethanol or water. A silver-staining solution was prepared by dissolving 2% gelatin in 1% formic Acid at room temperature and filtering through filter paper. One part of the solution was mixed with two parts of 50% silver nitrate immediately before use. Staining was done at room temperature for 30-35 minutes. The sections were washed thoroughly in water, dehydrated in 95% and 100% ethanol, and mounted in a permanent mounting.¹³ AgNOR expressions were determined independently by researchers. The expression in nucleoli was analyzed. Histochemistry staining of AgNOR was evaluated in terms of the proportion and staining intensity of tumor cells. The AgNOR was assessed on the count of mean AgNOR in 100 cells tumours nuclei (mAgNOR), with 1000x magnification, and we must use the emersion oil. The grading of dots dispersion was performed according to Khan et al.^{14,15,16}

Statistical analysis

Statistical analysis was performed using SPSS software package version 22.0 (SPSS Inc., Chicago) with 95% confidence interval and Microsoft Excel 2010. Categorical variables were presented in frequency and percentage. Saphiro-Wilk test was applied to find out the normality continue data. The differences between benign, borderline, and malignant phyllodes tumours is assessed by one way ANOVA welch, and continue with post hoc Games-Howell test to assessed the differences between the groups. The p-values < 0.05 were considered significant.

III. RESULT

Patients' characteristics

The mean age for phyllodes tumour patients was 41.89 (±13.61) years. The most common in 12-63 years age group. Twenty-three

patients (97.1%) were females, only 1 patients (2.9%) were males. The mean size of tumours was 21.85 cm which is 6-25 cm for benign phyllodes tumour, 12-15 cm for borderline phyllodes tumours, and 15-35 cm for malignant phyllodes tumours. The number of the patients benign phyllodes tumours was 15 (42.9%), borderline phyllodes tumours was 8 (22.9%), and malignant phyllodes tumours was 12 (34.2%). The histological subtypes of benign phyllodes was the majority of this case. Clinical basic characteristic of meningioma patients were summarized in table 1. Representative H&E sections are shown in figure 1.

Table 1. Characteristic of phyllodes patients

| Age, mean ± SD, years | 41.89 ± 13.61 | |
|------------------------|---------------|----------------|
| Benign 12-63 | | |
| Borderline 20-65 | | |
| Malignant 17-74 | | |
| Tumours size, mean, cm | 21.85 | |
| Benign 6-25 | | |
| Borderline 12-15 | | |
| Malignant 15-35 | | |
| Characteristic | N | Percentages(%) |
| Sex | | |
| Female | 34 | 97.1 |
| Male | 1 | 2.9 |
| Diagnosis | | |
| Benign phyllodes | 15 | 42.9 |
| Borderline phyllodes | 8 | 22.9 |
| Malignant phyllodes | 12 | 34.2 |
| TOTAL | 35 | 100 |

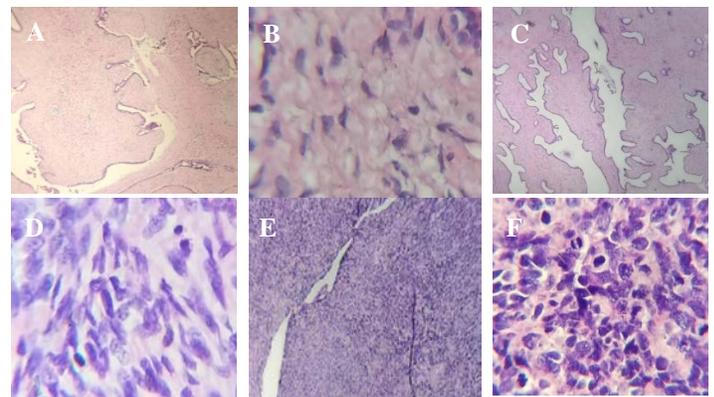


Figure 1. Histological type. A, Benign phyllodes (HE, 40x). B, Benign phyllodes (HE, 400x). C, Borderline phyllodes (HE, 40x). D, Borderline phyllodes (HE, 400x). E, Malignant phyllodes (HE, 40x). F, Malignant phyllodes (HE, 400x).

AgNOR expression

The intensity of AgNOR expression in nucleoli are shown in figure 2.

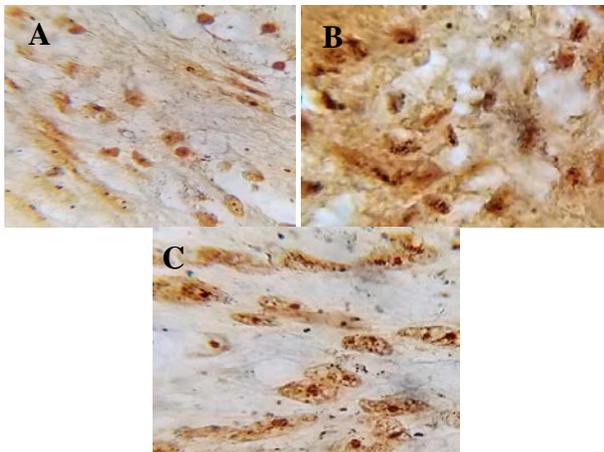
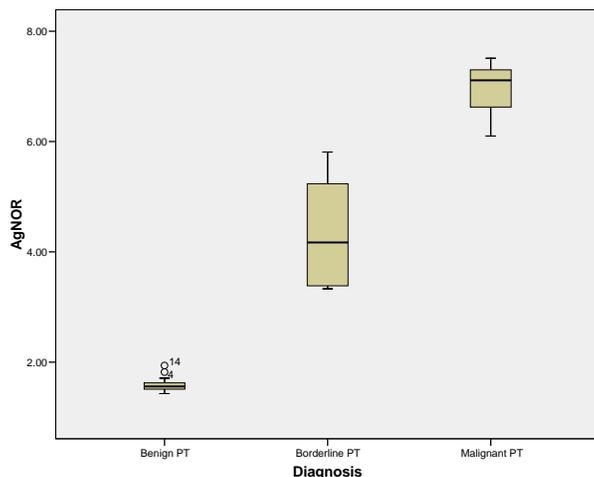


Figure 2. Histochemistry AgNOR expression. A, Benign phyllodes tumours. B, Borderline phyllodes tumours. C. Malignant phyllodes tumours.(AgNOR, 1000x)

Distribution of AgNOR’s value in benign, borderline, and malignant phyllodes tumours

The evaluation of AgNOR histochemistry staining in phyllodes tumours can be either homogeneous and small, or regular or irregular and sometimes in the form of lumps. The AgNOR’s dots are located in the nucleolus and colored blackish brown round to oval. The rest of the core is colored yellowish brown. In benign phyllodes, AgNOR dots appear smoother and fewer in number than borderline and malignant phyllodes tumours. Furthermore, the number of AgNOR dots can be determined at each cell nucleus in the stroma and carried out on 100 cells nuclei until the mAgNOR value is obtained. The mAgNOR value is calculated for each case and the group average value is obtained.

Tabel 2. Box Plot diagram of mAgNOR distribution value in each group of lesion.



In this study, we found that the distribution of the mAgNOR value in the lesion group is directly proportional, which means

that the more malignant lesions in the phyllodes tumours, the higher the mAgNOR value.

Table 3. The comparison expressions of mAgNOR value of benign, borderline, and malignant phyllodes tumours

| Diagnosed | N | mAgNOR Mean ± SD | p |
|----------------------|----|---------------------|--------|
| Benign phyllodes | 15 | 1.59 ± 0.14 | <0,001 |
| Borderline phyllodes | 8 | 4.34 ± 1.01 | |
| Malignant phyllodes | 12 | 6.97 ± 0.44 | |
| Total | 35 | | |

Table 4. The comparison mAgNOR value between group lesions of benign, borderline, and malignant phyllodes tumours

| Phyllodes tumours | Mean differences | CI 95% | | p |
|-------------------------|------------------|---------|---------|--------|
| | | Minimum | Maximum | |
| Malignant vs benign | 5.37 | 5.03 | 5.72 | <0.001 |
| Malignant vs borderline | 2.63 | 1.56 | 3.69 | |
| Borderline vs benign | 2.75 | 1.69 | 3.8 | |

There were differences in the mAgNOR values between groups of benign, borderline, and malignant phyllodes tumour lesions with p<0.001 and 95% confidence interval (CI). Clinically, there are differences in the mAgNOR values between malignant phyllodes tumours groups and benign phyllodes tumour with mean difference of 5.37. Between malignant and borderline groups there is a mean difference of 2.63. Whereas between the borderline and benign phyllodes tumour groups there was a mean difference of 2.75.

IV. DISCUSSION

The incidence of breast phyllodes tumours is very rare, with the most incidence occurring at the age of 30 to 40 years, even in one study reported phyllodes tumours occurred at an older age, ie 45-54 years. Tan et al. reported that phyllodes tumours were 6.92% of all malignancies in the breast and occurred at a younger age of 25-30 years.¹ In this study the mean age of the sufferers was 41.89 ± 13.61 years with the youngest age is 12 years, and the oldest age is 74 years. And most occur at the age of 12-63 years.

Karim et al., reported that although it was rarely found, phyllodes tumours had been reported report in men.¹⁷ This was in line with this study where of the 35 samples studied, there was one male samples (2.9%), while 34 other samples were female (97.1%). The frequency of these tumour events based on changes in histopathological features is 75% benign, 16% borderline, and 9% malignant.¹⁷ Tan et al., reported that the relative proportions

of benign phyllodes tumours were 60-70%, borderline 15-20%, and malignant at 10-20%.¹ Xiaofang et al., in their study reported from 52 patients there were 64% benign phyllodes tumours 25% borderline phyllodes tumours, and 6% malignant phyllodes tumours.¹⁸ From this study we found 15 benign phyllodes tumours (42.9%), 8 borderline phyllodes tumours (22.9%), and 12 malignant phyllodes tumours (34.3%).

The tumours can be clearly seen if it rapidly enlarges. Rapid enlargement does not always indicates malignancy. Looks shiny with stretched skin surface accompanied by widening of the skin surface veins. In cases that are not handled properly, skin ulcers can occur due to tissue ischemia. Although proper skin changes in breast tumours always show signs of malignancy, but not phyllodes tumours, ulcer on the skin can occur in benign, borderline, or malignant lesions. Nipple retraction is not common. Ulceration indicates tissue necrosis due to large tumour suppression. Large tumours can also cause necrosis with bleeding.^{19,20,21} Some previous studies found tumours to be less than 5 cm in size, therefore, the diagnosis cannot be made based solely on tumour size. Prolonged gaps (leaf-like appearance) in the across section are typical signs of phyllodes tumours.²² In this study, the average tumour size was 21.85 cm, with a range of 6-35 cm. In benign phyllodes tumours the tumour size ranges from 6-25 cm, borderline 12-15 cm, and malignant phyllodes tumours 15-35 cm. Calhoun et al., in their study found that the phyllodes tumour size ranged from 1-40 cm. The results of this study indicate that most phyllodes tumours are large, however, there are also small-sized phyllodes tumours. In a study conducted by Flynn et al., and Calhoun et al., it was reported that phyllodes tumours were generally large (>2-3 cm).^{20,21,23} This is suitable with the results of this study where it was found that phyllodes tumours size ranged from 6-35 cm.

The average value of calculation of AgNOR can be a way of assessing cell proliferation where the mAgNOR value is diagnostic in distinguishing between benign, borderline, and malignant lesions. This study used the WHO classification breast tumours involving 35 samples of phyllodes tumour consisting of 15 samples of benign phyllodes tumours, 8 samples of borderline phyllodes, and 12 samples for malignant phyllodes tumours.

From the 15 benign phyllodes tumour samples, the mAgNOR value was 1.59 ± 0.14 . This value is lower than the results of the study reported by Machala et al. (3.2), and also lower than the AgNOR value obtained by study of Rajeevan et al. (2.7).²⁴

In the group of borderline phyllodes tumour, the mAgNOR value was 4.34 ± 1.01 . This value is not much different from the results of research conducted by Machala et al., which amounted to 3.18. While the group of malignant phyllodes tumours based on research conducted by Machala et al., Was equal to 4.98, and amounted to 5.37 ± 0.32 according to a study conducted by Rao et al., while in this study the mAgNOR value was 6.97 ± 0.44 . This is also in line with the research obtained by Raymond et al. (5.5 \pm 2.3) and Chen et al. who found that >5 AgNORs in the cell nucleus.²⁵ This result are not statistically much different from those reported by Giri et al., with value of 4.4 ± 1.2 .²⁶

The study reported by Machala et al., found that AgNOR values in benign phyllodes tumour were 1.94, borderline phyllodes 3.18, and malignant phyllodes were 4.98.²⁷ Rao et al., in their study obtained an AgNOR value of benign phyllodes tumours of 3.2, borderline phyllodes 5.6, and malignant

phyllodes had an AgNOR value of 5.37 ± 0.32 .²⁸ This study shows that malignant phyllodes tumours have the highest mAgNOR values compared to benign and borderline phyllodes. This is suitable with research conducted by Machala et al., Rao et al., which states that the AgNOR value of malignant phyllodes tumour is higher than benign and borderline phyllodes tumours. Hena et al., and Iin et al., also reported that mAgNOR value in malignant lesions in the breast was higher than in benign lesions. Machala et al., also stated that the AgNOR value could be used to assess the proliferation of a tumour, and that AgNOR values were not much different in each group of tumours. This is suitable with this study which has a mAgNOR value that is not much different in each group.

The mAgNOR assessment of breast samples conducted by Machala et al., Rao et al., Hena et al., and Iin et al., showed significant difference in value between the mAgNOR values in benign breast lesions and malignant breast lesions. Rapid proliferation is part of the aggressive growth of cancer cells. In this study it was found that the mAgNOR value in benign phyllodes tumours was the lowest, followed by borderline phyllodes tumours, and the highest was malignant phyllodes tumours. Machala et al., reported that highest AgNOR value in malignant phyllodes tumours compared to benign and borderline phyllodes tumours, and AgNOR values can be used to assess proliferation of tumour lesions.²⁷ Mourad et al., reported the value of AgNOR is a reflection of the biological aggressiveness of breast cancer.²⁹ Egan et al., reported that the AgNOR value is an illustration of cancer cell proliferation activity. In another study it was reported that AgNOR values could be used to classify cancer tissue differentiation that cannot be done by HE staining from small biopsy and non patterned tissue certain.^{30,31} Based on description above, the results of this study indicate that AgNOR histochemical staining can be used in the diagnosis of benign, borderline, and malignant phyllodes tumour of the breast, where AgNOR staining results are quite strong and reliable.

V. CONCLUSION

The average AgNOR value of benign phyllodes tumours is 1.59 ± 0.14 , borderline phyllodes tumours 4.34 ± 1.01 , and the mean values for malignant phyllodes tumours are 6.97 ± 0.44 . There is a difference in the mean value of AgNOR between groups of malignant and benign phyllodes, between malignant and borderline phyllodes, and between groups of borderline and benign phyllodes tumours.

COMPETING INTERESTS

The authors have no relevant financial interest in the products or companies described in this article.

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ETHICAL APPROVAL

Health Research Ethical Committee, University of Sumatera Utara, Medan, Indonesia approved this study.

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The Influence of Multimedia Assisted Inquiry Learning Methods on My Heroes' Theme of Critical Thinking Skills and Learning Outcomes of Class IV Students of Elementary School

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Abstract

Researchers were interested in applying Inquiry's learning method to teach my hero material. The media is called "Multimedia in the form of VCD". This study aims to analyze and observe the effect of inquiry learning methods on critical thinking skills and learning outcomes in grade IV elementary schools. This research was conducted at Elementary School 2 Experiment Malang, in the first semester of 2017-2018 school year. This study uses two classes namely the experimental class and the control class. The research sample was class IV B students as the experimental class and IVC class as the control class. The research instruments used were observation sheets of critical thinking skills and learning outcomes tests. Data analysis techniques used include normality test, homogeneous test, and independent test t-test. The results showed: Multimedia-assisted Inquiry learning method had an effect on critical thinking skills and learning outcomes of fourth grade students of SD Negeri Percobaan 2 Malang. Thus, the media is used as an alternative medium in social studies learning in the fourth grade.

Key words: Inquiry Learning Method, Multimedia, Critical Thinking Skills, Learning Outcomes

I. INTRODUCTION

Education "is" part "of the" needs "of living" humans. "The existence of" education "can" increase "the ability to" think "with" good "and" "Acquire" knowledge. According to Hadi (2008: 20) the highest proportion in formal education is a lesson. Teaching is a process of transferring knowledge, attitudes, likes and behaviors to students through teaching assisted by various learning resources. The teaching can be given through 3 education channels, namely formal, informal, non-formal. "Formal" education (school) "has" the main problem "in" teaching "that is" decreasing the ability of students to receive lessons. "This is evidenced from" acquisition "Results of" daily "tests, namely" partially "" students have not "fulfilled the minimum" completeness "criteria (KKM)," so that "must" be held "remedial / improved" value "to" meet the "value" of the KKM. There are several things that can be influenced by the high or low value of learning or student achievement. Such things usually come from outside, such as strategies or ways of teaching teachers, methods used, media used, and learning environments. While internal factors can be intelligence, motivation, self discipline, and various things that come from students.

The success of a learning can be seen from the achievement of learning objectives as evidenced by changes in student learning outcomes obtained. So that related to the use of methods, approaches and strategies that have a large influence on the achievement of student learning outcomes. According to Piaget, Inquiry has an educational concept that emphasizes "preparing students to conduct experiments on their own extensively so that they see what is happening, want to do something, ask questions, and find answers themselves, and connect findings to one another, comparing what he found with what other students found. Therefore we need a learning method that accommodates this, one of which is the Inquiry Learning Method. The researcher concludes the theory from the theory above that Inquiry is a learning method that prepares students in situations to conduct their own experiments so that they can think critically to find and find answers to a problem in question. According to Marzano, one of the main goals of attending school is to improve the ability of students to think critically, so that they can make rational decisions about what to do or what to believe. These critical thinking skills need to be trained early on in students. This is because critical thinking is needed in every profession and it allows one to face reality in a reasonable and independent way.

According to Supardi (2011: 182) social studies education emphasizes the skills students must have in solving problems, both problems that exist within the scope of themselves to even complex problems. In essence, social studies education is more focused on providing provision of problem solving skills faced by students. Learning activities using the Inquiry learning method will be suitable if combined with learning media, the intended learning media is a medium that can be used as a tool to support the success of learning that can improve student learning enthusiasm. "The media used in this study were educational videos about heroes. By using multimedia to support social studies learning through the Inquiry learning method so that pleasant experiences can be obtained to meet each other's needs and can present something that can be seen and heard to be able to motivate students in learning and provide learning experiences to students. Multimedia has a very good

role and benefits in terms of applications that provide a variety of the best services including videos that can be downloaded first, then stored and can be used even though they don't have a network that is online.

According to Vaughan (2004, p1), Multimedia is a combination of text, images, sounds, animations and videos sent to you via a computer or other electronic device or by digital manipulation. The following is a study that was conducted by I Kd. Arik Antini, I Gst. Agung Oka Negara, I Wy. The 2014 Sudjana entitled "Guided Inquiry Learning Method Assisted by Audio-Visual Media Influences Social Studies in Class V Elementary School Students Group Letda Kajeng." The results showed that there were significant differences in social studies between groups of students who learned using media-assisted inquiry learning methods. audio-visual with those taught using conventional learning. This is evident from the difference in average IPS between the experimental group and the control group namely = 74.45 > 57.74. The results of the analysis using the t test were obtained this = 5.58 > ttab = 2.00. It can be concluded that the guided inquiry learning method assisted by audio-visual media has an effect on the social studies of students in grade V in the Elementary School of Letda Kajeng Academic Year 2013/2014.

Other studies that "support" the "solving" of the "problem" are "research" that are "carried out" by "Leni Sofianida, Sri Utaminingsih, Su'ad" 2018 "with" title "" Effects of Guided Inquiry Learning Methods Based on Local Wisdom Against Skills "Critical Thinking My Heroes' Class IV Elementary School." "The results of this show that: 1) guided inquiry methods based on effective local wisdom to improve critical thinking skills in the theme of my elementary school fourth grade hero are somewhat of a guided inquiry method. This is evidenced by the results of the average guided inquiry method based on local wisdom and not on the inquiry method initiative (76.55 > 67.94), 2) there is a significant effect of students critical thinking skills between guided inquiry methods based on local wisdom and guided Inquiry method. This is evidenced by the results of tcount > t table (2.757 > 2.002) and a smaller significance value with a significance level of 5% (p = 0.010 > 0.05).

II. RESEARCH METHODS

Type of research is Quasi Eksperimental is a design that has a control group but is not fully functional to examine external variables such as student motivation, student interest, and learning time that can affect the implementation of experiments. This method is used to determine whether or not there is an influence between the use of Inquiry and Multimedia learning methods that are used on critical thinking skills and student learning outcomes. The design of this research is the design of nonequivalent (pretest and posttest) Design Control Group. In the experimental class the implementation of learning uses the Inquiry learning method. While the learning control class is conventional with the lecture method. Then the final test is carried out to find out the IPS about the cognitive abilities of students who have attended learning. This research was conducted at SD Negeri Percobaan 2 Malang which is located on Jl. Galunggung No.1, Pisang Candi, Sukun, Malang City, Malang City, East Java. Time of study in even semester 2018/2019.

State Elementary School 2 Experiment 2 Malang has 4 class IV races. In this study, the subjects chosen were students of class IV B, amounting to 25 students as the experimental class and class IV C, which amounted to 25 students as the control class. The research sample used Cluster Random Sampling. This technique takes samples randomly from groups. Random sampling is done to determine the experimental class and the control class. Based on the results of randomization, it was obtained class IV B experiment and class IV C control. The experimental sample used Multimedia Assisted Inquiry learning method while the control class used conventional learning methods, namely the lecture method. From the results of assessment of students' critical thinking skills can be calculated using the formula listed below: $M = \frac{\sum F}{N} \times 100$

Source: Indarti (2008, p.25)

Analysis of data from student learning outcomes, can be calculated using a formula listed below: $\text{Score} = \frac{B}{N} \times 100\%$

Source: Yamin (2010, p. 159)

Based on the information on minimum completeness criteria (KKM) in SD Negeri Experiment 2 Malang City, students are declared to have completed their learning outcomes if they get a value of ≥ 70 .

III. RESULTS

The use of media tailored to the learning material and can draw enthusiasm of students in the learning process. The media used can be seen in the following figure:



Figure 3.1 multimedia (video)

After the media, learning devices, and research instruments are compiled at the planning stage, a number of validators are then assessed. The validator in this study consisted of two lecturers. The results of multimedia validation obtained an average value of 3.7 with very good and feasible categories used without revisions. The revised media and learning tools were based on input from the validator, then tested in class IVB at Elementary School 2 Experiment Malang. Data collected in the implementation of the trial includes thinking skills and student learning outcomes. Data on student activity during learning in experimental classes is presented in the following table.

Table 3.8 Normality Test Results

| Variables | Class | Significance | Level | Information |
|-----------------------------|-------------|--------------|-------|-------------|
| Critical Thinking | Control | ,125 | 0,05 | Normal |
| Critical Thinking | Experiments | ,177 | 0,05 | Normal |
| Learning Results (Pretest) | Control | ,120 | 0,05 | Normal |
| Learning Results (Posttest) | | ,119 | 0,05 | Normal |
| Learning Results (Pretest) | Experiments | ,128 | 0,05 | Normal |
| Learning Results (Posttest) | | ,181 | 0,05 | Normal |

Test for normality using the chi square test formula with a significance level of 0.05 or 5%. If the significance of <0.05 , the conclusion is that the data is not normal. But if the significance is > 0.05 , the data is normally distributed. Variables of control critical thinking obtained a significant value of $0.125 > 0.05$. The experimental critical thinking variable obtained a significant value of $0.177 > 0.05$. The variables of the pretest learning outcomes of the control class students obtained a significance value of $0.120 > 0.05$ on the posttest learning outcomes of the control class students obtained a significance value of $0.119 > 0.05$. Variables of pre-student learning outcomes in the experimental class obtained a significance value of $0.128 > 0.05$, on the posttest learning outcomes of students in the experimental class obtained a significance value of $0.181 > 0.05$. So that it can be stated that all variables in table 4.18 are normally distributed. The homogeneity test was carried out using the Oneway Anova test with the help of SPSS 21 program. The homogeneity test results are shown in the following table:

Table 3.9 Homogeneity Results

| Test of Homogeneity of Variances | | | | |
|----------------------------------|------------------|-----|-----|------|
| | Levene Statistic | df1 | df2 | Sig. |
| Thinking Critical | ,255 | 1 | 48 | ,616 |
| Pretest | ,490 | 1 | 48 | ,487 |
| Post test | 1,604 | 1 | 48 | ,211 |

Table 3.9 is homogeneity test data using a significance level of 0.05 or 5%. If the significance is <0.05 , the data group variant is not homogeneous, and if the significance is > 0.05 , the data group variant is homogeneous. The critical thinking skills variable obtained a significance value of $0.616 > 0.05$, it is said that the variable is homogeneous, the learning outcome variable (pretest) obtained a significance value of $0.487 > 0.05$, it can be said that the variable is homogeneous. Whereas the learning outcome variable (posttest) obtained a significance value of $0.211 > 0.05$, it can be said that the variable is homogeneous. From these two variables it can be concluded that the data is homogeneous or has met the basic assumptions of homogeneity. After the normality and homogeneity tests are carried out, the hypothesis testing can be used to determine the effect of Multimedia assisted Inquiry learning methods on critical thinking skills and Social Sciences learning outcomes of my heroic theme for fourth grade students of SDN Percobaan 2 Malang. The decision making can also be seen in a significant level p Sig. (2-tailed). If $p > 0.05$, H_0 is accepted and H_a is rejected, if $p < 0.05$ then H_0 is rejected and H_a is accepted (Triton, 2006, p.175). The following are the results of the t-test of critical thinking skills and student learning outcomes in the experimental group using the Inquiry learning method and the control group using conventional models.

Table 3.10 Test Results for T Group Statistics

| | Class | N | Mean | Std. Deviation | Std. Error Mean |
|-------------------|------------|----|-------|----------------|-----------------|
| Thinking Critical | Control | 25 | 84,84 | 10,323 | 2,065 |
| | experiment | 25 | 61,12 | 10,787 | 2,157 |
| Pretest | Control | 25 | 64,60 | 11,173 | 2,235 |
| | experiment | 25 | 63,00 | 11,547 | 2,309 |
| Post test | Control | 25 | 88,00 | 9,242 | 1,848 |
| | experiment | 25 | 73,80 | 10,924 | 2,185 |

In the results of the analysis with the Independent Sample T-test showed that critical thinking skills obtained a tcount of 7.944, a value of ttable at (df.48) and a real level of 0.05 of 1,677, if a comparison was made then $tcount < ttable$ with the results of sig. 2 tailed at $0,000 < 0,05$ and said to accept H_0 which means that there is a significant difference. Which means there are differences in critical thinking skills and student learning outcomes between the control class and the experimental class. At the pretest the tcount is 0.498. The value of ttable at (df.48) and the real level of 0.05 is 1,677, if a comparison is made then $tcount < ttable$ with the results of sig. 2 tailed $0.621 > 0.05$ and said to accept H_0 which means that there is no significant difference. Which means there is no difference in student learning outcomes between the control class and the experimental class at the time of the pretest. Whereas in the Posttest, the tcount is 4.962. The value of ttable is at (df.48) and the real level of 0.05 is 1,677, if a comparison is made then $tcount > ttable$ with the results of sig. 2 tailed at $0,000 < 0,05$ and said to receive H_a which means that there are significant differences. Which means that there are differences in student learning outcomes between the control class and the experimental class at the posttest.

IV. DISCUSSION

Based on the analysis of the results of the research presented in chapter 4, this chapter will discuss the results of the research that focused on the findings so that the findings can be justified by theoretical studies. In table 3.9 the normality test

for critical thinking skills is in the control class 0, 125 and in the experimental class 0.177. The two test groups have a significant value $> 0, 05$. It is concluded that the results of critical thinking skills in each are normally distributed. In table 3.10 the homogeneity test obtained the value of homogeneity of critical thinking skills in the control class of 0.487 and in the experimental class of 0.211. With a significance number > 0.05 , it can be concluded that the sample variants are homogeneous or the same.

The average value of critical thinking students before treatment. Can be seen the acquisition of the average value of control is 1.829 while in the experimental class is 2.121. Then by looking at the results of the Independent Samples Test, the T-test obtained a tcount of 7.944, a value of ttable at (df.48) and a real level of 0.05 of 1,677, if a comparison was made then tcount $<$ ttable with the results of sig. 2 tailed at 0,000 $<$ 0,05 and said to accept H_0 which means that there is a significant difference. Which means there are differences in critical thinking skills and student learning outcomes between the control class and the experimental class. The influence of the Inquiry learning method on critical thinking skills of students in the experimental class is in line with the opinion of Huda (2013, p. 318) that the Inquiry learning method is a learning model that is an alternative in solving problems that invite students to think creatively and critically. The problem given by the teacher to students and students is given confidence in solving problems will train and encourage mental students more critical.

Based on the discussion above, it can be concluded that the critical thinking skills of students who use the Inquiry learning method with class groups that use conventional learning models using the 2013 curriculum. This is supported by Dawsen's description in Wicaksono (2014, p. 85-92) which states "students who have good development of metacognition will be better able to solve problems, make decisions and think critically, are more motivated to learn, more able to regulate emotions and better able to overcome difficulties".

Based on the results of the elaboration of the above research related to the Inquiry learning method, there is the influence of critical thinking skills of students experiencing significant changes between classes using the Inquiry learning model compared to classes that only use conventional learning models. This finding is also supported by research relating to Inquiry learning methods conducted by Sadam Husein, Lovy Herayanti and Gunawan in 2015 entitled "The Effect of Using Interactive Multimedia on Mastery of Concepts and Critical Thinking Skills of Students on Temperature and Heat Material" that Inquiry learning method is very affect the mastery of students 'concepts in the temperature and heat material of class X SMA Negeri 1 and can be used or used as a learning model to improve students' critical thinking skills. The equation in this study is that both have the independent variable namely Inquiry learning method while in the use of media both use multimedia both previous research and in this study and the measured benchmarks are students' critical thinking skills and learning outcomes. Both of these studies showed good results and had an influence on the experimental class. Furthermore, other studies that are in line with this research are research conducted by Hidayati Suhada in 2017 with the title "Inquiry Learning Method and Critical Thinking Ability to the Science Process Skills of Class V Students in Science Subjects". In this study, it has been proven that Inquiry learning methods can improve the thinking skills of fifth grade students of elementary school. The equation in this study is in the independent variables used, namely the Inquiry learning method and the students' critical thinking skills that are measured, similar to this study, the Y2 variable is learning outcomes. Both of these studies showed good results and had an influence on the experimental class and were successful.

Based on table 3.9 the results of the normality test for student learning outcomes on the pretest problem, namely the control class of 0.120 while in the experimental class is 0.128. Furthermore, for the results of the analysis of the normality of learning outcomes in the post test questions, namely in the control class of 0.119 while the experimental class is 0.181. The two test groups have a significance value of > 0.05 , so it can be concluded that the data on student learning outcomes in each class are normally distributed. In table 3.10 the homogeneity test results obtained the value of student learning outcomes on the news question of 0, 487 while in the experimental class of 0, 211. Both of these results have a significance value > 0.05 can be concluded that the sample variants in the study were homogeneous or the same. The average value of students before the treatment (pretest) obtained an average value of control of 1.575 while in the experimental class amounted to 1. 620. Then by looking at the results of the Independent Sample T-test obtained a tcount of 0.498. The value of ttable at (df.48) and the real level of 0.05 is 1,677, if a comparison is made then tcount $<$ t table with the results of sig. 2 tailed 0.621 $>$ 0.05 and said to accept H_0 which means that there is no significant difference. Which means there is no difference in student learning outcomes between the control class and the experimental class at the time of the pretest. After the learning treatment of the two classes, namely the experimental class and the control class, the next step was posttest. The results of the analysis of student learning outcomes during the implementation of the post test in the control class get an average value of 1,845 while in the experimental class is 2,200. Then after seeing the results of the Independent Sample T-test, tcount was 4.962. The value of ttable is at (df.48) and the real level of 0.05 is 1,677, if a comparison is made then tcount $>$ t table with the results of sig. 2 tailed at 0,000 $<$ 0,05 and said to receive H_a which means that there are significant differences. Which means that there are differences in student learning outcomes between the control class and the experimental class at the posttest.

At the time of the implementation of the news from both classes there was no significant difference. However, during the post test there were significant differences between the control class and the experimental class. This means that student learning outcomes using multimedia-assisted Inquiry learning methods are higher than the learning outcomes of students who use conventional models. The influence of the Inquiry learning method on student learning outcomes is in line with the opinions expressed by Nasution (Supardi, 2015, p.2) which says that learning outcomes are changes that occur in students, not only visible from their knowledge but visible changes in attitudes, skills, habits, understanding, and appreciation in someone who learns. From the description and the corroborating opinion above, it can be concluded that the Inquiry learning method has a significant effect related to student learning outcomes.

This finding is also supported by research conducted by Maria AF Mbari, Marianus Yufinalis, and Theresia Nona in 2018 with the title "The Effect of Using Inquiry Learning Methods on Learning Outcomes and Student Motivation in Class

V Elementary School Students". This research has similarities, namely learning outcomes, and this research together shows good results. This finding is also supported by research related to learning outcomes examined by Utami researchers Rukmaliani, Rosnita, and Mastar Asran with the title "The Influence of Inquiry Learning Methods on Science IV Learning Outcomes of Class IV Elementary School Students" indicating that this Learning Method is suitable for improving outcomes student learning. The dependent variable in this study is the same, namely measuring student learning outcomes. In this study, both showed the results of good and successful research.

V. CONCLUSION

This experimental research by applying multimedia-assisted inquiry methods can influence critical thinking skills and learning outcomes on the theme of my hero in grade IV elementary school. The media used fulfills good criteria after going through validation and field trials. This can be seen from the completeness of student learning outcomes in social studies subjects. The value of normalized gain of critical thinking skills of the experimental class students is 0, 177 and the control class is 0, 125. The normalized gain value of the pretest learning outcomes of the experimental class students is 0.128 and the control class is 0.120. The normalized gain value of the posttest learning outcomes of the experimental class students is 0.181 and the control class is 0.119. Test results of independent samples t-test of critical thinking skills showed that the value of tcount was 7.944, the value of ttable at (df.48) and the significance level of 0.05 was 1,677. the results of the test of independent samples t-test of the pretest learning results indicate that the tcount is 0.498. The value of ttable at (df.48) and the real level of 0.05 is 1,677 and the results of the test independent samples t-test of the posttest learning outcomes indicate that the value of tcount is 4.962. The value of ttable is at (df.48) and the significance level of 0.05 is 1,677. so that it can be concluded that the multimedia-assisted Inquiry learning method has an effect on critical thinking skills and learning outcomes of fourth grade students of SD Negeri Percobaan 2 Malang.

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Situational Underlying Value (SUV) – A Single Statistic For Individual Performance In Professional Football And NCAA Men’s Division I Basketball

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Abstract- The concept of the Situational Underlying Value (SUV) statistic has been introduced in connection with major league baseball, based on the “run expectancy” associated with each base and number of outs. Having completed that development, including the “proof of principle” for one-third of one team’s entire season (54 of 162 games), the SUV has been extended to both professional football (National Football League) and NCAA Men’s Division I College Basketball. The development for the SUV in these two sports is described in this article, including a similar “proof of principle” which analyzes one-third of an NFL team’s regular season (five of 16 games) and five games for one team in the NCAA Division I Men’s Basketball Championship. The SUV version for football takes advantage of previous analyses which attribute point values to each field position based on the down and number of “yards to go.” The basketball version develops its SUV from “first principles,” based on statistics from an entire season of NCAA Division I Men’s Basketball. As with baseball, the SUV statistics for football and basketball proved to be functional in measuring individual player performance via one overarching statistic. Results from the “Proof of Principle” exercises showed very good agreement with traditional statistics for football while uncovering some possibly unique insights that would lead to different conclusions in basketball from traditional statistics.

Index Terms- Positional Point Values, Football, Basketball, Season Statistics

I. INTRODUCTION

SUV for professional football (National Football League [NFL]) is not as readily conceived as that for baseball (References 1-4), although the concept of each position on the field with down and yards to go has been examined for the possibility of assigning point values (from here on referred to as SUVs). Quantification of this concept is taken from Reference 5:

*Every spot on the field has an abstract value in terms of points. We can begin assigning values at the end zones, where having the ball has a clear and concrete value. Possessing the ball at the opponent’s end zone is worth (nearly always) 7 points. And having the ball at your own end zone is worth -2 points. Every other yard line has a point value too. We can measure it by averaging how many points will be scored next ... The concept of point expectancy originated with the work of Virgil Carter, a former NFL quarterback who studied operations research in the early 1970s (while an active player). Carroll, Palmer, and Thorn adapted the concept in their 1987 book *The Hidden Game of Football* ... The graph below [see Figure 1] plots the expected points for a 1st down at each yard line. For simplicity, I’ve named each yard line in terms of its distance from an opponent’s end zone. Having the ball at one’s own 20 is “the 80 yard line” for example.*

This was readily linearized into segments based on the following values assumed for field position and expected points from the chart: (1, 6.5), (4, 5.6), (10, 5), (35, 3), (93, -0.5), (98, -1) and (99, -1.4). When plotted, this piecewise linear function appears as in Figure 2. To adjust for 2nd and 3rd downs, Burke recommends the following:

Things become more complicated when we consider other down and distance situations. Suppose at any given yard line, a pass falls incomplete on 1st and 10. Second down and 10 represents a drop off of about 0.5 points expected. Second and 9 represents a slightly smaller drop off, until at about 2nd and 5 when the expected points are approximately equal to those for 1st and 10. This is consistent with the 1st down probability method I described in my previous posts. Third down and 10 represents a further drop off of about 0.5 points.

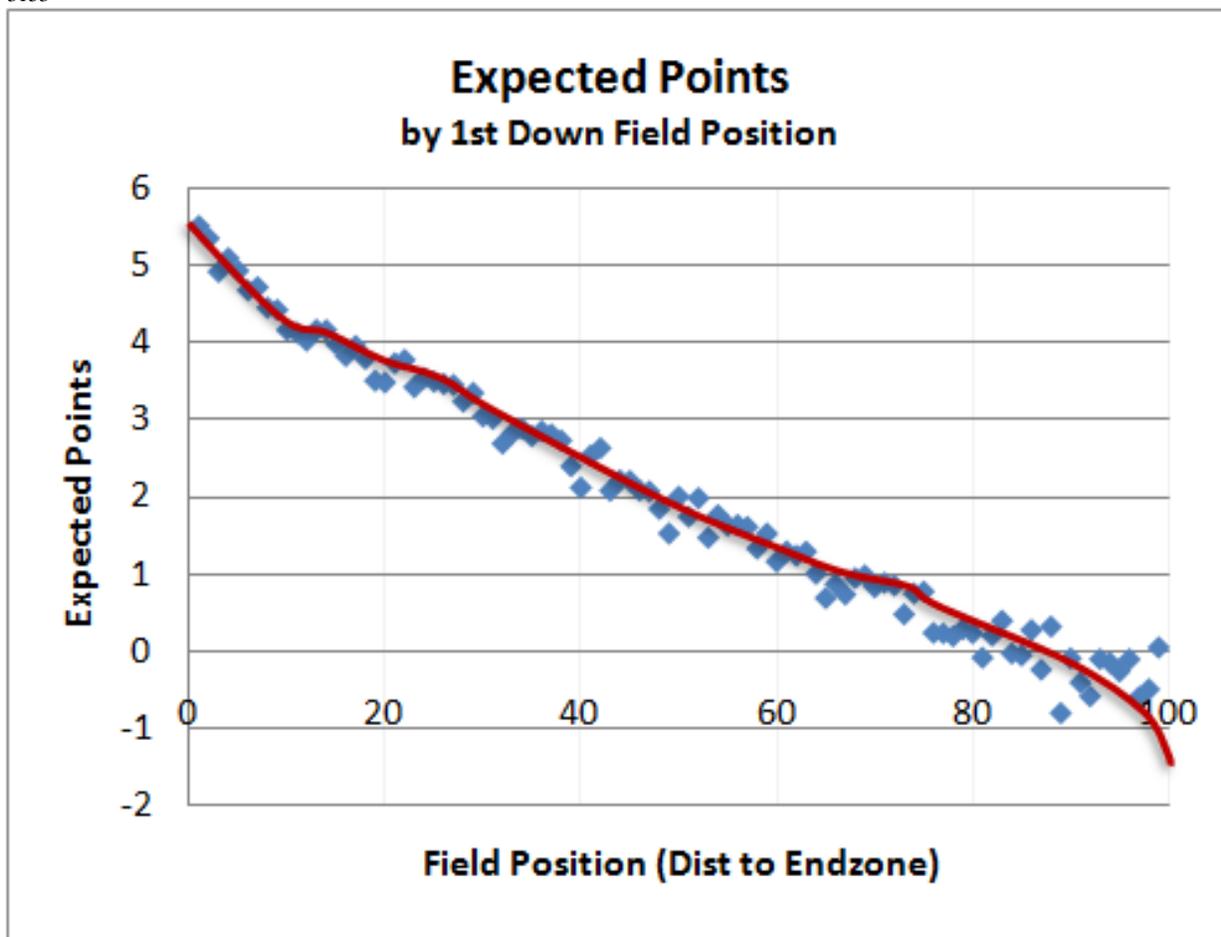


Figure 1. Expected Points by First Down Field Position (See Reference 5)

II.SUV FOOTBALL: TABLES BASED ON DOWN, YARDS TO GO AND FIELD POSITION

Based on the fitted curve and Burke’s recommended adjustments for 2nd and 3rd down, I compiled the following SUVs for all field positions for 1st, 2nd and 3rd down with 10 or less yards to go. Note that, after decreasing the SUV for 1st and 10 by Burke’s recommended 0.5, I increased each SUV by 0.1 as the yards to go decreased from 10 to five. For five or less, I assumed a constant equal to 1st and 10. I did likewise for 3rd downs, with 3rd and 10 0.5 less than 2nd and 10 down to 3rd and five (or less) being the same as 2nd and 10. The results are shown in Table 1. They are immediately followed by results for more than 10 yards to go. For these, I assumed a 0.1 decrease by yard up to 20 yards, which I then treated as constant for anything higher. These are shown in Table 2 for 1st down only – to keep the number and length of tables tractable, the tables for 2nd and 3rd down for more than 10 yards to go can be extrapolated from Table 2 (or viewed directly in Reference 1).

A. SUVs for Fourth Down

Guidance for 4th down was more difficult to find and develop into an SUV. For this, two articles (References 6 and 7) provided information. The first article provided the chart in Figure 3, recommending what to choose on 4th down, on which I superimposed line segments representing the boundaries between going for it vs. other. The line segments connected at the following values for field position and yards to go: (99, 2), (76, 2), (61, 4), (38, 10.5), (32, 7), (21, 3), (12, 3), (4, 4). The second article provided the following information:



Figure 2.

Expected Points by First Down Field Position - Linearized from Table 1

Going for it on 4th-and-short has had a 62.7% success rate over the last three years [2010-2012] ... There is a noticeable dip in the 2011 data: 2010 and 2012 look alike and suggest an over 66% (2 out of 3) conversion rate ... The year-to-year data sets are small enough to allow for this kind of fluctuation. It is best to assume that the "real" success rate lies between the low of 2011 and the high of the other two years, though we will see later that there are compelling reasons to lean toward the higher rate ... The raw data tells us that 4th-and-short conversion attempts are not a high-risk gamble. A 63% success rate represents good odds. ... That stability is the most interesting finding of this study. The 62.7% success rate we started with is much closer to 66.7%, or two-thirds, if a few more dire circumstance attempts are teased out ... [I]f a team goes for it on 4th-and-short three times in a game, they are statistically likely to gain two 1st downs and turn the ball over on downs once. If the team makes those three attempts at, say, the opponent's 40-yard line, that means they will get the ball in scoring position twice but give the opponent good field position once.

Table 1. SUVs for Field Positions with Ten or Less “Yards to Go”

| y d | pt (1/10-) | pt (2/10) | pt (2/9) | pt (2/8) | pt (2/7) | pt (2/6) | pt (2/5-) | pt (3/10) | pt (3/9) | pt (3/8) | pt (3/7) | pt (3/6) | pt (3/5-) |
|--------|---------------|--------------|-------------|-------------|-------------|-------------|---------------|--------------|-------------|-------------|-------------|-------------|---------------|
| 1 | 6.50 | 6.00 | 6.10 | 6.20 | 6.30 | 6.40 | 6.50 | 5.50 | 5.60 | 5.70 | 5.80 | 5.90 | 6.00 |
| 2 | 6.20 | 5.70 | 5.80 | 5.90 | 6.00 | 6.10 | 6.20 | 5.20 | 5.30 | 5.40 | 5.50 | 5.60 | 5.70 |
| 3 | 5.90 | 5.40 | 5.50 | 5.60 | 5.70 | 5.80 | 5.90 | 4.90 | 5.00 | 5.10 | 5.20 | 5.30 | 5.40 |
| 4 | 5.60 | 5.10 | 5.20 | 5.30 | 5.40 | 5.50 | 5.60 | 4.60 | 4.70 | 4.80 | 4.90 | 5.00 | 5.10 |
| 5 | 5.50 | 5.00 | 5.10 | 5.20 | 5.30 | 5.40 | 5.50 | 4.50 | 4.60 | 4.70 | 4.80 | 4.90 | 5.00 |
| 6 | 5.40 | 4.90 | 5.00 | 5.10 | 5.20 | 5.30 | 5.40 | 4.40 | 4.50 | 4.60 | 4.70 | 4.80 | 4.90 |
| 7 | 5.30 | 4.80 | 4.90 | 5.00 | 5.10 | 5.20 | 5.30 | 4.30 | 4.40 | 4.50 | 4.60 | 4.70 | 4.80 |
| 8 | 5.20 | 4.70 | 4.80 | 4.90 | 5.00 | 5.10 | 5.20 | 4.20 | 4.30 | 4.40 | 4.50 | 4.60 | 4.70 |
| 9 | 5.10 | 4.60 | 4.70 | 4.80 | 4.90 | 5.00 | 5.10 | 4.10 | 4.20 | 4.30 | 4.40 | 4.50 | 4.60 |
| 10 | 5.00 | 4.50 | 4.60 | 4.70 | 4.80 | 4.90 | 5.00 | 4.00 | 4.10 | 4.20 | 4.30 | 4.40 | 4.50 |
| 11 | 4.92 | 4.42 | 4.52 | 4.62 | 4.72 | 4.82 | 4.92 | 3.92 | 4.02 | 4.12 | 4.22 | 4.32 | 4.42 |
| 12 | 4.84 | 4.34 | 4.44 | 4.54 | 4.64 | 4.74 | 4.84 | 3.84 | 3.94 | 4.04 | 4.14 | 4.24 | 4.34 |
| 13 | 4.76 | 4.26 | 4.36 | 4.46 | 4.56 | 4.66 | 4.76 | 3.76 | 3.86 | 3.96 | 4.06 | 4.16 | 4.26 |
| 14 | 4.68 | 4.18 | 4.28 | 4.38 | 4.48 | 4.58 | 4.68 | 3.68 | 3.78 | 3.88 | 3.98 | 4.08 | 4.18 |
| 15 | 4.60 | 4.10 | 4.20 | 4.30 | 4.40 | 4.50 | 4.60 | 3.60 | 3.70 | 3.80 | 3.90 | 4.00 | 4.10 |
| 16 | 4.52 | 4.02 | 4.12 | 4.22 | 4.32 | 4.42 | 4.52 | 3.52 | 3.62 | 3.72 | 3.82 | 3.92 | 4.02 |
| 17 | 4.44 | 3.94 | 4.04 | 4.14 | 4.24 | 4.34 | 4.44 | 3.44 | 3.54 | 3.64 | 3.74 | 3.84 | 3.94 |
| 18 | 4.36 | 3.86 | 3.96 | 4.06 | 4.16 | 4.26 | 4.36 | 3.36 | 3.46 | 3.56 | 3.66 | 3.76 | 3.86 |
| 19 | 4.28 | 3.78 | 3.88 | 3.98 | 4.08 | 4.18 | 4.28 | 3.28 | 3.38 | 3.48 | 3.58 | 3.68 | 3.78 |
| 20 | 4.20 | 3.70 | 3.80 | 3.90 | 4.00 | 4.10 | 4.20 | 3.20 | 3.30 | 3.40 | 3.50 | 3.60 | 3.70 |
| 21 | 4.12 | 3.62 | 3.72 | 3.82 | 3.92 | 4.02 | 4.12 | 3.12 | 3.22 | 3.32 | 3.42 | 3.52 | 3.62 |
| 22 | 4.04 | 3.54 | 3.64 | 3.74 | 3.84 | 3.94 | 4.04 | 3.04 | 3.14 | 3.24 | 3.34 | 3.44 | 3.54 |
| 23 | 3.96 | 3.46 | 3.56 | 3.66 | 3.76 | 3.86 | 3.96 | 2.96 | 3.06 | 3.16 | 3.26 | 3.36 | 3.46 |
| 24 | 3.88 | 3.38 | 3.48 | 3.58 | 3.68 | 3.78 | 3.88 | 2.88 | 2.98 | 3.08 | 3.18 | 3.28 | 3.38 |
| 25 | 3.80 | 3.30 | 3.40 | 3.50 | 3.60 | 3.70 | 3.80 | 2.80 | 2.90 | 3.00 | 3.10 | 3.20 | 3.30 |
| 26 | 3.72 | 3.22 | 3.32 | 3.42 | 3.52 | 3.62 | 3.72 | 2.72 | 2.82 | 2.92 | 3.02 | 3.12 | 3.22 |
| 27 | 3.64 | 3.14 | 3.24 | 3.34 | 3.44 | 3.54 | 3.64 | 2.64 | 2.74 | 2.84 | 2.94 | 3.04 | 3.14 |
| 28 | 3.56 | 3.06 | 3.16 | 3.26 | 3.36 | 3.46 | 3.56 | 2.56 | 2.66 | 2.76 | 2.86 | 2.96 | 3.06 |
| 29 | 3.48 | 2.98 | 3.08 | 3.18 | 3.28 | 3.38 | 3.48 | 2.48 | 2.58 | 2.68 | 2.78 | 2.88 | 2.98 |
| 30 | 3.40 | 2.90 | 3.00 | 3.10 | 3.20 | 3.30 | 3.40 | 2.40 | 2.50 | 2.60 | 2.70 | 2.80 | 2.90 |
| 31 | 3.32 | 2.82 | 2.92 | 3.02 | 3.12 | 3.22 | 3.32 | 2.32 | 2.42 | 2.52 | 2.62 | 2.72 | 2.82 |

| y d | pt (1/10-) | pt (2/10) | pt (2/9) | pt (2/8) | pt (2/7) | pt (2/6) | pt (2/5-) | pt (3/10) | pt (3/9) | pt (3/8) | pt (3/7) | pt (3/6) | pt (3/5-) |
|--------|---------------|--------------|-------------|-------------|-------------|-------------|---------------|--------------|-------------|-------------|-------------|-------------|---------------|
| 3 2 | 3.24 | 2.74 | 2.84 | 2.94 | 3.04 | 3.14 | 3.24 | 2.24 | 2.34 | 2.44 | 2.54 | 2.64 | 2.74 |
| 3 3 | 3.16 | 2.66 | 2.76 | 2.86 | 2.96 | 3.06 | 3.16 | 2.16 | 2.26 | 2.36 | 2.46 | 2.56 | 2.66 |
| 3 4 | 3.08 | 2.58 | 2.68 | 2.78 | 2.88 | 2.98 | 3.08 | 2.08 | 2.18 | 2.28 | 2.38 | 2.48 | 2.58 |
| 3 5 | 3.00 | 2.50 | 2.60 | 2.70 | 2.80 | 2.90 | 3.00 | 2.00 | 2.10 | 2.20 | 2.30 | 2.40 | 2.50 |
| 3 6 | 2.94 | 2.44 | 2.54 | 2.64 | 2.74 | 2.84 | 2.94 | 1.94 | 2.04 | 2.14 | 2.24 | 2.34 | 2.44 |
| 3 7 | 2.88 | 2.38 | 2.48 | 2.58 | 2.68 | 2.78 | 2.88 | 1.88 | 1.98 | 2.08 | 2.18 | 2.28 | 2.38 |
| 3 8 | 2.82 | 2.32 | 2.42 | 2.52 | 2.62 | 2.72 | 2.82 | 1.82 | 1.92 | 2.02 | 2.12 | 2.22 | 2.32 |
| 3 9 | 2.76 | 2.26 | 2.36 | 2.46 | 2.56 | 2.66 | 2.76 | 1.76 | 1.86 | 1.96 | 2.06 | 2.16 | 2.26 |
| 4 0 | 2.70 | 2.20 | 2.30 | 2.40 | 2.50 | 2.60 | 2.70 | 1.70 | 1.80 | 1.90 | 2.00 | 2.10 | 2.20 |
| 4 1 | 2.64 | 2.14 | 2.24 | 2.34 | 2.44 | 2.54 | 2.64 | 1.64 | 1.74 | 1.84 | 1.94 | 2.04 | 2.14 |
| 4 2 | 2.58 | 2.08 | 2.18 | 2.28 | 2.38 | 2.48 | 2.58 | 1.58 | 1.68 | 1.78 | 1.88 | 1.98 | 2.08 |
| 4 3 | 2.52 | 2.02 | 2.12 | 2.22 | 2.32 | 2.42 | 2.52 | 1.52 | 1.62 | 1.72 | 1.82 | 1.92 | 2.02 |
| 4 4 | 2.46 | 1.96 | 2.06 | 2.16 | 2.26 | 2.36 | 2.46 | 1.46 | 1.56 | 1.66 | 1.76 | 1.86 | 1.96 |
| 4 5 | 2.40 | 1.90 | 2.00 | 2.10 | 2.20 | 2.30 | 2.40 | 1.40 | 1.50 | 1.60 | 1.70 | 1.80 | 1.90 |
| 4 6 | 2.34 | 1.84 | 1.94 | 2.04 | 2.14 | 2.24 | 2.34 | 1.34 | 1.44 | 1.54 | 1.64 | 1.74 | 1.84 |
| 4 7 | 2.28 | 1.78 | 1.88 | 1.98 | 2.08 | 2.18 | 2.28 | 1.28 | 1.38 | 1.48 | 1.58 | 1.68 | 1.78 |
| 4 8 | 2.22 | 1.72 | 1.82 | 1.92 | 2.02 | 2.12 | 2.22 | 1.22 | 1.32 | 1.42 | 1.52 | 1.62 | 1.72 |
| 4 9 | 2.16 | 1.66 | 1.76 | 1.86 | 1.96 | 2.06 | 2.16 | 1.16 | 1.26 | 1.36 | 1.46 | 1.56 | 1.66 |
| 5 0 | 2.09 | 1.59 | 1.69 | 1.79 | 1.89 | 1.99 | 2.09 | 1.09 | 1.19 | 1.29 | 1.39 | 1.49 | 1.59 |
| 5 1 | 2.03 | 1.53 | 1.63 | 1.73 | 1.83 | 1.93 | 2.03 | 1.03 | 1.13 | 1.23 | 1.33 | 1.43 | 1.53 |
| 5 2 | 1.97 | 1.47 | 1.57 | 1.67 | 1.77 | 1.87 | 1.97 | 0.97 | 1.07 | 1.17 | 1.27 | 1.37 | 1.47 |
| 5 3 | 1.91 | 1.41 | 1.51 | 1.61 | 1.71 | 1.81 | 1.91 | 0.91 | 1.01 | 1.11 | 1.21 | 1.31 | 1.41 |
| 5 4 | 1.85 | 1.35 | 1.45 | 1.55 | 1.65 | 1.75 | 1.85 | 0.85 | 0.95 | 1.05 | 1.15 | 1.25 | 1.35 |
| 5 5 | 1.79 | 1.29 | 1.39 | 1.49 | 1.59 | 1.69 | 1.79 | 0.79 | 0.89 | 0.99 | 1.09 | 1.19 | 1.29 |
| 5 6 | 1.73 | 1.23 | 1.33 | 1.43 | 1.53 | 1.63 | 1.73 | 0.73 | 0.83 | 0.93 | 1.03 | 1.13 | 1.23 |
| 5 7 | 1.67 | 1.17 | 1.27 | 1.37 | 1.47 | 1.57 | 1.67 | 0.67 | 0.77 | 0.87 | 0.97 | 1.07 | 1.17 |
| 5 8 | 1.61 | 1.11 | 1.21 | 1.31 | 1.41 | 1.51 | 1.61 | 0.61 | 0.71 | 0.81 | 0.91 | 1.01 | 1.11 |
| 5 9 | 1.55 | 1.05 | 1.15 | 1.25 | 1.35 | 1.45 | 1.55 | 0.55 | 0.65 | 0.75 | 0.85 | 0.95 | 1.05 |

| y d | pt (1/10-) | pt (2/10) | pt (2/9) | pt (2/8) | pt (2/7) | pt (2/6) | pt (2/5-) | pt (3/10) | pt (3/9) | pt (3/8) | pt (3/7) | pt (3/6) | pt (3/5-) |
|--------|---------------|--------------|-------------|-------------|-------------|-------------|---------------|--------------|-------------|-------------|-------------|-------------|---------------|
| 6 0 | 1.49 | 0.99 | 1.09 | 1.19 | 1.29 | 1.39 | 1.49 | 0.49 | 0.59 | 0.69 | 0.79 | 0.89 | 0.99 |
| 6 1 | 1.43 | 0.93 | 1.03 | 1.13 | 1.23 | 1.33 | 1.43 | 0.43 | 0.53 | 0.63 | 0.73 | 0.83 | 0.93 |
| 6 2 | 1.37 | 0.87 | 0.97 | 1.07 | 1.17 | 1.27 | 1.37 | 0.37 | 0.47 | 0.57 | 0.67 | 0.77 | 0.87 |
| 6 3 | 1.31 | 0.81 | 0.91 | 1.01 | 1.11 | 1.21 | 1.31 | 0.31 | 0.41 | 0.51 | 0.61 | 0.71 | 0.81 |
| 6 4 | 1.25 | 0.75 | 0.85 | 0.95 | 1.05 | 1.15 | 1.25 | 0.25 | 0.35 | 0.45 | 0.55 | 0.65 | 0.75 |
| 6 5 | 1.19 | 0.69 | 0.79 | 0.89 | 0.99 | 1.09 | 1.19 | 0.19 | 0.29 | 0.39 | 0.49 | 0.59 | 0.69 |
| 6 6 | 1.13 | 0.63 | 0.73 | 0.83 | 0.93 | 1.03 | 1.13 | 0.13 | 0.23 | 0.33 | 0.43 | 0.53 | 0.63 |
| 6 7 | 1.07 | 0.57 | 0.67 | 0.77 | 0.87 | 0.97 | 1.07 | 0.07 | 0.17 | 0.27 | 0.37 | 0.47 | 0.57 |
| 6 8 | 1.01 | 0.51 | 0.61 | 0.71 | 0.81 | 0.91 | 1.01 | 0.01 | 0.11 | 0.21 | 0.31 | 0.41 | 0.51 |
| 6 9 | 0.95 | 0.45 | 0.55 | 0.65 | 0.75 | 0.85 | 0.95 | -0.05 | 0.05 | 0.15 | 0.25 | 0.35 | 0.45 |
| 7 0 | 0.89 | 0.39 | 0.49 | 0.59 | 0.69 | 0.79 | 0.89 | -0.11 | -0.01 | 0.09 | 0.19 | 0.29 | 0.39 |
| 7 1 | 0.83 | 0.33 | 0.43 | 0.53 | 0.63 | 0.73 | 0.83 | -0.17 | -0.07 | 0.03 | 0.13 | 0.23 | 0.33 |
| 7 2 | 0.77 | 0.27 | 0.37 | 0.47 | 0.57 | 0.67 | 0.77 | -0.23 | -0.13 | -0.03 | 0.07 | 0.17 | 0.27 |
| 7 3 | 0.71 | 0.21 | 0.31 | 0.41 | 0.51 | 0.61 | 0.71 | -0.29 | -0.19 | -0.09 | 0.01 | 0.11 | 0.21 |
| 7 4 | 0.65 | 0.15 | 0.25 | 0.35 | 0.45 | 0.55 | 0.65 | -0.35 | -0.25 | -0.15 | -0.05 | 0.05 | 0.15 |
| 7 5 | 0.59 | 0.09 | 0.19 | 0.29 | 0.39 | 0.49 | 0.59 | -0.41 | -0.31 | -0.21 | -0.11 | -0.01 | 0.09 |
| 7 6 | 0.53 | 0.03 | 0.13 | 0.23 | 0.33 | 0.43 | 0.53 | -0.47 | -0.37 | -0.27 | -0.17 | -0.07 | 0.03 |
| 7 7 | 0.47 | -0.03 | 0.07 | 0.17 | 0.27 | 0.37 | 0.47 | -0.53 | -0.43 | -0.33 | -0.23 | -0.13 | -0.03 |
| 7 8 | 0.41 | -0.09 | 0.01 | 0.11 | 0.21 | 0.31 | 0.41 | -0.59 | -0.49 | -0.39 | -0.29 | -0.19 | -0.09 |
| 7 9 | 0.34 | -0.16 | -0.06 | 0.04 | 0.14 | 0.24 | 0.34 | -0.66 | -0.56 | -0.46 | -0.36 | -0.26 | -0.16 |
| 8 0 | 0.28 | -0.22 | -0.12 | -0.02 | 0.08 | 0.18 | 0.28 | -0.72 | -0.62 | -0.52 | -0.42 | -0.32 | -0.22 |
| 8 1 | 0.22 | -0.28 | -0.18 | -0.08 | 0.02 | 0.12 | 0.22 | -0.78 | -0.68 | -0.58 | -0.48 | -0.38 | -0.28 |
| 8 2 | 0.16 | -0.34 | -0.24 | -0.14 | -0.04 | 0.06 | 0.16 | -0.84 | -0.74 | -0.64 | -0.54 | -0.44 | -0.34 |
| 8 3 | 0.10 | -0.40 | -0.30 | -0.20 | -0.10 | 0.00 | 0.10 | -0.90 | -0.80 | -0.70 | -0.60 | -0.50 | -0.40 |
| 8 4 | 0.04 | -0.46 | -0.36 | -0.26 | -0.16 | -0.06 | 0.04 | -0.96 | -0.86 | -0.76 | -0.66 | -0.56 | -0.46 |
| 8 5 | -0.02 | -0.52 | -0.42 | -0.32 | -0.22 | -0.12 | -0.02 | -1.02 | -0.92 | -0.82 | -0.72 | -0.62 | -0.52 |
| 8 6 | -0.08 | -0.58 | -0.48 | -0.38 | -0.28 | -0.18 | -0.08 | -1.08 | -0.98 | -0.88 | -0.78 | -0.68 | -0.58 |
| 8 7 | -0.14 | -0.64 | -0.54 | -0.44 | -0.34 | -0.24 | -0.14 | -1.14 | -1.04 | -0.94 | -0.84 | -0.74 | -0.64 |

| yd | pt (1/10-) | pt (2/10) | pt (2/9) | pt (2/8) | pt (2/7) | pt (2/6) | pt (2/5-) | pt (3/10) | pt (3/9) | pt (3/8) | pt (3/7) | pt (3/6) | pt (3/5-) |
|----|------------|-----------|----------|----------|----------|----------|-----------|-----------|----------|----------|----------|----------|-----------|
| 8 | -0.20 | -0.70 | -0.60 | -0.50 | -0.40 | -0.30 | -0.20 | -1.20 | -1.10 | -1.00 | -0.90 | -0.80 | -0.70 |
| 8 | -0.26 | -0.76 | -0.66 | -0.56 | -0.46 | -0.36 | -0.26 | -1.26 | -1.16 | -1.06 | -0.96 | -0.86 | -0.76 |
| 9 | -0.32 | -0.82 | -0.72 | -0.62 | -0.52 | -0.42 | -0.32 | -1.32 | -1.22 | -1.12 | -1.02 | -0.92 | -0.82 |
| 9 | -0.38 | -0.88 | -0.78 | -0.68 | -0.58 | -0.48 | -0.38 | -1.38 | -1.28 | -1.18 | -1.08 | -0.98 | -0.88 |
| 9 | -0.44 | -0.94 | -0.84 | -0.74 | -0.64 | -0.54 | -0.44 | -1.44 | -1.34 | -1.24 | -1.14 | -1.04 | -0.94 |
| 9 | -0.50 | -1.00 | -0.90 | -0.80 | -0.70 | -0.60 | -0.50 | -1.50 | -1.40 | -1.30 | -1.20 | -1.10 | -1.00 |
| 9 | -0.60 | -1.10 | -1.00 | -0.90 | -0.80 | -0.70 | -0.60 | -1.60 | -1.50 | -1.40 | -1.30 | -1.20 | -1.10 |
| 9 | -0.70 | -1.20 | -1.10 | -1.00 | -0.90 | -0.80 | -0.70 | -1.70 | -1.60 | -1.50 | -1.40 | -1.30 | -1.20 |
| 9 | -0.80 | -1.30 | -1.20 | -1.10 | -1.00 | -0.90 | -0.80 | -1.80 | -1.70 | -1.60 | -1.50 | -1.40 | -1.30 |
| 9 | -0.90 | -1.40 | -1.30 | -1.20 | -1.10 | -1.00 | -0.90 | -1.90 | -1.80 | -1.70 | -1.60 | -1.50 | -1.40 |
| 9 | -1.00 | -1.50 | -1.40 | -1.30 | -1.20 | -1.10 | -1.00 | -2.00 | -1.90 | -1.80 | -1.70 | -1.60 | -1.50 |
| 9 | -1.40 | -1.90 | -1.80 | -1.70 | -1.60 | -1.50 | -1.40 | -2.40 | -2.30 | -2.20 | -2.10 | -2.00 | -1.90 |

Table 2. SUVs for Field Positions – First Down with More than Ten “Yards to Go”

| yd | pt (1/10-) | pt (1/11) | pt (1/12) | pt (1/13) | pt (1/14) | pt (1/15) | pt (1/16) | pt (1/17) | pt (1/18) | pt (1/19) | pt (1/20+) |
|----|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|
| 1 | 6.50 | 6.40 | 6.30 | 6.20 | 6.10 | 6.00 | 5.90 | 5.80 | 5.70 | 5.60 | 5.50 |
| 2 | 6.20 | 6.10 | 6.00 | 5.90 | 5.80 | 5.70 | 5.60 | 5.50 | 5.40 | 5.30 | 5.20 |
| 3 | 5.90 | 5.80 | 5.70 | 5.60 | 5.50 | 5.40 | 5.30 | 5.20 | 5.10 | 5.00 | 4.90 |
| 4 | 5.60 | 5.50 | 5.40 | 5.30 | 5.20 | 5.10 | 5.00 | 4.90 | 4.80 | 4.70 | 4.60 |
| 5 | 5.50 | 5.40 | 5.30 | 5.20 | 5.10 | 5.00 | 4.90 | 4.80 | 4.70 | 4.60 | 4.50 |
| 6 | 5.40 | 5.30 | 5.20 | 5.10 | 5.00 | 4.90 | 4.80 | 4.70 | 4.60 | 4.50 | 4.40 |
| 7 | 5.30 | 5.20 | 5.10 | 5.00 | 4.90 | 4.80 | 4.70 | 4.60 | 4.50 | 4.40 | 4.30 |
| 8 | 5.20 | 5.10 | 5.00 | 4.90 | 4.80 | 4.70 | 4.60 | 4.50 | 4.40 | 4.30 | 4.20 |
| 9 | 5.10 | 5.00 | 4.90 | 4.80 | 4.70 | 4.60 | 4.50 | 4.40 | 4.30 | 4.20 | 4.10 |
| 10 | 5.00 | 4.90 | 4.80 | 4.70 | 4.60 | 4.50 | 4.40 | 4.30 | 4.20 | 4.10 | 4.00 |
| 11 | 4.92 | 4.82 | 4.72 | 4.62 | 4.52 | 4.42 | 4.32 | 4.22 | 4.12 | 4.02 | 3.92 |
| 12 | 4.84 | 4.74 | 4.64 | 4.54 | 4.44 | 4.34 | 4.24 | 4.14 | 4.04 | 3.94 | 3.84 |
| 13 | 4.76 | 4.66 | 4.56 | 4.46 | 4.36 | 4.26 | 4.16 | 4.06 | 3.96 | 3.86 | 3.76 |
| 14 | 4.68 | 4.58 | 4.48 | 4.38 | 4.28 | 4.18 | 4.08 | 3.98 | 3.88 | 3.78 | 3.68 |
| 15 | 4.60 | 4.50 | 4.40 | 4.30 | 4.20 | 4.10 | 4.00 | 3.90 | 3.80 | 3.70 | 3.60 |
| 16 | 4.52 | 4.42 | 4.32 | 4.22 | 4.12 | 4.02 | 3.92 | 3.82 | 3.72 | 3.62 | 3.52 |
| 17 | 4.44 | 4.34 | 4.24 | 4.14 | 4.04 | 3.94 | 3.84 | 3.74 | 3.64 | 3.54 | 3.44 |
| 18 | 4.36 | 4.26 | 4.16 | 4.06 | 3.96 | 3.86 | 3.76 | 3.66 | 3.56 | 3.46 | 3.36 |
| 19 | 4.28 | 4.18 | 4.08 | 3.98 | 3.88 | 3.78 | 3.68 | 3.58 | 3.48 | 3.38 | 3.28 |
| 20 | 4.20 | 4.10 | 4.00 | 3.90 | 3.80 | 3.70 | 3.60 | 3.50 | 3.40 | 3.30 | 3.20 |
| 21 | 4.12 | 4.02 | 3.92 | 3.82 | 3.72 | 3.62 | 3.52 | 3.42 | 3.32 | 3.22 | 3.12 |
| 22 | 4.04 | 3.94 | 3.84 | 3.74 | 3.64 | 3.54 | 3.44 | 3.34 | 3.24 | 3.14 | 3.04 |
| 23 | 3.96 | 3.86 | 3.76 | 3.66 | 3.56 | 3.46 | 3.36 | 3.26 | 3.16 | 3.06 | 2.96 |
| 24 | 3.88 | 3.78 | 3.68 | 3.58 | 3.48 | 3.38 | 3.28 | 3.18 | 3.08 | 2.98 | 2.88 |
| 25 | 3.80 | 3.70 | 3.60 | 3.50 | 3.40 | 3.30 | 3.20 | 3.10 | 3.00 | 2.90 | 2.80 |
| 26 | 3.72 | 3.62 | 3.52 | 3.42 | 3.32 | 3.22 | 3.12 | 3.02 | 2.92 | 2.82 | 2.72 |
| 27 | 3.64 | 3.54 | 3.44 | 3.34 | 3.24 | 3.14 | 3.04 | 2.94 | 2.84 | 2.74 | 2.64 |

| yd | pt (1/10-) | pt (1/11) | pt (1/12) | pt (1/13) | pt (1/14) | pt (1/15) | pt (1/16) | pt (1/17) | pt (1/18) | pt (1/19) | pt (1/20+) |
|----|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|
| 28 | 3.56 | 3.46 | 3.36 | 3.26 | 3.16 | 3.06 | 2.96 | 2.86 | 2.76 | 2.66 | 2.56 |
| 29 | 3.48 | 3.38 | 3.28 | 3.18 | 3.08 | 2.98 | 2.88 | 2.78 | 2.68 | 2.58 | 2.48 |
| 30 | 3.40 | 3.30 | 3.20 | 3.10 | 3.00 | 2.90 | 2.80 | 2.70 | 2.60 | 2.50 | 2.40 |
| 31 | 3.32 | 3.22 | 3.12 | 3.02 | 2.92 | 2.82 | 2.72 | 2.62 | 2.52 | 2.42 | 2.32 |
| 32 | 3.24 | 3.14 | 3.04 | 2.94 | 2.84 | 2.74 | 2.64 | 2.54 | 2.44 | 2.34 | 2.24 |
| 33 | 3.16 | 3.06 | 2.96 | 2.86 | 2.76 | 2.66 | 2.56 | 2.46 | 2.36 | 2.26 | 2.16 |
| 34 | 3.08 | 2.98 | 2.88 | 2.78 | 2.68 | 2.58 | 2.48 | 2.38 | 2.28 | 2.18 | 2.08 |
| 35 | 3.00 | 2.90 | 2.80 | 2.70 | 2.60 | 2.50 | 2.40 | 2.30 | 2.20 | 2.10 | 2.00 |
| 36 | 2.94 | 2.84 | 2.74 | 2.64 | 2.54 | 2.44 | 2.34 | 2.24 | 2.14 | 2.04 | 1.94 |
| 37 | 2.88 | 2.78 | 2.68 | 2.58 | 2.48 | 2.38 | 2.28 | 2.18 | 2.08 | 1.98 | 1.88 |
| 38 | 2.82 | 2.72 | 2.62 | 2.52 | 2.42 | 2.32 | 2.22 | 2.12 | 2.02 | 1.92 | 1.82 |
| 39 | 2.76 | 2.66 | 2.56 | 2.46 | 2.36 | 2.26 | 2.16 | 2.06 | 1.96 | 1.86 | 1.76 |
| 40 | 2.70 | 2.60 | 2.50 | 2.40 | 2.30 | 2.20 | 2.10 | 2.00 | 1.90 | 1.80 | 1.70 |
| 41 | 2.64 | 2.54 | 2.44 | 2.34 | 2.24 | 2.14 | 2.04 | 1.94 | 1.84 | 1.74 | 1.64 |
| 42 | 2.58 | 2.48 | 2.38 | 2.28 | 2.18 | 2.08 | 1.98 | 1.88 | 1.78 | 1.68 | 1.58 |
| 43 | 2.52 | 2.42 | 2.32 | 2.22 | 2.12 | 2.02 | 1.92 | 1.82 | 1.72 | 1.62 | 1.52 |
| 44 | 2.46 | 2.36 | 2.26 | 2.16 | 2.06 | 1.96 | 1.86 | 1.76 | 1.66 | 1.56 | 1.46 |
| 45 | 2.40 | 2.30 | 2.20 | 2.10 | 2.00 | 1.90 | 1.80 | 1.70 | 1.60 | 1.50 | 1.40 |
| 46 | 2.34 | 2.24 | 2.14 | 2.04 | 1.94 | 1.84 | 1.74 | 1.64 | 1.54 | 1.44 | 1.34 |
| 47 | 2.28 | 2.18 | 2.08 | 1.98 | 1.88 | 1.78 | 1.68 | 1.58 | 1.48 | 1.38 | 1.28 |
| 48 | 2.22 | 2.12 | 2.02 | 1.92 | 1.82 | 1.72 | 1.62 | 1.52 | 1.42 | 1.32 | 1.22 |
| 49 | 2.16 | 2.06 | 1.96 | 1.86 | 1.76 | 1.66 | 1.56 | 1.46 | 1.36 | 1.26 | 1.16 |
| 50 | 2.09 | 1.99 | 1.89 | 1.79 | 1.69 | 1.59 | 1.49 | 1.39 | 1.29 | 1.19 | 1.09 |
| 51 | 2.03 | 1.93 | 1.83 | 1.73 | 1.63 | 1.53 | 1.43 | 1.33 | 1.23 | 1.13 | 1.03 |
| 52 | 1.97 | 1.87 | 1.77 | 1.67 | 1.57 | 1.47 | 1.37 | 1.27 | 1.17 | 1.07 | 0.97 |
| 53 | 1.91 | 1.81 | 1.71 | 1.61 | 1.51 | 1.41 | 1.31 | 1.21 | 1.11 | 1.01 | 0.91 |
| 54 | 1.85 | 1.75 | 1.65 | 1.55 | 1.45 | 1.35 | 1.25 | 1.15 | 1.05 | 0.95 | 0.85 |
| 55 | 1.79 | 1.69 | 1.59 | 1.49 | 1.39 | 1.29 | 1.19 | 1.09 | 0.99 | 0.89 | 0.79 |
| 56 | 1.73 | 1.63 | 1.53 | 1.43 | 1.33 | 1.23 | 1.13 | 1.03 | 0.93 | 0.83 | 0.73 |
| 57 | 1.67 | 1.57 | 1.47 | 1.37 | 1.27 | 1.17 | 1.07 | 0.97 | 0.87 | 0.77 | 0.67 |
| 58 | 1.61 | 1.51 | 1.41 | 1.31 | 1.21 | 1.11 | 1.01 | 0.91 | 0.81 | 0.71 | 0.61 |
| 59 | 1.55 | 1.45 | 1.35 | 1.25 | 1.15 | 1.05 | 0.95 | 0.85 | 0.75 | 0.65 | 0.55 |
| 60 | 1.49 | 1.39 | 1.29 | 1.19 | 1.09 | 0.99 | 0.89 | 0.79 | 0.69 | 0.59 | 0.49 |
| 61 | 1.43 | 1.33 | 1.23 | 1.13 | 1.03 | 0.93 | 0.83 | 0.73 | 0.63 | 0.53 | 0.43 |
| 62 | 1.37 | 1.27 | 1.17 | 1.07 | 0.97 | 0.87 | 0.77 | 0.67 | 0.57 | 0.47 | 0.37 |
| 63 | 1.31 | 1.21 | 1.11 | 1.01 | 0.91 | 0.81 | 0.71 | 0.61 | 0.51 | 0.41 | 0.31 |
| 64 | 1.25 | 1.15 | 1.05 | 0.95 | 0.85 | 0.75 | 0.65 | 0.55 | 0.45 | 0.35 | 0.25 |
| 65 | 1.19 | 1.09 | 0.99 | 0.89 | 0.79 | 0.69 | 0.59 | 0.49 | 0.39 | 0.29 | 0.19 |
| 66 | 1.13 | 1.03 | 0.93 | 0.83 | 0.73 | 0.63 | 0.53 | 0.43 | 0.33 | 0.23 | 0.13 |
| 67 | 1.07 | 0.97 | 0.87 | 0.77 | 0.67 | 0.57 | 0.47 | 0.37 | 0.27 | 0.17 | 0.07 |
| 68 | 1.01 | 0.91 | 0.81 | 0.71 | 0.61 | 0.51 | 0.41 | 0.31 | 0.21 | 0.11 | 0.01 |
| 69 | 0.95 | 0.85 | 0.75 | 0.65 | 0.55 | 0.45 | 0.35 | 0.25 | 0.15 | 0.05 | -0.05 |
| 70 | 0.89 | 0.79 | 0.69 | 0.59 | 0.49 | 0.39 | 0.29 | 0.19 | 0.09 | -0.01 | -0.11 |
| 71 | 0.83 | 0.73 | 0.63 | 0.53 | 0.43 | 0.33 | 0.23 | 0.13 | 0.03 | -0.07 | -0.17 |
| 72 | 0.77 | 0.67 | 0.57 | 0.47 | 0.37 | 0.27 | 0.17 | 0.07 | -0.03 | -0.13 | -0.23 |
| 73 | 0.71 | 0.61 | 0.51 | 0.41 | 0.31 | 0.21 | 0.11 | 0.01 | -0.09 | -0.19 | -0.29 |
| 74 | 0.65 | 0.55 | 0.45 | 0.35 | 0.25 | 0.15 | 0.05 | -0.05 | -0.15 | -0.25 | -0.35 |
| 75 | 0.59 | 0.49 | 0.39 | 0.29 | 0.19 | 0.09 | -0.01 | -0.11 | -0.21 | -0.31 | -0.41 |
| 76 | 0.53 | 0.43 | 0.33 | 0.23 | 0.13 | 0.03 | -0.07 | -0.17 | -0.27 | -0.37 | -0.47 |
| 77 | 0.47 | 0.37 | 0.27 | 0.17 | 0.07 | -0.03 | -0.13 | -0.23 | -0.33 | -0.43 | -0.53 |
| 78 | 0.41 | 0.31 | 0.21 | 0.11 | 0.01 | -0.09 | -0.19 | -0.29 | -0.39 | -0.49 | -0.59 |
| 79 | 0.34 | 0.24 | 0.14 | 0.04 | -0.06 | -0.16 | -0.26 | -0.36 | -0.46 | -0.56 | -0.66 |
| 80 | 0.28 | 0.18 | 0.08 | -0.02 | -0.12 | -0.22 | -0.32 | -0.42 | -0.52 | -0.62 | -0.72 |
| 81 | 0.22 | 0.12 | 0.02 | -0.08 | -0.18 | -0.28 | -0.38 | -0.48 | -0.58 | -0.68 | -0.78 |
| 82 | 0.16 | 0.06 | -0.04 | -0.14 | -0.24 | -0.34 | -0.44 | -0.54 | -0.64 | -0.74 | -0.84 |

| yd | pt (1/10-) | pt (1/11) | pt (1/12) | pt (1/13) | pt (1/14) | pt (1/15) | pt (1/16) | pt (1/17) | pt (1/18) | pt (1/19) | pt (1/20+) |
|----|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|
| 83 | 0.10 | 0.00 | -0.10 | -0.20 | -0.30 | -0.40 | -0.50 | -0.60 | -0.70 | -0.80 | -0.90 |
| 84 | 0.04 | -0.06 | -0.16 | -0.26 | -0.36 | -0.46 | -0.56 | -0.66 | -0.76 | -0.86 | -0.96 |
| 85 | -0.02 | -0.12 | -0.22 | -0.32 | -0.42 | -0.52 | -0.62 | -0.72 | -0.82 | -0.92 | -1.02 |
| 86 | -0.08 | -0.18 | -0.28 | -0.38 | -0.48 | -0.58 | -0.68 | -0.78 | -0.88 | -0.98 | -1.08 |
| 87 | -0.14 | -0.24 | -0.34 | -0.44 | -0.54 | -0.64 | -0.74 | -0.84 | -0.94 | -1.04 | -1.14 |
| 88 | -0.20 | -0.30 | -0.40 | -0.50 | -0.60 | -0.70 | -0.80 | -0.90 | -1.00 | -1.10 | -1.20 |
| 89 | -0.26 | -0.36 | -0.46 | -0.56 | -0.66 | -0.76 | -0.86 | -0.96 | -1.06 | -1.16 | -1.26 |
| 90 | -0.32 | -0.42 | -0.52 | -0.62 | -0.72 | -0.82 | -0.92 | -1.02 | -1.12 | -1.22 | -1.32 |
| 91 | -0.38 | -0.48 | -0.58 | -0.68 | -0.78 | -0.88 | -0.98 | -1.08 | -1.18 | -1.28 | -1.38 |
| 92 | -0.44 | -0.54 | -0.64 | -0.74 | -0.84 | -0.94 | -1.04 | -1.14 | -1.24 | -1.34 | -1.44 |
| 93 | -0.50 | -0.60 | -0.70 | -0.80 | -0.90 | -1.00 | -1.10 | -1.20 | -1.30 | -1.40 | -1.50 |
| 94 | -0.60 | -0.70 | -0.80 | -0.90 | -1.00 | -1.10 | -1.20 | -1.30 | -1.40 | -1.50 | -1.60 |
| 95 | -0.70 | -0.80 | -0.90 | -1.00 | -1.10 | -1.20 | -1.30 | -1.40 | -1.50 | -1.60 | -1.70 |
| 96 | -0.80 | -0.90 | -1.00 | -1.10 | -1.20 | -1.30 | -1.40 | -1.50 | -1.60 | -1.70 | -1.80 |
| 97 | -0.90 | -1.00 | -1.10 | -1.20 | -1.30 | -1.40 | -1.50 | -1.60 | -1.70 | -1.80 | -1.90 |
| 98 | -1.00 | -1.10 | -1.20 | -1.30 | -1.40 | -1.50 | -1.60 | -1.70 | -1.80 | -1.90 | -2.00 |
| 99 | -1.40 | -1.50 | -1.60 | -1.70 | -1.80 | -1.90 | -2.00 | -2.10 | -2.20 | -2.30 | -2.40 |

Based on this discussion, I assumed that the probability of success in “going for it” on 4th and short would be 2/3. However, the “go for it” region in the chart extends beyond two yards over much of its range. While the probability of success for 4th and longer than two yards is surely less than 2/3, in terms of SUV, I assumed that the full “go for it” region could be characterized by an SUV as follows. Starting with the equivalent yardage (and field position) on 4th down, adjust the corresponding SUV for 3rd down by multiplying by 2/3 and then subtracting 1/3 of the SUV for 1st and 10 from that same field position, representing the SUV of the other team should it take over after 4th down. If the 4th down yardage exceeded the “break even” threshold (BET) for the “go for it” region, as indicated by the solid black line superimposed on the chart, then the SUV would be reduced further using the following equation (note that “|” represents absolute value):

$$\frac{2}{3}x 0.9^{(yds\ needed - BET\ from\ above)}x(SUV\ for\ 3rd\ down\ equivalent\ yardage) - [(1 - \frac{2}{3}x 0.9^{(yds\ needed - BET\ from\ above)})x|SUV\ if\ defense\ takes\ over\ 1st\ and\ 10|]$$

The assumption here is that the SUV is reduced by 10% for each yard beyond the BET. Here are two examples. Say a team has 4th and 3 or less from its own 30, where the BET = 3. From the chart, this lies within the “go for it” region, so the SUV would be as follows:

$$\frac{2}{3}x 0.39 - \left(1 - \frac{2}{3}\right)x 3.40 = -0.87$$

where 0.39 = SUV for 3rd and 3 (i.e., 5 or less) from 70 yards away and 3.40 is the SUV for 1st and 10 from 30 yards away. Now, if at the same field position it was 4th and 6, the SUV would be reduced using the following:

$$\frac{2}{3}x 0.9^{(6-3)}x 0.29 - \left[1 - \frac{2}{3}x 0.9^{(6-3)}\right]x 3.40 = -1.61$$

but now using the SUV for 3rd and 6 from 70 yards away (0.29).

Based on the above, the SUVs for 4th down are presented in Tables 3 and 4 (anything above 20 yards to go was treated as constant, consistent with 1st, 2nd and 3rd downs).

A.1 Real Game Examples

The next step was to apply this to an actual game. The AFC playoff between Pittsburgh and Kansas City (January 15, 2017) was chosen, which Pittsburgh won 18-16 (see Reference 8). The analysis of the entire game is complete in Reference 1. Selected results are provided in Table 5.

Let’s analyze Kansas City’s scoring drive. Kansas City receives the punt at their own 20 (potential 1st and 10 from 80 yards away gives starting SUV = 0.28) and returns it 25 yards to the 45 (finishing SUV for 1st and 10 from 55 yards away = 1.79), an increase in SUV of 1.79 – 0.28 = 1.51. Next is a 7-yard gain to Pittsburgh’s 48, making it 2nd and 7, which has an SUV = 2.22 for an increase of 2.22 – 1.79 = 0.43. Another run for 7 yards yields a 1st and 10 at Pittsburgh’s 41, an SUV = 2.64 and another increase of 2.64 – 2.22 = 0.42. A 20-yard completion to the Pittsburgh 20 yields another 1st and 10, with an SUV = 4.20 for another gain of 4.20

- 2.64 = 1.56. Next is a 7-yard completion to the 13, where the SUV for 2nd and 3 is 4.84 – an increase of 4.84 – 4.20 = 0.64. Another completion to the 5 yields 1st and goal with an SUV = 5.50 (for 1st and 10 or less), an increase of 5.50 – 4.84 = 0.66. Finally a touchdown pass, with a successful extra point yields 7.00 points and a final SUV gain of 7.00 – 5.50 = 1.50. Summing all the SUV changes yields 6.72, which happens to be the difference between the final SUV (7.00) and the starting SUV (0.28), as expected.

Continuing with the game ... (see Table 6). Also, let's analyze this drive, which resulted in a punt and included a penalty. The kickoff was taken in the end zone, which potentially is a 1st and 10 and the 25, giving a starting SUV from 75 yards away = 0.59. The kick was returned only 12 yards for a finishing SUV for 1st and 10 and 88 yards away = -0.20, a negative SUV change of -0.20 – 0.559 = -0.79. An incomplete pass makes it 2nd and 10, an SUV = -0.70 for a loss of 0.50 (negative SUV). Next is a 13-yard completion to the 25, where the SUV for 1st and 10 is 0.59, a gain of 1.29. Another completion for 4 yards yields 2nd and 6, with an SUV = 0.73 for another gain of 0.14. The next play is nullified by offensive holding, so it becomes 2nd and 16 from 71 yards away, with an SUV = -0.88, resulting in a decrease of 1.61. An incompletion makes it 3rd and 16, reducing the SUV to -0.88, another drop of 0.50. A completion of 9 yards still leaves 4th and 7 from 72 yards away, an SUV = -1.97, representing yet another decrease of 0.59. Kansas City punts to the Pittsburgh 29, where there is a fair catch and a starting SUV for the Steelers of 0.83, which is evaluated as a negative for Kansas City, i.e., -0.83. However, this play results in a gain of 1.14 from -1.97 to -0.83. Overall, this drive has a negative SUV of -1.42, again the difference between the finishing SUV of -0.38 and the starting SUV of 0.59.

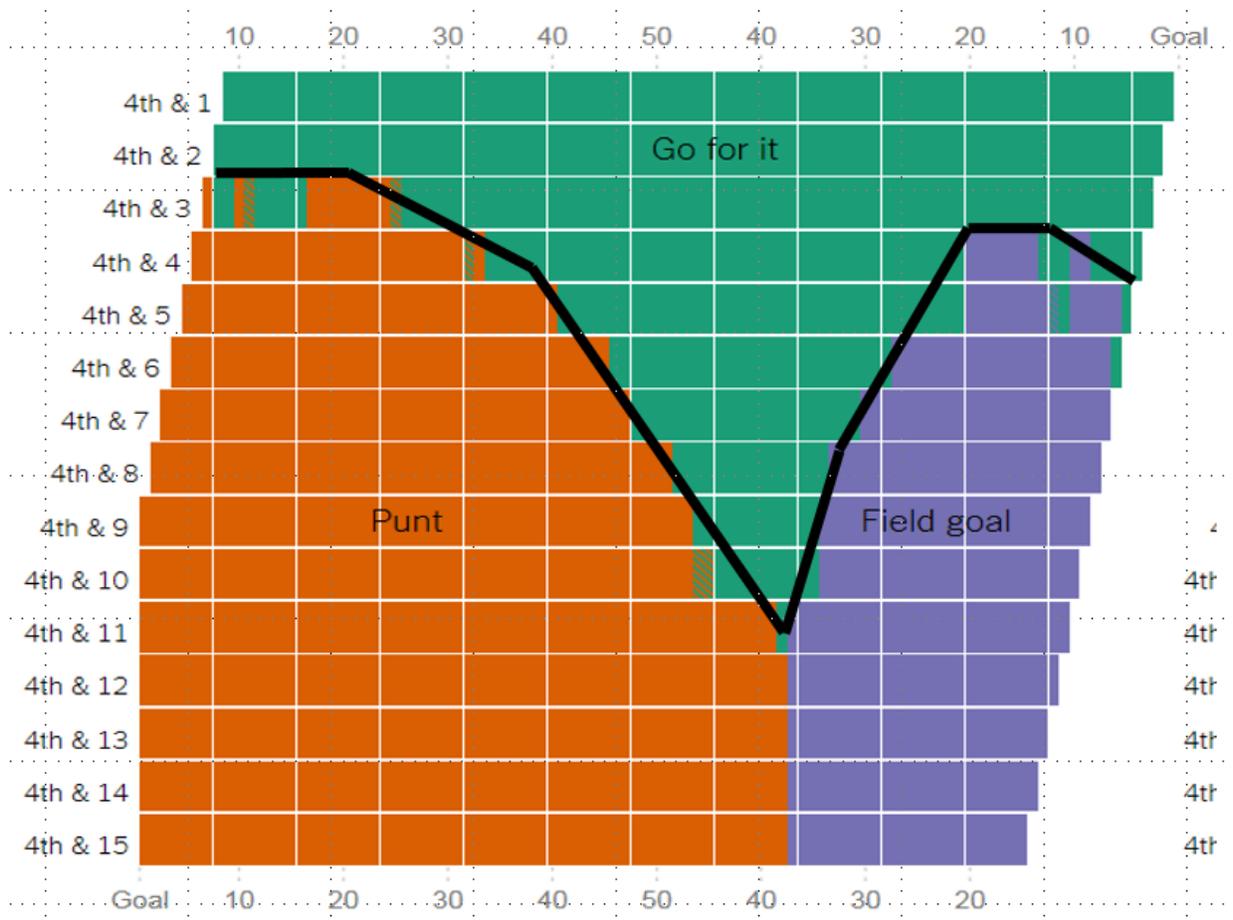


Figure 3. Chart Showing Efficacy of “Going for It” on Fourth Down (see Reference 6)

Table 3. SUVs for Field Positions – Fourth Down with Ten or Less “Yards to Go”

| yd | pt (4/1) | pt (4/2) | pt (4/3) | pt (4/4) | pt (4/5) | pt (4/6) | pt (4/7) | pt (4/8) | pt (4/9) | pt (4/10) |
|----|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| 1 | 3.53 | 3.53 | 3.53 | 3.53 | 3.04 | 2.54 | 2.10 | 1.71 | 1.36 | 1.04 |
| 2 | 3.47 | 3.47 | 3.47 | 3.47 | 3.02 | 2.56 | 2.16 | 1.80 | 1.48 | 1.20 |
| 3 | 3.30 | 3.30 | 3.30 | 3.30 | 2.88 | 2.45 | 2.06 | 1.72 | 1.42 | 1.15 |
| 4 | 3.13 | 3.13 | 3.13 | 3.13 | 2.74 | 2.33 | 1.97 | 1.65 | 1.37 | 1.11 |
| 5 | 3.10 | 3.10 | 3.10 | 3.10 | 2.72 | 2.32 | 1.97 | 1.66 | 1.39 | 1.14 |
| 6 | 3.07 | 3.07 | 3.07 | 3.07 | 2.70 | 2.32 | 1.98 | 1.67 | 1.41 | 1.17 |
| 7 | 3.03 | 3.03 | 3.03 | 3.03 | 2.68 | 2.31 | 1.98 | 1.69 | 1.43 | 1.20 |
| 8 | 2.99 | 2.99 | 2.99 | 2.99 | 2.64 | 2.28 | 1.96 | 1.68 | 1.43 | 1.20 |
| 9 | 2.94 | 2.94 | 2.94 | 2.61 | 2.31 | 1.99 | 1.71 | 1.46 | 1.24 | 1.05 |
| 10 | 2.89 | 2.89 | 2.89 | 2.57 | 2.28 | 1.97 | 1.70 | 1.46 | 1.25 | 1.06 |
| 11 | 2.86 | 2.86 | 2.86 | 2.55 | 2.27 | 1.97 | 1.70 | 1.47 | 1.26 | 1.07 |
| 12 | 2.83 | 2.83 | 2.83 | 2.52 | 2.25 | 1.96 | 1.70 | 1.47 | 1.27 | 1.09 |
| 13 | 2.79 | 2.79 | 2.79 | 2.50 | 2.24 | 1.95 | 1.70 | 1.48 | 1.28 | 1.10 |
| 14 | 2.76 | 2.76 | 2.76 | 2.48 | 2.22 | 1.94 | 1.70 | 1.48 | 1.29 | 1.12 |
| 15 | 2.73 | 2.73 | 2.73 | 2.45 | 2.21 | 1.94 | 1.70 | 1.49 | 1.30 | 1.14 |
| 16 | 2.67 | 2.67 | 2.67 | 2.39 | 2.15 | 1.88 | 1.65 | 1.44 | 1.25 | 1.09 |
| 17 | 2.59 | 2.59 | 2.59 | 2.32 | 2.08 | 1.81 | 1.58 | 1.37 | 1.19 | 1.03 |
| 18 | 2.52 | 2.52 | 2.52 | 2.25 | 2.01 | 1.74 | 1.51 | 1.30 | 1.12 | 0.96 |
| 19 | 2.45 | 2.45 | 2.45 | 2.18 | 1.94 | 1.67 | 1.44 | 1.23 | 1.05 | 0.89 |
| 20 | 2.37 | 2.37 | 2.37 | 2.11 | 1.87 | 1.60 | 1.37 | 1.17 | 0.99 | 0.83 |
| 21 | 2.30 | 2.30 | 2.30 | 2.03 | 1.80 | 1.53 | 1.30 | 1.10 | 0.92 | 0.76 |
| 22 | 2.22 | 2.22 | 2.22 | 1.96 | 1.73 | 1.46 | 1.23 | 1.03 | 0.85 | 0.69 |
| 23 | 2.15 | 2.15 | 2.15 | 2.15 | 1.89 | 1.60 | 1.35 | 1.12 | 0.92 | 0.75 |
| 24 | 2.08 | 2.08 | 2.08 | 2.08 | 1.82 | 1.53 | 1.28 | 1.05 | 0.85 | 0.68 |
| 25 | 2.00 | 2.00 | 2.00 | 2.00 | 1.75 | 1.46 | 1.21 | 0.98 | 0.79 | 0.61 |
| 26 | 1.93 | 1.93 | 1.93 | 1.93 | 1.93 | 1.61 | 1.33 | 1.09 | 0.87 | 0.68 |
| 27 | 1.86 | 1.86 | 1.86 | 1.86 | 1.86 | 1.54 | 1.26 | 1.02 | 0.80 | 0.61 |
| 28 | 1.78 | 1.78 | 1.78 | 1.78 | 1.78 | 1.72 | 1.41 | 1.14 | 0.90 | 0.69 |
| 29 | 1.71 | 1.71 | 1.71 | 1.71 | 1.71 | 1.64 | 1.34 | 1.07 | 0.83 | 0.62 |
| 30 | 1.64 | 1.64 | 1.64 | 1.64 | 1.64 | 1.57 | 1.26 | 1.00 | 0.76 | 0.55 |
| 31 | 1.56 | 1.56 | 1.56 | 1.56 | 1.56 | 1.50 | 1.43 | 1.13 | 0.87 | 0.64 |
| 32 | 1.49 | 1.49 | 1.49 | 1.49 | 1.49 | 1.42 | 1.36 | 1.06 | 0.80 | 0.57 |
| 33 | 1.42 | 1.42 | 1.42 | 1.42 | 1.42 | 1.35 | 1.28 | 1.22 | 0.93 | 0.67 |
| 34 | 1.34 | 1.34 | 1.34 | 1.34 | 1.34 | 1.28 | 1.21 | 1.14 | 0.86 | 0.60 |
| 35 | 1.27 | 1.27 | 1.27 | 1.27 | 1.27 | 1.20 | 1.14 | 1.07 | 1.00 | 0.72 |
| 36 | 1.21 | 1.21 | 1.21 | 1.21 | 1.21 | 1.14 | 1.08 | 1.01 | 0.94 | 0.66 |
| 37 | 1.15 | 1.15 | 1.15 | 1.15 | 1.15 | 1.08 | 1.02 | 0.95 | 0.88 | 0.82 |
| 38 | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 | 1.02 | 0.96 | 0.89 | 0.82 | 0.76 |
| 39 | 1.03 | 1.03 | 1.03 | 1.03 | 1.03 | 0.96 | 0.90 | 0.83 | 0.76 | 0.70 |
| 40 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.90 | 0.84 | 0.77 | 0.70 | 0.64 |
| 41 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.84 | 0.77 | 0.71 | 0.64 | 0.57 |
| 42 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.78 | 0.71 | 0.65 | 0.58 | 0.30 |
| 43 | 0.79 | 0.79 | 0.79 | 0.79 | 0.79 | 0.72 | 0.65 | 0.59 | 0.52 | 0.24 |
| 44 | 0.73 | 0.73 | 0.73 | 0.73 | 0.73 | 0.66 | 0.59 | 0.53 | 0.46 | 0.18 |
| 45 | 0.67 | 0.67 | 0.67 | 0.67 | 0.67 | 0.60 | 0.53 | 0.47 | 0.40 | 0.12 |
| 46 | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 | 0.54 | 0.47 | 0.41 | 0.12 | -0.13 |
| 47 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.48 | 0.41 | 0.35 | 0.06 | -0.19 |
| 48 | 0.49 | 0.49 | 0.49 | 0.49 | 0.49 | 0.42 | 0.35 | 0.29 | 0.00 | -0.25 |
| 49 | 0.43 | 0.43 | 0.43 | 0.43 | 0.43 | 0.36 | 0.29 | 0.00 | -0.26 | -0.48 |
| 50 | 0.36 | 0.36 | 0.36 | 0.36 | 0.36 | 0.30 | 0.23 | -0.06 | -0.32 | -0.54 |
| 51 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.24 | 0.17 | -0.12 | -0.38 | -0.61 |
| 52 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.18 | 0.11 | -0.18 | -0.44 | -0.67 |
| 53 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.12 | -0.18 | -0.45 | -0.68 | -0.88 |
| 54 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.06 | -0.24 | -0.51 | -0.74 | -0.94 |

| yd | pt (4/1) | pt (4/2) | pt (4/3) | pt (4/4) | pt (4/5) | pt (4/6) | pt (4/7) | pt (4/8) | pt (4/9) | pt (4/10) |
|----|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| 55 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.00 | -0.30 | -0.57 | -0.80 | -1.00 |
| 56 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.30 | -0.57 | -0.81 | -1.02 | -1.20 |
| 57 | -0.06 | -0.06 | -0.06 | -0.06 | -0.06 | -0.36 | -0.63 | -0.87 | -1.08 | -1.26 |
| 58 | -0.12 | -0.12 | -0.12 | -0.12 | -0.12 | -0.42 | -0.69 | -0.93 | -1.14 | -1.32 |
| 59 | -0.18 | -0.18 | -0.18 | -0.18 | -0.18 | -0.48 | -0.75 | -0.99 | -1.20 | -1.38 |
| 60 | -0.24 | -0.24 | -0.24 | -0.24 | -0.48 | -0.76 | -1.00 | -1.22 | -1.40 | -1.57 |
| 61 | -0.30 | -0.30 | -0.30 | -0.30 | -0.54 | -0.82 | -1.06 | -1.28 | -1.46 | -1.63 |
| 62 | -0.36 | -0.36 | -0.36 | -0.36 | -0.61 | -0.88 | -1.12 | -1.34 | -1.52 | -1.69 |
| 63 | -0.42 | -0.42 | -0.42 | -0.42 | -0.67 | -0.94 | -1.18 | -1.40 | -1.58 | -1.75 |
| 64 | -0.48 | -0.48 | -0.48 | -0.48 | -0.73 | -1.00 | -1.24 | -1.46 | -1.64 | -1.81 |
| 65 | -0.54 | -0.54 | -0.54 | -0.79 | -1.01 | -1.26 | -1.47 | -1.67 | -1.83 | -1.98 |
| 66 | -0.61 | -0.61 | -0.61 | -0.85 | -1.08 | -1.33 | -1.55 | -1.74 | -1.91 | -2.06 |
| 67 | -0.67 | -0.67 | -0.67 | -0.92 | -1.15 | -1.40 | -1.62 | -1.81 | -1.98 | -2.13 |
| 68 | -0.74 | -0.74 | -0.74 | -0.99 | -1.22 | -1.47 | -1.69 | -1.88 | -2.05 | -2.20 |
| 69 | -0.81 | -0.81 | -0.81 | -1.06 | -1.29 | -1.54 | -1.76 | -1.95 | -2.13 | -2.28 |
| 70 | -0.87 | -0.87 | -0.87 | -1.13 | -1.35 | -1.61 | -1.83 | -2.03 | -2.20 | -2.35 |
| 71 | -0.94 | -0.94 | -0.94 | -1.20 | -1.42 | -1.68 | -1.90 | -2.10 | -2.27 | -2.43 |
| 72 | -1.01 | -1.01 | -1.01 | -1.26 | -1.49 | -1.75 | -1.97 | -2.17 | -2.35 | -2.50 |
| 73 | -1.08 | -1.08 | -1.33 | -1.56 | -1.77 | -2.00 | -2.20 | -2.38 | -2.54 | -2.68 |
| 74 | -1.14 | -1.14 | -1.40 | -1.63 | -1.84 | -2.07 | -2.28 | -2.46 | -2.61 | -2.75 |
| 75 | -1.21 | -1.21 | -1.47 | -1.70 | -1.91 | -2.14 | -2.35 | -2.53 | -2.69 | -2.83 |
| 76 | -1.28 | -1.28 | -1.54 | -1.77 | -1.98 | -2.22 | -2.42 | -2.60 | -2.76 | -2.90 |
| 77 | -1.34 | -1.34 | -1.60 | -1.84 | -2.05 | -2.29 | -2.49 | -2.68 | -2.84 | -2.98 |
| 78 | -1.41 | -1.41 | -1.67 | -1.91 | -2.12 | -2.36 | -2.57 | -2.75 | -2.91 | -3.05 |
| 79 | -1.48 | -1.48 | -1.74 | -1.98 | -2.19 | -2.43 | -2.64 | -2.82 | -2.98 | -3.13 |
| 80 | -1.54 | -1.54 | -1.81 | -2.05 | -2.26 | -2.50 | -2.71 | -2.89 | -3.06 | -3.20 |
| 81 | -1.61 | -1.61 | -1.88 | -2.12 | -2.33 | -2.57 | -2.78 | -2.97 | -3.13 | -3.27 |
| 82 | -1.68 | -1.68 | -1.95 | -2.19 | -2.40 | -2.64 | -2.85 | -3.04 | -3.20 | -3.35 |
| 83 | -1.74 | -1.74 | -2.01 | -2.26 | -2.47 | -2.72 | -2.93 | -3.11 | -3.28 | -3.42 |
| 84 | -1.81 | -1.81 | -2.08 | -2.33 | -2.55 | -2.79 | -3.00 | -3.19 | -3.35 | -3.50 |
| 85 | -1.88 | -1.88 | -2.15 | -2.40 | -2.62 | -2.86 | -3.07 | -3.26 | -3.43 | -3.57 |
| 86 | -1.95 | -1.95 | -2.22 | -2.46 | -2.69 | -2.93 | -3.14 | -3.33 | -3.50 | -3.65 |
| 87 | -2.01 | -2.01 | -2.29 | -2.53 | -2.76 | -3.00 | -3.22 | -3.41 | -3.57 | -3.72 |
| 88 | -2.08 | -2.08 | -2.35 | -2.60 | -2.83 | -3.07 | -3.29 | -3.48 | -3.65 | -3.79 |
| 89 | -2.15 | -2.15 | -2.42 | -2.67 | -2.90 | -3.14 | -3.36 | -3.55 | -3.72 | -3.87 |
| 90 | -2.21 | -2.21 | -2.49 | -2.74 | -2.97 | -3.21 | -3.43 | -3.62 | -3.79 | -3.94 |
| 91 | -2.29 | -2.29 | -2.57 | -2.82 | -3.05 | -3.30 | -3.52 | -3.71 | -3.88 | -4.03 |
| 92 | -2.36 | -2.36 | -2.64 | -2.90 | -3.13 | -3.38 | -3.60 | -3.80 | -3.97 | -4.12 |
| 93 | -2.43 | -2.43 | -2.72 | -2.98 | -3.21 | -3.46 | -3.69 | -3.88 | -4.06 | -4.21 |
| 94 | -2.53 | -2.53 | -2.82 | -3.08 | -3.31 | -3.56 | -3.79 | -3.98 | -4.16 | -4.31 |
| 95 | -2.63 | -2.63 | -2.92 | -3.18 | -3.41 | -3.66 | -3.89 | -4.08 | -4.26 | -4.41 |
| 96 | -2.73 | -2.73 | -3.02 | -3.28 | -3.51 | -3.76 | -3.99 | -4.18 | -4.36 | -4.51 |
| 97 | -2.90 | -2.90 | -3.20 | -3.47 | -3.71 | -3.98 | -4.21 | -4.41 | -4.59 | -4.75 |
| 98 | -3.07 | -3.07 | -3.38 | -3.66 | -3.92 | -4.19 | -4.43 | -4.64 | -4.83 | -4.99 |
| 99 | -3.43 | -3.43 | -3.74 | -4.02 | -4.26 | -4.53 | -4.77 | -4.98 | -5.16 | -5.32 |

Table 4. SUVs for Field Positions – Fourth Down with More than Ten “Yards to Go”

| yd | pt (4/11) | pt (4/12) | pt (4/13) | pt (4/14) | pt (4/15) | pt (4/16) | pt (4/17) | pt (4/18) | pt (4/19) | pt (4/20+) |
|----|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|
| 1 | 0.77 | 0.52 | 0.30 | 0.11 | -0.06 | -0.21 | -0.35 | -0.47 | -0.58 | -0.67 |
| 2 | 0.95 | 0.72 | 0.52 | 0.35 | 0.19 | 0.05 | -0.07 | -0.18 | -0.27 | -0.36 |
| 3 | 0.92 | 0.71 | 0.52 | 0.36 | 0.21 | 0.08 | -0.04 | -0.14 | -0.23 | -0.31 |

| yd | pt (4/11) | pt (4/12) | pt (4/13) | pt (4/14) | pt (4/15) | pt (4/16) | pt (4/17) | pt (4/18) | pt (4/19) | pt (4/20+) |
|----|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|
| 4 | 0.89 | 0.69 | 0.52 | 0.36 | 0.23 | 0.10 | 0.00 | -0.10 | -0.18 | -0.26 |
| 5 | 0.93 | 0.73 | 0.57 | 0.42 | 0.28 | 0.17 | 0.06 | -0.03 | -0.11 | -0.18 |
| 6 | 0.96 | 0.78 | 0.61 | 0.47 | 0.34 | 0.23 | 0.13 | 0.04 | -0.04 | -0.11 |
| 7 | 1.00 | 0.82 | 0.66 | 0.52 | 0.40 | 0.29 | 0.19 | 0.11 | 0.04 | -0.03 |
| 8 | 1.01 | 0.83 | 0.68 | 0.55 | 0.43 | 0.32 | 0.23 | 0.15 | 0.07 | 0.01 |
| 9 | 0.88 | 0.73 | 0.59 | 0.47 | 0.37 | 0.28 | 0.20 | 0.13 | 0.06 | 0.01 |
| 10 | 0.89 | 0.74 | 0.62 | 0.50 | 0.40 | 0.31 | 0.23 | 0.16 | 0.10 | 0.05 |
| 11 | 0.91 | 0.77 | 0.64 | 0.53 | 0.43 | 0.35 | 0.27 | 0.21 | 0.15 | 0.09 |
| 12 | 0.93 | 0.79 | 0.67 | 0.56 | 0.47 | 0.38 | 0.31 | 0.25 | 0.19 | 0.14 |
| 13 | 0.95 | 0.82 | 0.70 | 0.59 | 0.50 | 0.42 | 0.35 | 0.29 | 0.23 | 0.18 |
| 14 | 0.97 | 0.84 | 0.73 | 0.62 | 0.54 | 0.46 | 0.39 | 0.33 | 0.28 | 0.23 |
| 15 | 0.99 | 0.87 | 0.75 | 0.66 | 0.57 | 0.49 | 0.43 | 0.37 | 0.32 | 0.27 |
| 16 | 0.95 | 0.83 | 0.72 | 0.62 | 0.53 | 0.46 | 0.39 | 0.34 | 0.29 | 0.24 |
| 17 | 0.88 | 0.76 | 0.65 | 0.55 | 0.47 | 0.40 | 0.33 | 0.27 | 0.22 | 0.18 |
| 18 | 0.82 | 0.69 | 0.59 | 0.49 | 0.41 | 0.33 | 0.27 | 0.21 | 0.16 | 0.12 |
| 19 | 0.75 | 0.63 | 0.52 | 0.43 | 0.34 | 0.27 | 0.20 | 0.15 | 0.10 | 0.05 |
| 20 | 0.69 | 0.56 | 0.46 | 0.36 | 0.28 | 0.20 | 0.14 | 0.08 | 0.03 | -0.01 |
| 21 | 0.62 | 0.50 | 0.39 | 0.30 | 0.21 | 0.14 | 0.08 | 0.02 | -0.03 | -0.07 |
| 22 | 0.55 | 0.43 | 0.33 | 0.23 | 0.15 | 0.08 | 0.01 | -0.04 | -0.09 | -0.13 |
| 23 | 0.59 | 0.46 | 0.34 | 0.24 | 0.15 | 0.07 | 0.00 | -0.07 | -0.12 | -0.17 |
| 24 | 0.53 | 0.39 | 0.28 | 0.17 | 0.08 | 0.00 | -0.07 | -0.13 | -0.18 | -0.23 |
| 25 | 0.46 | 0.33 | 0.21 | 0.11 | 0.02 | -0.06 | -0.13 | -0.19 | -0.24 | -0.29 |
| 26 | 0.51 | 0.36 | 0.23 | 0.12 | 0.02 | -0.07 | -0.14 | -0.21 | -0.27 | -0.32 |
| 27 | 0.44 | 0.30 | 0.17 | 0.05 | -0.05 | -0.13 | -0.21 | -0.28 | -0.33 | -0.38 |
| 28 | 0.50 | 0.34 | 0.20 | 0.07 | -0.04 | -0.13 | -0.22 | -0.29 | -0.36 | -0.41 |
| 29 | 0.44 | 0.27 | 0.13 | 0.01 | -0.10 | -0.20 | -0.28 | -0.36 | -0.42 | -0.48 |
| 30 | 0.37 | 0.21 | 0.06 | -0.06 | -0.17 | -0.26 | -0.35 | -0.42 | -0.48 | -0.54 |
| 31 | 0.44 | 0.26 | 0.10 | -0.03 | -0.15 | -0.26 | -0.35 | -0.43 | -0.50 | -0.56 |
| 32 | 0.37 | 0.19 | 0.04 | -0.10 | -0.22 | -0.32 | -0.42 | -0.50 | -0.57 | -0.63 |
| 33 | 0.45 | 0.26 | 0.08 | -0.07 | -0.20 | -0.31 | -0.42 | -0.50 | -0.58 | -0.65 |
| 34 | 0.38 | 0.19 | 0.02 | -0.13 | -0.27 | -0.38 | -0.48 | -0.57 | -0.65 | -0.71 |
| 35 | 0.48 | 0.26 | 0.07 | -0.09 | -0.24 | -0.36 | -0.48 | -0.57 | -0.66 | -0.73 |
| 36 | 0.42 | 0.20 | 0.01 | -0.15 | -0.30 | -0.42 | -0.54 | -0.63 | -0.72 | -0.79 |
| 37 | 0.54 | 0.30 | 0.09 | -0.09 | -0.25 | -0.39 | -0.52 | -0.62 | -0.72 | -0.80 |
| 38 | 0.69 | 0.42 | 0.19 | -0.01 | -0.19 | -0.35 | -0.49 | -0.61 | -0.71 | -0.81 |
| 39 | 0.42 | 0.18 | -0.03 | -0.21 | -0.37 | -0.51 | -0.64 | -0.75 | -0.84 | -0.92 |
| 40 | 0.36 | 0.12 | -0.09 | -0.27 | -0.43 | -0.57 | -0.70 | -0.81 | -0.90 | -0.98 |
| 41 | 0.30 | 0.06 | -0.15 | -0.33 | -0.49 | -0.63 | -0.76 | -0.87 | -0.96 | -1.04 |
| 42 | 0.06 | -0.16 | -0.35 | -0.51 | -0.66 | -0.79 | -0.90 | -0.99 | -1.08 | -1.15 |
| 43 | 0.00 | -0.22 | -0.41 | -0.57 | -0.72 | -0.85 | -0.96 | -1.06 | -1.14 | -1.21 |
| 44 | -0.06 | -0.28 | -0.47 | -0.63 | -0.78 | -0.91 | -1.02 | -1.12 | -1.20 | -1.27 |
| 45 | -0.12 | -0.34 | -0.53 | -0.69 | -0.84 | -0.97 | -1.08 | -1.18 | -1.26 | -1.34 |
| 46 | -0.35 | -0.55 | -0.72 | -0.87 | -1.00 | -1.11 | -1.21 | -1.30 | -1.37 | -1.44 |
| 47 | -0.41 | -0.61 | -0.78 | -0.93 | -1.06 | -1.17 | -1.27 | -1.36 | -1.43 | -1.50 |
| 48 | -0.47 | -0.67 | -0.84 | -0.99 | -1.12 | -1.23 | -1.33 | -1.42 | -1.50 | -1.56 |
| 49 | -0.68 | -0.86 | -1.01 | -1.14 | -1.26 | -1.37 | -1.46 | -1.53 | -1.60 | -1.66 |
| 50 | -0.74 | -0.92 | -1.07 | -1.21 | -1.32 | -1.43 | -1.52 | -1.59 | -1.66 | -1.72 |
| 51 | -0.80 | -0.98 | -1.13 | -1.27 | -1.38 | -1.49 | -1.58 | -1.66 | -1.72 | -1.78 |
| 52 | -0.86 | -1.04 | -1.19 | -1.33 | -1.44 | -1.55 | -1.64 | -1.72 | -1.78 | -1.84 |
| 53 | -1.06 | -1.22 | -1.35 | -1.48 | -1.58 | -1.67 | -1.76 | -1.83 | -1.89 | -1.94 |
| 54 | -1.12 | -1.28 | -1.41 | -1.54 | -1.64 | -1.73 | -1.82 | -1.89 | -1.95 | -2.00 |
| 55 | -1.18 | -1.34 | -1.48 | -1.60 | -1.70 | -1.79 | -1.88 | -1.95 | -2.01 | -2.06 |
| 56 | -1.36 | -1.50 | -1.63 | -1.74 | -1.83 | -1.92 | -1.99 | -2.05 | -2.11 | -2.16 |
| 57 | -1.42 | -1.56 | -1.69 | -1.80 | -1.89 | -1.98 | -2.05 | -2.11 | -2.17 | -2.22 |
| 58 | -1.48 | -1.62 | -1.75 | -1.86 | -1.95 | -2.04 | -2.11 | -2.17 | -2.23 | -2.28 |
| 59 | -1.54 | -1.68 | -1.81 | -1.92 | -2.01 | -2.10 | -2.17 | -2.23 | -2.29 | -2.34 |
| 60 | -1.71 | -1.84 | -1.95 | -2.05 | -2.14 | -2.21 | -2.28 | -2.33 | -2.38 | -2.43 |
| 61 | -1.77 | -1.90 | -2.01 | -2.11 | -2.20 | -2.27 | -2.34 | -2.39 | -2.44 | -2.49 |

| yd | pt (4/11) | pt (4/12) | pt (4/13) | pt (4/14) | pt (4/15) | pt (4/16) | pt (4/17) | pt (4/18) | pt (4/19) | pt (4/20+) |
|----|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|
| 62 | -1.83 | -1.96 | -2.07 | -2.17 | -2.26 | -2.33 | -2.40 | -2.45 | -2.50 | -2.55 |
| 63 | -1.89 | -2.02 | -2.13 | -2.23 | -2.32 | -2.39 | -2.46 | -2.51 | -2.57 | -2.61 |
| 64 | -1.95 | -2.08 | -2.19 | -2.29 | -2.38 | -2.45 | -2.52 | -2.58 | -2.63 | -2.67 |
| 65 | -2.11 | -2.23 | -2.33 | -2.42 | -2.49 | -2.56 | -2.62 | -2.67 | -2.72 | -2.76 |
| 66 | -2.19 | -2.30 | -2.40 | -2.49 | -2.57 | -2.64 | -2.70 | -2.75 | -2.79 | -2.83 |
| 67 | -2.26 | -2.38 | -2.48 | -2.57 | -2.65 | -2.71 | -2.77 | -2.83 | -2.87 | -2.91 |
| 68 | -2.34 | -2.45 | -2.55 | -2.64 | -2.72 | -2.79 | -2.85 | -2.90 | -2.95 | -2.99 |
| 69 | -2.41 | -2.53 | -2.63 | -2.72 | -2.80 | -2.87 | -2.93 | -2.98 | -3.03 | -3.07 |
| 70 | -2.49 | -2.60 | -2.71 | -2.80 | -2.88 | -2.94 | -3.01 | -3.06 | -3.11 | -3.15 |
| 71 | -2.56 | -2.68 | -2.78 | -2.87 | -2.95 | -3.02 | -3.08 | -3.14 | -3.18 | -3.22 |
| 72 | -2.63 | -2.75 | -2.86 | -2.95 | -3.03 | -3.10 | -3.16 | -3.21 | -3.26 | -3.30 |
| 73 | -2.80 | -2.91 | -3.00 | -3.09 | -3.16 | -3.22 | -3.28 | -3.33 | -3.37 | -3.41 |
| 74 | -2.88 | -2.98 | -3.08 | -3.16 | -3.23 | -3.30 | -3.35 | -3.40 | -3.45 | -3.48 |
| 75 | -2.95 | -3.06 | -3.15 | -3.24 | -3.31 | -3.38 | -3.43 | -3.48 | -3.52 | -3.56 |
| 76 | -3.03 | -3.13 | -3.23 | -3.31 | -3.39 | -3.45 | -3.51 | -3.56 | -3.60 | -3.64 |
| 77 | -3.10 | -3.21 | -3.31 | -3.39 | -3.46 | -3.53 | -3.59 | -3.64 | -3.68 | -3.72 |
| 78 | -3.18 | -3.29 | -3.38 | -3.47 | -3.54 | -3.61 | -3.66 | -3.71 | -3.76 | -3.80 |
| 79 | -3.25 | -3.36 | -3.46 | -3.54 | -3.62 | -3.68 | -3.74 | -3.79 | -3.83 | -3.87 |
| 80 | -3.33 | -3.44 | -3.53 | -3.62 | -3.69 | -3.76 | -3.82 | -3.87 | -3.91 | -3.95 |
| 81 | -3.40 | -3.51 | -3.61 | -3.70 | -3.77 | -3.84 | -3.90 | -3.95 | -3.99 | -4.03 |
| 82 | -3.48 | -3.59 | -3.69 | -3.77 | -3.85 | -3.91 | -3.97 | -4.02 | -4.07 | -4.11 |
| 83 | -3.55 | -3.66 | -3.76 | -3.85 | -3.92 | -3.99 | -4.05 | -4.10 | -4.15 | -4.19 |
| 84 | -3.63 | -3.74 | -3.84 | -3.92 | -4.00 | -4.07 | -4.13 | -4.18 | -4.22 | -4.26 |
| 85 | -3.70 | -3.81 | -3.91 | -4.00 | -4.08 | -4.15 | -4.20 | -4.26 | -4.30 | -4.34 |
| 86 | -3.78 | -3.89 | -3.99 | -4.08 | -4.15 | -4.22 | -4.28 | -4.33 | -4.38 | -4.42 |
| 87 | -3.85 | -3.96 | -4.06 | -4.15 | -4.23 | -4.30 | -4.36 | -4.41 | -4.46 | -4.50 |
| 88 | -3.93 | -4.04 | -4.14 | -4.23 | -4.31 | -4.38 | -4.44 | -4.49 | -4.54 | -4.58 |
| 89 | -4.00 | -4.12 | -4.22 | -4.31 | -4.38 | -4.45 | -4.51 | -4.57 | -4.61 | -4.65 |
| 90 | -4.08 | -4.19 | -4.29 | -4.38 | -4.46 | -4.53 | -4.59 | -4.64 | -4.69 | -4.73 |
| 91 | -4.16 | -4.28 | -4.38 | -4.47 | -4.55 | -4.62 | -4.69 | -4.74 | -4.79 | -4.83 |
| 92 | -4.25 | -4.37 | -4.48 | -4.57 | -4.65 | -4.72 | -4.78 | -4.83 | -4.88 | -4.92 |
| 93 | -4.34 | -4.46 | -4.57 | -4.66 | -4.74 | -4.81 | -4.87 | -4.93 | -4.98 | -5.02 |
| 94 | -4.44 | -4.56 | -4.67 | -4.76 | -4.84 | -4.91 | -4.97 | -5.03 | -5.08 | -5.12 |
| 95 | -4.54 | -4.66 | -4.77 | -4.86 | -4.94 | -5.01 | -5.07 | -5.13 | -5.18 | -5.22 |
| 96 | -4.64 | -4.76 | -4.87 | -4.96 | -5.04 | -5.11 | -5.17 | -5.23 | -5.28 | -5.32 |
| 97 | -4.89 | -5.02 | -5.13 | -5.22 | -5.31 | -5.38 | -5.45 | -5.50 | -5.56 | -5.60 |
| 98 | -5.14 | -5.27 | -5.38 | -5.48 | -5.57 | -5.65 | -5.72 | -5.78 | -5.83 | -5.88 |
| 99 | -5.47 | -5.59 | -5.71 | -5.80 | -5.89 | -5.97 | -6.03 | -6.09 | -6.14 | -6.19 |

This analysis continues through the entire game, with the final SUV results shown in Table 7. This summarize all the drives and give the total SUVs for the game, broken down by type of play and for three individual players (one quarterback, one running back and one wide receiver) for each team. The green entries for Pittsburgh remove the SUVs from the kneel-downs. Incomplete passes are attributed fully to the quarterback, except if there is a clear indication that the receiver dropped the ball, in which case he receives full negative credit. Pass completions are halved between the quarterback and receiver. Individual players also get (or lose) credit for kick returns and penalties. Quarterback runs are attributed solely to the quarterback (so a sack is treated as a run, not a pass). Quarterbacks get full negative credit for interceptions, unless there is clear indication that the receiver bobbled the ball causing the interception. Other “judgmental” assignments can be made as needed based on particulars of a play. The results suggest that, while the game was very close (an 18-16 Pittsburgh victory via a missed two-point conversion by Kansas City at the end), Pittsburgh dominated the play (SUV = 14.60 vs. 5.41), given they drove for six field goals and nearly a touchdown (end zone interception).

Following this exercise, it was clear that some expediting could be done, in particular assigning the SUV for each play to the particular type of play (kick, run, pass, etc.), as this would streamline the summation effort at the end. This was done for the next game, the Giants’ 20-19 Super Bowl XXV win over Buffalo, when Norwood missed the field goal “wide right” at the end. This game also had a safety, which is discussed in the next paragraph with reference to Table 8, which shows selected results as with Example 1. Again, Reference 1 provides the complete game analysis.

With respect to Drive Nyg-04, the safety and post-safety excessive celebration penalty were treated separately. For the safety, the Giants started 2nd and 10 from their own 7, an SUV = -1.00 at 93 yards away. The safety resulted in a loss of 2.00 points and a free kick, which was treated as giving the ball to Buffalo at their 25 (SUV = 0.59), where they would have been without the 10-yard penalty. Thus, the finishing SUV was the negative sum of the safety (-2.00) and Buffalo’s assumed starting position (-0.59), or -2.59,

resulting in an SUV decrease for the play of -1.59. The penalty was treated as Buffalo getting the ball at their 25 and losing 10 yards, a change in SUV from 0.59 to -0.02 for them, or from -0.59 to +0.02 for the Giants, an increase of 0.61.

As with Example 1, this analysis continues through the entire game, with the final SUV results shown in Table 9. Again, the green highlighted entries remove the SUVs for kneel-downs. The SUVs for both teams are essentially equal, consistent with the closeness of the game and the fact that both teams scored two touchdowns and drove far enough for two field goal attempts each, with Buffalo missing its last one (partially compensated with the safety).

Another streamlining effort for a future time would be to assign EXCEL Name Labels to each specific triplet of field position, down and yards to go, such that, rather than looking this up from the tables manually, they could automatically be entered into a spreadsheet. For example, if “1st down, 10 yards to go, from 55 yards away” (SUV = 1.79) were labeled as “55_1_10-,” entering this directly would automatically provide the SUV (note the “10-“ where the minus sign means the SUV is the same for all 1st and 10 yards or less).

Table 5. Selected Results from Example 1 (Pittsburgh-18, Kansas City-16, January 15, 2017)

| DRIVE pit-01 | SUV: start | finish | delta |
|---|-----------------------|---------------|--------------|
| (15:00 - 1st) C.Santos kicks 63 yards from KC 35 to PIT 2. J.Gilbert to PIT 30 for 28 yards (A.Sherman). | -1.00 | 0.89 | 1.89 |
| 1st and 10 at PIT 30 | | | |
| (14:54 - 1st) (Shotgun) B.Roethlisberger pass incomplete short middle to L.Bell (D.Poe). | 0.89 | 0.39 | -0.50 |
| 2nd and 10 at PIT 30 | | | |
| (14:50 - 1st) (Shotgun) B.Roethlisberger pass short right to A.Brown to PIT 37 for 7 yards (R.Parker). | 0.39 | 0.81 | 0.42 |
| 3rd and 3 at PIT 37 | | | |
| (14:14 - 1st) (No Huddle, Shotgun) B.Roethlisberger pass short left to E.Rogers to PIT 41 for 4 yards (E.Berry). | 0.81 | 1.55 | 0.74 |
| 1st and 10 at PIT 41 | | | |
| (13:38 - 1st) (No Huddle, Shotgun) B.Roethlisberger pass short right to J.James to KC 46 for 13 yards (R.Parker; D.Sorensen). | 1.55 | 2.34 | 0.79 |
| 1st and 10 at KC 46 | | | |
| (12:58 - 1st) (No Huddle, Shotgun) B.Roethlisberger pass short middle to J.James to KC 30 for 16 yards (M.Peters; E.Berry). | 2.34 | 3.40 | 1.06 |
| 1st and 10 at KC 30 | | | |
| (12:16 - 1st) (No Huddle, Shotgun) L.Bell right guard to KC 24 for 6 yards (J.Jenkins). | 3.40 | 3.88 | 0.48 |
| 2nd and 4 at KC 24 | | | |
| (11:38 - 1st) L.Bell right guard to KC 13 for 11 yards (J.Houston). | 3.88 | 4.76 | 0.88 |
| 1st and 10 at KC 13 | | | |
| (11:01 - 1st) (Shotgun) L.Bell up the middle to KC 5 for 8 yards (R.Wilson). | 4.76 | 5.50 | 0.74 |
| 2nd and 2 at KC 5 | | | |
| (10:18 - 1st) (No Huddle, Shotgun) B.Roethlisberger pass incomplete short right to L.Bell. | 5.50 | 5.00 | -0.50 |
| 3rd and 2 at KC 5 | | | |
| (10:11 - 1st) (No Huddle, Shotgun) B.Roethlisberger pass short left to E.Rogers to KC 4 for 1 yard (R.Parker). | 5.00 | 3.13 | -1.87 |
| 4th and 1 at KC 4 | | | |
| (9:38 - 1st) Chris Boswell 22 Yd Field Goal | 3.13 | 3.00 | -0.13 |
| | RESULT | | |
| | -1.00 | 3.00 | 4.00 |

| DRIVE KCI-01 | SUV: start | finish | delta |
|---|-----------------------|---------------|--------------|
| (9:38 - 1st) C.Boswell kicks 45 yards from PIT 35 to KC 20. D.Harris to KC 45 for 25 yards (D.Heyward-Bey). | 0.28 | 1.79 | 1.51 |
| 1st and 10 at KC 45 | | | |
| (9:31 - 1st) (Shotgun) S.Ware right guard to PIT 48 for 7 yards (J.Harrison). | 1.79 | 2.22 | 0.43 |
| 2nd and 3 at PIT 48 | | | |
| (9:01 - 1st) (No Huddle) T.Hill right end to PIT 41 for 7 yards (R.Shazier). | 2.22 | 2.64 | 0.42 |
| 1st and 10 at PIT 41 | | | |

| DRIVE pit-01 | SUV: start | finish | delta |
|--|-----------------------|---------------|--------------|
| (8:11 - 1st) (Shotgun) A.Smith pass short right to T.Kelce to PIT 20 for 21 yards (S.Davis). 1st and 10 at PIT 20 | 2.64 | 4.20 | 1.56 |
| (7:24 - 1st) (Shotgun) A.Smith pass short middle to T.Hill to PIT 13 for 7 yards (B.Dupree). 2nd and 3 at PIT 13 | 4.20 | 4.84 | 0.64 |
| (6:48 - 1st) A.Smith pass short left to J.Maclin to PIT 5 for 8 yards (A.Burns). 1st and Goal at PIT 5 | 4.84 | 5.50 | 0.66 |
| (6:09 - 1st) Albert Wilson Pass From Alex Smith for 5 Yrds C.Santos extra point is Good | 5.50 | 7.00 | 1.50 |
| | RESULT | | |
| | 0.28 | 7.00 | 6.72 |

Table 6. Selected Results from Example 1 Continued

| DRIVE pit-02 | SUV: start | finish | delta |
|---|-----------------------|---------------|--------------|
| (6:09 - 1st) C.Santos kicks 65 yards from KC 35 to end zone, Touchback. 1st and 10 at PIT 25 | 0.59 | 0.59 | 0.00 |
| (6:09 - 1st) L.Bell left guard to PIT 25 for no gain (R.Wilson). 2nd and 10 at PIT 25 | 0.59 | 0.09 | -0.50 |
| (5:33 - 1st) (Shotgun) B.Roethlisberger pass incomplete short right to A.Brown. 3rd and 10 at PIT 25 | 0.09 | -0.41 | -0.50 |
| (5:28 - 1st) (Shotgun) B.Roethlisberger pass deep left to A.Brown to KC 23 for 52 yards (J.Houston). 1st and 10 at KC 23 | -0.41 | 3.96 | 4.37 |
| (4:44 - 1st) (No Huddle, Shotgun) B.Roethlisberger pass incomplete short right to J.James. 2nd and 10 at KC 23 | 3.96 | 3.46 | -0.50 |
| (4:41 - 1st) (Shotgun) B.Roethlisberger pass short right to E.Rogers pushed ob at KC 20 for 3 yards (S.Nelson). 3rd and 7 at KC 20 | 3.46 | 3.50 | 0.04 |
| (4:02 - 1st) (Shotgun) B.Roethlisberger pass incomplete short left to A.Brown. 4th and 7 at KC 20 | 3.50 | 1.37 | -2.13 |
| (3:51 - 1st) Chris Boswell 38 Yd Field Goal | 1.37 | 3.00 | 1.63 |
| | RESULT | | |
| | 0.59 | 3.00 | 2.41 |

Table 7. SUV Summaries from Example 1 (Pittsburgh-18, Kansas City-16, January 15, 2017)

PITTSBURGH

| DRIVE | Ben | Bell | Brown | kick | run | pass | pen. | kneel | punt | FG | SUM | CUMU |
|-------|--------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 01 | -0.430 | 2.100 | 0.210 | 1.89 | 2.10 | 0.14 | 0.00 | 0.00 | 0.00 | -0.13 | 4.00 | 4.00 |
| 02 | -0.925 | -0.500 | 2.185 | 0.00 | -0.50 | 1.28 | 0.00 | 0.00 | 0.00 | 1.63 | 2.41 | 6.41 |
| 03 | -2.360 | 1.910 | 0.330 | 0.00 | 2.05 | -2.06 | 0.00 | 0.00 | 0.00 | 2.18 | 2.17 | 8.58 |
| 04 | -4.690 | 0.860 | 0.000 | 0.00 | 0.86 | -3.60 | 0.00 | 0.00 | 0.00 | 0.00 | -2.74 | 5.84 |
| 05 | -3.345 | 1.830 | 0.385 | 0.00 | 2.35 | -3.13 | -0.71 | 0.00 | 0.00 | 2.70 | 1.21 | 7.05 |
| half | 1.110 | 0.000 | 1.110 | 0.00 | 0.00 | 2.22 | 0.00 | 0.00 | 0.00 | 0.00 | 2.22 | 9.27 |
| 06 | -1.685 | 1.645 | 0.180 | 0.00 | 2.83 | -2.87 | 0.00 | 0.00 | 0.00 | 2.39 | 2.35 | 11.62 |
| 07 | 0.000 | -1.150 | 0.000 | 0.00 | -1.15 | 0.00 | 0.00 | 0.00 | -0.19 | 0.00 | -1.34 | 10.28 |
| 08 | -1.885 | -0.780 | 0.000 | 1.49 | -4.15 | 3.37 | 0.00 | 0.00 | 0.00 | 2.89 | 3.60 | 13.88 |
| end | -3.550 | -0.100 | 0.460 | -0.20 | -0.10 | 1.02 | 0.00 | -4.06 | 0.00 | 0.00 | -3.34 | 10.54 |
| T | - | 5.815 | 4.860 | 3.18 | 4.29 | -3.63 | -0.71 | -4.06 | -0.19 | 11.66 | 10.54 | 10.54 |
| end | 0.510 | -0.100 | 0.460 | -0.20 | -0.10 | 1.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.72 | 14.60 |
| T | - | 5.815 | 4.860 | 3.18 | 4.29 | -3.63 | -0.71 | 0.00 | -0.19 | 11.66 | 14.60 | 14.60 |

Brown SUVs include two punt returns in KCI-04 (in pit-05, 6 yards from Pit 39 for +0.36) and KCI-06 (in pit-06, 3 yards from Pit 23 for +0.18).

KANSAS CITY

| DRIVE | Smith | Hill | Kelce | kick | run | pass | pen. | kneel | punt | FG | SUM | CUMU |
|-------|--------|--------|--------|-------|-------|-------|-------|-------|------|------|-------|-------|
| 01 | 2.180 | 0.740 | 0.780 | 1.51 | 0.85 | 4.36 | 0.00 | 0.00 | 0.00 | 0.00 | 6.72 | 6.72 |
| 02 | -1.645 | -1.085 | 0.645 | -0.79 | 0.00 | -0.16 | -1.61 | 0.00 | 1.14 | 0.00 | -1.42 | 5.30 |
| 03 | -3.340 | 0.310 | 0.000 | 0.00 | -0.02 | -3.03 | 0.00 | 0.00 | 0.00 | 0.00 | -3.05 | 2.25 |
| 04 | -2.760 | 0.000 | 0.000 | 0.00 | -0.01 | -2.76 | 0.00 | 0.00 | 0.70 | 0.00 | -2.07 | 0.18 |
| 05 | -0.190 | 0.070 | 0.000 | -0.55 | 0.00 | -2.95 | 0.21 | 0.00 | 0.00 | 0.00 | -3.29 | -3.11 |
| 06 | -2.970 | 1.230 | 0.000 | 1.23 | -0.66 | -2.97 | 0.00 | 0.00 | 2.45 | 0.00 | 0.05 | -3.06 |
| 07 | -4.380 | 2.220 | 0.000 | 1.74 | -1.44 | -1.48 | 1.51 | 0.00 | 2.07 | 0.00 | 2.40 | -0.66 |
| 08 | -0.210 | 0.000 | -1.380 | 0.00 | -0.66 | 1.34 | -1.38 | 0.00 | 0.00 | 1.36 | 0.66 | 0.00 |
| 09 | 0.330 | 0.040 | 0.980 | 0.00 | 0.21 | 4.26 | 0.94 | 0.00 | 0.00 | 0.00 | 5.41 | 5.41 |
| T | - | 3.525 | 1.025 | 3.14 | -1.73 | -3.39 | -0.33 | 0.00 | 6.36 | 1.36 | 5.41 | 5.41 |

Smith SUVs includes completed pass fumbled by receiver in KCI-05 (8 yards from KCI 30 for +0.48/2 = +0.24).

Table 8. Selected Results from Example 2 (NY Giants-20, Buffalo-19, Super Bowl XXV)

| DRIVE Buf-03 | | | | | | | | | | | | |
|--------------|------|--|-------|------|------|------|------|------|------|----|-------|--|
| Yard | Down | Play | Start | Kick | Run | Pass | Pen. | Knee | Punt | FG | Delta | |
| B 20 | 1-10 | Thomas 3 run middle (Howard). | 0.28 | | 0.27 | | | | | | -0.01 | |
| B 23 | 2-7 | Kelly 11 pass to Reed right (Thompson, Collins). | 0.27 | | | 1.13 | | | | | 0.86 | |
| B 34 | 1-10 | Kelly 4 pass to Reed left (Thompson, Banks). | 1.13 | | | 1.27 | | | | | 0.14 | |
| B 38 | 2-6 | Buffalo penalized 5 for false start (Ritcher). | 1.27 | | | | 0.47 | | | | -0.80 | |
| B 33 | 2-11 | Kelly 20 pass to Reed middle (Collins, Walls). | 0.47 | | | 2.28 | | | | | 1.81 | |
| N 47 | 1-10 | Thomas 6 Shotgun draw left (Reasons). | 2.28 | | 2.64 | | | | | | 0.36 | |
| N 41 | 2-4 | Kelly 13 pass to Thomas short right (Banks). | 2.64 | | 3.56 | | | | | | 0.92 | |
| N 28 | 1-10 | K. Davis 3 run right (Howard). | 3.56 | | 3.60 | | | | | | 0.04 | |
| N 25 | 2-7 | Kelly 9 pass to Reed crossing right (Collins). | 3.60 | | | 4.52 | | | | | 0.92 | |
| N 16 | 1-10 | Thomas 3 run right (Johnson). | 4.52 | | 4.56 | | | | | | 0.04 | |
| N 13 | 2-7 | Kelly 5 pass to McKeller left (Guyton). | 4.56 | | | 4.70 | | | | | 0.14 | |
| N 8 | 3-2 | New York penalized 4 (half the distance) for | 4.70 | | | | 5.60 | | | | 0.90 | |

| | | | | | | | | | | |
|--------------|------|---|-------|------|------|------|------|------|------|-------------|
| | | roughing the passer (Marshall). New York– first time out (13:14). | | | | | | | | |
| N 4 | 1–go | Mueller 3 run middle (Taylor). | 5.60 | | 6.50 | | | | | 0.90 |
| N 1 | 2–go | D. Smith 1 run right, touchdown (12:30). Norwood kicked extra point. | 6.50 | | 7.00 | | | | | 0.50 |
| Total | | | 41.38 | 0.00 | 2.75 | 3.87 | 0.10 | 0.00 | 0.00 | 6.72 |

| DRIVE Nyg-03 | | | | | | | | | | | |
|--|------|--|-------|------|-------|-------|------|------|-------|------|--------------|
| Yard | Down | Play | Start | Kick | Run | Pass | Pen. | Knee | Punt | FG | Delta |
| Norwood kick to NY 10, Duerson 22 return (Tasker). | | | -0.32 | 1.01 | | | | | | | 1.33 |
| N 32 | 1-10 | Hostetler 2 scramble left (out of bounds). | 1.01 | | 0.83 | | | | | | -0.18 |
| N 34 | 2-8 | Anderson 2 run middle (Wright). | 0.83 | | 0.65 | | | | | | -0.18 |
| N 36 | 3-6 | Hostetler hit as he threw (Seals), pass to Kyles incomplete. | 0.65 | | | -1.00 | | | | | -1.65 |
| N 36 | 4-6 | Landeta 37 punt, Edwards fair catch. | -1.00 | | | | | | -0.71 | | 0.29 |
| Total | | | 1.17 | 1.33 | -0.36 | -1.65 | 0.00 | 0.00 | 0.29 | 0.00 | -0.39 |

| DRIVE Buf-04 | | | | | | | | | | | |
|---------------------|------|--|-------|------|-------|-------|------|------|------|------|--------------|
| Yard | Down | Play | Start | Kick | Run | Pass | Pen. | Knee | Punt | FG | Delta |
| B 27 | 1-10 | Thomas 14 run left (Walls, P. Williams). | 0.71 | | 1.55 | | | | | | 0.84 |
| B 41 | 1-10 | Thomas 4 run left (Johnson). | 1.55 | | 1.69 | | | | | | 0.14 |
| B 45 | 2-6 | Kelly pass to Reed right broken up (Guyton), incomplete. | 1.69 | | | 1.19 | | | | | -0.50 |
| B 45 | 3-6 | New York penalized 5 for offsides (Howard). | 1.19 | | | | 1.59 | | | | 0.40 |
| 50 | 3-1 | Kelly pass to Reed middle dropped, incomplete. | 1.59 | | | 0.36 | | | | | -1.23 |
| 50 | 4-1 | Tuten 43 punt, Meggett fair catch. | 0.36 | | | | | | 0.50 | | 0.14 |
| Total | | | 7.09 | 0.00 | -0.71 | -0.04 | 0.40 | 0.00 | 0.14 | 0.00 | -0.21 |

| DRIVE Nyg-04 | | | | | | | | | | | |
|---|------|--|-------|------|-------|-------|-------|------|------|------|--------------|
| Yard | Down | Play | Start | Kick | Run | Pass | Pen. | Knee | Punt | FG | Delta |
| N 7 | 1-10 | Hostetler 7 pass to Anderson middle (K. Jackson). | -0.50 | | | -0.08 | | | | | 0.42 |
| N 14 | 2-3 | Anderson 3 run middle (Bentley). Play nullified and New York penalized 7 (half the distance) for holding (Oates). | -0.08 | | | | -1.00 | | | | -0.92 |
| N 7 | 2-10 | Hostetler tripped over Anderson, regained footing, then sacked, loss of 7 (B. Smith), SAFETY (8:27). Buffalo penalized 5 for excessive celebration (B. Smith), assessed on free kick. Landeta free kick from NY 25 to B 15. Treated as if kick went to B 25 (if no penalty). | -1.00 | | -2.59 | | | | | | -1.59 |
| Buffalo penalized 5 for excessive celebration (B. Smith), assessed on free kick. Landeta free kick from NY 25 to B 15. Treated as if kick went to B 25, with 10-yd penalty taking it back to 15. | | | -0.59 | | | | 0.02 | | | | 0.61 |
| Total | | | -2.17 | 0.00 | -1.59 | 0.42 | -0.31 | 0.00 | 0.00 | 0.00 | -1.48 |

Table 9. SUV Summaries from Example 2 (NY Giants-20, Buffalo-19, Super Bowl XXV)

| Nyg Summary | | | | | | | | | | | | |
|--------------------|--------------|--------------|---------------|-------------|--------------|--------------|--------------|--------------|-------------|-------------|--------------|--------------|
| DRIVE | Hoss | Meggett | Bavaro | kick | run | pass | pen. | kneel | punt | FG | SUM | CUMU |
| 01 | 2.535 | 2.110 | 0.000 | 0.00 | -3.52 | 4.24 | 0.30 | 0.00 | 0.00 | 1.03 | 2.05 | 2.05 |
| 02 | 0.470 | -1.100 | 0.000 | 0.00 | 0.74 | -0.36 | 0.00 | 0.00 | -0.94 | 0.00 | -0.56 | 1.49 |
| 03 | -1.830 | 0.000 | 0.000 | 1.33 | -0.36 | -1.65 | 0.00 | 0.00 | 0.29 | 0.00 | -0.39 | 1.10 |
| 04 | -2.380 | 0.000 | 0.000 | 0.00 | -1.59 | 0.42 | -0.31 | 0.00 | 0.00 | 0.00 | -1.48 | -0.38 |
| 05 | -1.260 | 0.000 | 0.000 | 0.00 | -0.08 | -1.26 | 0.00 | 0.00 | 0.83 | 0.00 | -0.51 | -0.89 |
| 06 | 2.155 | 1.240 | 0.180 | 0.00 | 1.83 | 5.31 | 0.00 | 0.00 | 0.00 | 0.00 | 7.14 | 6.25 |
| 07 | 2.795 | 1.735 | -1.800 | 0.97 | 3.45 | 5.97 | -3.01 | 0.00 | 0.00 | 0.00 | 7.38 | 13.63 |
| 08 | 0.160 | 0.000 | 0.000 | 0.00 | -5.57 | 0.78 | 0.30 | 0.00 | 0.00 | 0.00 | -4.49 | 9.14 |
| 09 | -0.720 | 1.910 | 1.360 | 0.61 | 1.67 | 1.16 | 0.00 | 0.00 | 0.00 | -0.30 | 3.14 | 12.28 |
| 10 | -0.955 | -0.500 | 0.215 | 0.00 | 0.95 | 0.43 | 0.00 | 0.00 | -0.17 | 0.00 | 1.21 | 13.49 |
| end | -0.540 | 1.030 | 0.000 | 0.00 | 0.00 | 0.00 | 0.00 | -0.54 | 0.00 | 0.00 | -0.54 | 12.95 |
| Total | 0.430 | 6.425 | -0.045 | 2.91 | -2.48 | 15.04 | -2.72 | -0.54 | 0.01 | 0.73 | 12.95 | 12.95 |
| end | 0.000 | 1.030 | 0.000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 13.49 |
| Total | 0.970 | 6.425 | -0.045 | 2.91 | -2.48 | 15.04 | -2.72 | 0.00 | 0.01 | 0.73 | 13.49 | 13.49 |

Meggett SUVs include two punt returns in Buf-01 (in Nyg-01, 20 yards from Nyg 11 for +1.21) and Buf-09 (in Nyg-10, 17 yards from Nyg 13 for +1.03).

| Buf Summary | | | | | | | | | | | | |
|--------------------|---------------|---------------|---------------|-------------|-------------|-------------|--------------|--------------|-------------|--------------|--------------|--------------|
| DRIVE | Kelly | Thomas | Reed | kick | run | pass | pen. | kneel | punt | FG | SUM | CUMU |
| 01 | -0.845 | 0.000 | -0.345 | 1.21 | 0.00 | -1.19 | 0.00 | 0.00 | -0.89 | 0.00 | -0.87 | -0.87 |
| 02 | -0.305 | -0.080 | 0.000 | 1.53 | -0.08 | 1.97 | 0.00 | 0.00 | 0.00 | 0.28 | 3.70 | 2.83 |
| 03 | 1.475 | 0.850 | 1.865 | 0.00 | 2.75 | 3.87 | 0.10 | 0.00 | 0.00 | 0.00 | 6.72 | 9.55 |
| 04 | 1.190 | 0.980 | -1.230 | 0.00 | -0.71 | -0.04 | 0.40 | 0.00 | 0.14 | 0.00 | -0.21 | 9.34 |
| 05 | -3.240 | 0.000 | 0.000 | 0.91 | 0.00 | -3.24 | 0.00 | 0.00 | 1.88 | 0.00 | -0.45 | 8.89 |
| 06 | -0.270 | 1.705 | -0.365 | 0.00 | 1.23 | -0.04 | -0.50 | 0.00 | -0.59 | 0.00 | 0.10 | 8.99 |
| half | -0.660 | 0.000 | 0.000 | 0.66 | 0.00 | 0.00 | 0.00 | -0.66 | 0.00 | 0.00 | 0.00 | 8.99 |
| 07 | -2.730 | 0.300 | 0.000 | 1.99 | -2.54 | 0.11 | -1.61 | 0.00 | 0.94 | 0.00 | -1.11 | 7.88 |
| 08 | 0.220 | 3.165 | 0.000 | 0.00 | 3.68 | 0.44 | 0.00 | 0.00 | 0.00 | 0.00 | 4.12 | 12.00 |
| 09 | -1.580 | 0.650 | 0.000 | 0.78 | -0.53 | -0.74 | 0.00 | 0.00 | 1.88 | 0.00 | 1.39 | 13.39 |
| 10 | 0.440 | 2.610 | 0.070 | 0.00 | 3.30 | 0.00 | 0.00 | 0.00 | 0.00 | -3.81 | -0.51 | 12.88 |
| Total | -6.305 | 10.180 | -0.005 | 7.08 | 7.10 | 1.14 | -1.61 | -0.66 | 3.36 | -3.53 | 12.88 | 12.88 |
| half | 0.000 | 0.000 | 0.000 | 0.66 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.66 | 13.54 |
| Total | -5.645 | 10.180 | -0.005 | 7.08 | 7.10 | 1.14 | -1.61 | 0.00 | 3.36 | -3.53 | 13.54 | 13.54 |

Table 10. SUVs for “Composite” Players from Two Example Games - Winning and Losing Quarterbacks, Running Backs and Wide Receivers

| Player | Pittsburgh at Kansas City | | NY Giants vs. Buffalo | | Cumulative | | Average SUV |
|--------------|---------------------------|---------|-----------------------|--------|------------|---------|-------------|
| | “Plays” | SUV | “Plays” | SUV | “Plays” | SUV | |
| Roethstetler | 34 | -13.700 | 38 | 0.970 | 72 | -12.730 | -0.177 |
| Smelly | 37 | -12.985 | 35 | -5.645 | 72 | -18.630 | -0.259 |

| | | | | | | | |
|----------------|----|-------|----|--------|----|--------|-------|
| Bellett | 32 | 5.815 | 16 | 6.425 | 48 | 12.240 | 0.255 |
| Hillmas | 12 | 3.525 | 20 | 10.180 | 32 | 13.705 | 0.428 |
| Brovaro | 8 | 4.860 | 6 | -0.045 | 14 | 4.815 | 0.344 |
| Kreed | 6 | 1.025 | 9 | -0.005 | 15 | 1.020 | 0.068 |

A.1.1 Summary

For these examples, we decided to form a set of “composite” players, consisting of the winning and losing quarterbacks, running backs and wide receivers from the two games, as shown in Table 10: (1) winning quarterbacks = Roethlisberger + Hostetler = Roethstetler, (2) losing quarterbacks = Smith + Kelly = Smelly, (3) winning running backs = Bell + Meggett = Bellett, (4) losing running backs = Hill + Thomas = Hillmas, (5) winning wide receivers = Brown + Bavaro = Brovaro, and (6) losing wide receivers = Kelce + Reed = Kreed. “Plays” includes all entries for each player, including penalties due to the player.

It is likely inappropriate to compare players from different positions (e.g., quarterbacks can accrue negative SUVs quickly with just a few incompletions, while running backs and wide receivers only can do so when losing yardage relative to the line of scrimmage, not too common). Therefore, for the quarterbacks, it is clear that both cumulatively and on average, Roethstetler was more productive (less unproductive?) than Smelly. The case is not as clear for the running backs, as their cumulative SUVs are about equal. However, clearly Hillmas, the “losing” running back with 33% less “plays,” has the noticeably higher average SUV, indicative of better performance “per play.” The wide receiver comparison clearly favors Brovaro in both categories.

III.SUV FOOTBALL: “PROOF OF PRINCIPLE”

As with major league baseball, the goal here is again “Proof of Principle” by tracking the performance of an individual team (offense only) over a substantial portion of an entire season (16 games). One-third of the 2017 season, i.e., five games, have been selected for the Seattle Seahawks, starting with Game 02 and tracking every third game up through Game 14. The SUVs are based on the play-by-play descriptions provided in Reference 10. The complete play-by-play for the Seahawks’ offensive possessions are provided for the following five games in Reference 3: (1) Game 02, San Francisco 49ers [9] @ Seattle [12], 09/17/2017; (2) Game 05, Seattle [16] @ Los Angeles Rams [10], 10/08/2017; (3) Game 08, Washington Redskins [17] @ Seattle [14], 11/02/2017; Game 11, Seattle [24] @ San Francisco 49ers [13], 11/23/2017; and (5) Los Angeles Rams [42] @ Seattle [7], 12/14/2017.

In Reference 3, for each play, the starting and finishing SUV are provided, with the difference allocated to the appropriate player(s). Special treatments other than the following are highlighted in **bold purple italics** with the play (e.g., see 2nd and 10 from the Sea 36 during Drive 01 in Game 02 as an example in Table 11). Plays involving penalties are highlighted in yellow. The following are not automatically highlighted but should be noted as they are standard practice throughout.

A. Passing

Completed passes have the change in SUV split 50/50 between the quarterback and receiver. Incomplete passes have the change in SUV assigned exclusively to the quarterback. The overall result is that quarterbacks tend to have negative SUVs, so cannot be compared against other players on their team.

B. Turnovers

When Seattle obtains possession via a turnover, the starting SUV is the negative of the opponent’s SUV where the turnover occurs. The finishing SUV is that where Seattle starts its drive. For example, Drive 03 for Seattle vs. San Francisco in Game 02 (see Table 11) began with an interception at the SFr 43 (SUV = -1.67 for Sea), returned to the SFr 36 (SUV = 2.94), representing an SUV gain of $2.94 - (-1.67) = 4.61$. When Seattle yields possession via a turnover, the starting SUV is that for where Seattle began its play. The finishing SUV is the negative of the opponent’s SUV where they start their drive. For example, Drive 04 in Game 08 ended when Wilson was intercepted on 3rd and 4 from the Was 49 (starting SUV = 1.66), with Washington taking over at their own 43 (finishing SUV = -1.67), representing an SUV loss of $1.66 - (-1.67) = 3.33$. This is shown in Table 12.

C. Kick Returns

On kick returns, the starting SUV is that where the kick is first fielded (assumed to be 0.59, corresponding to 1st and 10 at the Sea 25 if a kickoff is fielded in the end zone where a touchback could be chosen) and the finish where the play ends. On kickoff returns, this often results in an SUV loss if the kick is fielded in the end zone but not returned to at least the Sea 25 (e.g., see start of Drive 11 in Game 02, illustrated in Table 13).

D. Touchdowns

As highlighted in **bold purple italics**, touchdowns are assumed to have an SUV = 7.00 (see Table 12). Six-sevenths of the difference between 7.00 and the starting SUV is assigned to the player(s) scoring the touchdown. If an extra point is converted, the kicker receives the remaining one-seventh (or the player[s] scoring on a successful two-point conversion earns this plus an additional 1.00). A missed conversion costs a kicker this one-seventh (or a player[s] this one-seventh + 1.00 if a two-point conversion fails). A special category, “No XP,” is reserved strictly for touchdowns in overtime when no extra point is attempted.

E. SUV Analyses

Football offers more variations than baseball, so anticipating every possible SUV outcome is difficult. Analysis of these five games presented some unique challenges in addition to the above, and these are highlighted in **bold purple italics** with the play. Seattle both scored (Game 08, Drive 02 [see Table 12]) and yielded safeties (Game 14, Drive 13 [see Table 14]), and their treatments are described with the plays.

All players' SUVs were tracked cumulatively through the five games, as summarized in Table 15. Quarterbacks, kickers (punters and place kickers), and kick returners accrue SUVs quite differently from the other offensive players (runners and receivers) and are not readily comparable with them. Similarly, SUVs acquired by defensive players via turnovers are infrequent and usually very positive so as not to be comparable with offensive players. Penalties are their own unique category. Therefore, while all of these are tracked, for comparison purposes within the Seattle offense itself, only runners and receivers are considered. Over the span of the five games analyzed, only the following eight runners and receivers had enough plays (at least 14) to merit comparison: P. Richardson, Baldwin, Graham, Lockett (excluding kick returns), McKissic, Carson, Rawls and Lacy. The season statistics for these eight players were tabulated as well from the 2017 Full Season Statistics (Offense) provided for the Seahawks in Reference 10. (Mike Davis was included with the players selected for the full season statistics, but excluded from the comparison since he did not have enough plays in the five games analyzed for SUV [only eight plays].) The cumulative SUVs and traditional statistics for these eight players are presented in Table 16.

F. Comparison vs. "Traditional" Statistics

As before for baseball, the statistics for the various categories were normalized, then these normalized values were averaged (see Reference 1). A summary of the technique is repeated here.

The totals for the group of eight players, along with the mean and standard deviation in each category, "Cumulative SUV" and "SUV per Play" (or, for traditional statistics, "Total Pts" and "Total Yds," since these are the only categories common to all eight players), are calculated to enable a normalization of the statistics for each of the eight players as follows:

$$\text{Normalized Statistic (Cumulative SUV or SUV Per Play)} = \int_{-\infty}^x \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}} dx$$

where μ = mean and σ = standard deviation.

These normalized statistics, representing the percentiles of the normal distribution where the statistics occur, are calculated for both "Cumulative SUV" and "SUV per Play" for the eight players. These two normalized statistics for each player are then averaged ("Both" column) and used to rank the players from first through eighth.

As an example calculation, consider Baldwin, who has a Cumulative SUV = 6.683 and SUV per Play = 0.334. When normalized to the mean Cumulative SUV = 3.662 and mean SUV per Play = 0.211 (with respective standard deviations of 2.911 and 0.178), his normalized Cumulative SUV and SUV per Play become as follows:

$$\begin{aligned} \text{Normalized Cumulative SUV} &= \int_{-\infty}^{6.683} \frac{1}{(2.911)\sqrt{2\pi}} e^{-\frac{(6.683-3.662)^2}{2[2.911]^2}} dx = 0.850 \\ \text{Normalized SUV per Play} &= \int_{-\infty}^{0.334} \frac{1}{(0.178)\sqrt{2\pi}} e^{-\frac{(0.334-0.211)^2}{2[0.178]^2}} dx = 0.756 \end{aligned}$$

These indicate that his Cumulative SUV occurs at the 85.0%ile and SUV per Play at the 75.6%ile, both the second highest among the eight players. The average of the two is 0.803, which ranks him second, essentially midway between P. Richardson and Graham.

For the SUV comparison, two statistics were considered: Cumulative SUV and SUV per Play, as with baseball, corresponding to both longevity and "per Opportunity (Play)," respectively. For the full season statistics comparison, five statistics were considered: for longevity, Total Points, Total Yards, and Total Rushing Attempts + Receptions; for "per Play," Average Yards per Rushing Attempt and Average Yards per Reception. The results from the comparison of the normalized statistics are presented in Table 15.

The comparison is quite revealing, in that no player differs in rank between the SUV and full season comparison by more than one position (excluding Mike Davis, so only eight ranks are considered for the full season). P. Richardson and Baldwin occupy the top two position; Graham and McKissic the next two; Lockett and Carson positions five and six; and Rawls and Lacy the bottom pair. The SUV ranks are a bit more widespread (0.919 down to 0.061 vs. 0.835 down to 0.263), most likely because the sample size is smaller (only five of 16 games). Nonetheless, it is quite insightful to find this much consistency between the two sets of results, suggesting the simple SUV can be a useful surrogate vs. the larger set of diverse statistics that are presently being tracked.

Table 11. SUVs for First Three Offensive Series for Seattle vs. San Francisco, Game 02, Sept. 9, 2017 (from Reference 3)

| Game 02: SFr-9 @ Sea-12, 09-17- 2017 | Start | Finish | Penalty | No XP | Wilson | Rawls | Prosise | Baldwin | Wagner | Sherman | Carson | Lockett | Darboh | Ryan | Walsh |
|---|--------------|---------------|----------------|--------------|---------------|--------------|----------------|----------------|---------------|----------------|---------------|----------------|---------------|-------------|--------------|
| Drive 01 | | | | | | | | | | | | | | | |
| o (15:00 - 1st) B.Pinion kicks 65 yards from SF 35 to end zone, Touchback. | | 0.59 | | | | | | | | | | | | | |
| o 1st and 10 at SEA 25 | 0.59 | | | | | | | | | | | | | | |
| (15:00 - 1st) R.Wilson left end to SEA 26 for 1 yard (E.Reid). | | 0.25 | | | -0.340 | | | | | | | | | | |
| o 2nd and 9 at SEA 26 | 0.25 | | | | | | | | | | | | | | |
| (14:27 - 1st) T.Rawls right guard to SEA 27 for 1 yard (D.Buckner). | | -0.09 | | | | -0.340 | | | | | | | | | |
| o 3rd and 8 at SEA 27 | -0.09 | | | | | | | | | | | | | | |
| (13:50 - 1st) (Shotgun) R.Wilson pass short left to C.Prosise to SEA 36 for 9 yards (J.Ward). | | 1.25 | | | 0.670 | | 0.670 | | | | | | | | |
| o 1st and 10 at SEA 36 | 1.25 | | | | | | | | | | | | | | |
| (13:11 - 1st) (Shotgun) R.Wilson pass incomplete short left to J.Graham (J.Tartt). | | 0.75 | | | -0.500 | | | | | | | | | | |
| o 2nd and 10 at SEA 36 | 0.75 | | | | | | | | | | | | | | |

| Game 02: SFr-9 @ Sea-12, 09-17-2017 | Start | Finish | Penalty | No XP | Wilson | Rawls | Prosis | Baldwin | Wagner | Sherman | Carson | Lockett | Darboh | Ryan | Walsh |
|---|--------------|---------------|----------------|--------------|---------------|--------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|-------------|--------------|
| (13:07 - 1st) R.Wilson FUMBLES (Aborted) at SEA 31, recovered by SEA-T.Rawls at SEA 35. T.Rawls to SEA 35 for no gain (S.Thomas). <i>[Wilson lost 5 yds to 31 (SUV = -0.55); Rawls gained 4 yds to 35.]</i> | | 0.09 | | | -1.300 | 0.640 | | | | | | | | | |
| o 3rd and 11 at SEA 35 | 0.09 | | | | | | | | | | | | | | |
| (13:07 - 1st) (Shotgun) PENALTY on SF-E.Dumervil, Neutral Zone Infraction, 5 yards, enforced at SEA 35 - No Play. | | 0.89 | 0.800 | | | | | | | | | | | | |
| o 3rd and 6 at SEA 40 | 0.89 | | | | | | | | | | | | | | |
| (12:18 - 1st) (Shotgun) R.Wilson pass short left to D.Baldwin pushed ob at 50 for 10 yards (D.Johnson). | | 2.09 | | | 0.600 | | | 0.600 | | | | | | | |
| o 1st and 10 at 50 | 2.09 | | | | | | | | | | | | | | |
| (11:55 - 1st) R.Wilson pass short right to D.Baldwin to SF 48 for 2 yards | | 1.92 | | | -0.085 | | | -0.085 | | | | | | | |

| Game 02: SFr-9 @ Sea-12, 09-17- 2017 | Start | Finish | Penalty | No XP | Wilson | Rawls | Prosis | Baldwin | Wagner | Sherman | Carson | Lockett | Darboh | Ryan | Walsh |
|---|--------------|---------------|----------------|--------------|---------------|--------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|-------------|--------------|
| (E.Reid). | | | | | | | | | | | | | | | |
| o 2nd and 8 at SF 48 | 1.92 | | | | | | | | | | | | | | |
| (11:30 - 1st) (Shotgun) R.Wilson pass incomplete short left to P.Richardson. | | 1.42 | | | -0.500 | | | | | | | | | | |
| o 3rd and 8 at SF 48 | 1.42 | | | | | | | | | | | | | | |
| (11:26 - 1st) (Shotgun) R.Wilson pass short left to C.Carson to SF 41 for 7 yards (J.Ward; K.Williams). | | 0.91 | | | -0.255 | | | | | | -0.255 | | | | |
| o 4th and 1 at SF 41 | 0.91 | | | | | | | | | | | | | | |
| (10:53 - 1st) (Shotgun) R.Wilson left end ran ob at SF 32 for 9 yards (J.Tartt). | | 3.24 | | | 2.330 | | | | | | | | | | |
| o 1st and 10 at SF 32 | 3.24 | | | | | | | | | | | | | | |
| (10:24 - 1st) C.Carson left tackle to SF 29 for 3 yards (R.Armstrong; A.Armstead). | | 3.28 | | | | | | | | | 0.040 | | | | |
| o 2nd and 7 at SF 29 | 3.28 | | | | | | | | | | | | | | |
| (9:48 - 1st) (Shotgun) R.Wilson pass deep right to | | 5.30 | | | 1.010 | | | | | | | 1.010 | | | |

| Game 02: SFr-9 @ Sea-12, 09-17-2017 | Start | Finish | Penalty | No XP | Wilson | Rawls | Prosise | Baldwin | Wagner | Sherman | Carson | Lockett | Darboh | Ryan | Walsh |
|---|--------------|---------------|----------------|--------------|---------------|--------------|----------------|----------------|---------------|----------------|---------------|----------------|---------------|--------------|--------------|
| T.Lockett to SF 7 for 22 yards (K.Williams). Penalty on SF-A.Armstead, Defensive Holding, declined. | | | | | | | | | | | | | | | |
| o 1st and Goal at SF 7 | 5.30 | | | | | | | | | | | | | | |
| (9:34 - 1st) T.Rawls left tackle to SF 7 for no gain (A.Armstead; T.Carradine). | | 5.10 | | | | -0.200 | | | | | | | | | |
| o 2nd and Goal at SF 7 | 5.10 | | | | | | | | | | | | | | |
| (8:53 - 1st) (Shotgun) R.Wilson pass incomplete short middle to C.Prosise. | | 4.60 | | | | -0.500 | | | | | | | | | |
| o 3rd and Goal at SF 7 | 4.60 | | | | | | | | | | | | | | |
| (8:49 - 1st) (Shotgun) R.Wilson pass incomplete short left to D.Baldwin. | | 1.98 | | | | -2.620 | | | | | | | | | |
| o 4th and Goal at SF 7 | 1.98 | | | | | | | | | | | | | | |
| (8:38 - 1st) Blair Walsh 25 Yd Field Goal | | 3.00 | | | | | | | | | | | | | 1.020 |
| DRIVE NET (SUV: Finish minus Start & Sum of Players) | 2.41 | 2.41 | 0.800 | 0.000 | -1.490 | 0.100 | 0.670 | 0.515 | 0.000 | 0.000 | -0.215 | 1.010 | 0.000 | 0.000 | 1.020 |
| DRIVE 02 (SFr-9 @ Sea-12, 09-17- | Start | Finish | Penalty | No XP | Wilson | Rawls | Prosise | Baldwin | Wagner | Sherman | Carson | Lockett | Darboh | Ryan | Walsh |

| Game 02: SFr-9 @ Sea-12, 09-17-2017 | Start | Finish | Penalty | No XP | Wilson | Rawls | Prosis | Baldwin | Wagner | Sherman | Carson | Lockett | Darboh | Ryan | Walsh |
|---|--------------|---------------|----------------|--------------|---------------|--------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|--------------|--------------|
| (7:15 - 1st) B.Pinion punts 49 yards to SEA 17, Center-K.Nelson, fair catch by T.Lockett. | 0.10 | 0.10 | | | | | | | | | | 0.000 | | | |
| o 1st and 10 at SEA 17 | 0.10 | | | | | | | | | | | | | | |
| (7:07 - 1st) C.Carson right tackle to SEA 19 for 2 yards (N.Bowman). | | -0.08 | | | | | | | | | -0.180 | | | | |
| o 2nd and 8 at SEA 19 | -0.08 | | | | | | | | | | | | | | |
| (6:32 - 1st) R.Wilson sacked at SEA 18 for -1 yards (A.Lynch). | | -0.74 | | | -0.660 | | | | | | | | | | |
| o 3rd and 9 at SEA 18 | -0.74 | | | | | | | | | | | | | | |
| (5:54 - 1st) (Shotgun) R.Wilson pass incomplete deep left to T.Lockett. | | -3.20 | | | -2.460 | | | | | | | | | | |
| o 4th and 9 at SEA 18 | -3.20 | | | | | | | | | | | | | | |
| (5:50 - 1st) J.Ryan punts 54 yards to SF 28, Center-T.Ott. T.Taylor to SF 39 for 11 yards (D.McDonald). | | -1.43 | | | | | | | | | | | | 1.770 | |
| DRIVE NET (SUV: Finish minus Start & Sum of Players) | -1.53 | -1.53 | 0.000 | 0.000 | -3.120 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -0.180 | 0.000 | 0.000 | 1.770 | 0.000 |
| CUMULATIVES | 0.88 | 0.88 | 0.800 | 0.000 | -4.610 | 0.100 | 0.670 | 0.515 | 0.000 | 0.000 | -0.395 | 1.010 | 0.000 | 1.770 | 1.020 |

| Game 02: SFr-9 @ Sea-12, 09-17-2017 | Start | Finish | Penalty | No XP | Wilson | Rawls | Prosise | Baldwin | Wagner | Sherman | Carson | Lockett | Darboh | Ryan | Walsh |
|---|-------|--------|---------|-------|--------|-------|---------|---------|--------|---------|--------|---------|--------|------|-------|
| (SUV: Finish minus Start & Sum of Players) | | | | | | | | | | | | | | | |
| DRIVE 03 (SFr-9 @ Sea-12, 09-17-2017) | Start | Finish | Penalty | No XP | Wilson | Rawls | Prosise | Baldwin | Wagner | Sherman | Carson | Lockett | Darboh | Ryan | Walsh |
| (5:39 - 1st) (Shotgun) B.Hoyer pass short middle intended for C.Hyde INTERCEPTED by B.Wagner at SF 43. B.Wagner to SF 36 for 7 yards (M.Goodwin). FUMBLES (M.Goodwin), recovered by SEA-R.Sherman at SF 36. R.Sherman to SF 36 for no gain (C.Hyde). <i>[Wagner intercepts at SFr 43 (-1.67) and returns to SFr 36 (2.94). Sherman recovers Wagner fumble for no gain.]</i> | -1.67 | 2.94 | | | | | | | 4.610 | 0.000 | | | | | |
| o 1st and 10 at SF 36 | 2.94 | | | | | | | | | | | | | | |
| (5:31 - 1st) (Shotgun) R.Wilson sacked at SF 44 for -8 yards (T.Carradine). | | 1.16 | | | -1.780 | | | | | | | | | | |
| o 2nd and 18 at SF 44 | 1.16 | | | | | | | | | | | | | | |

| Game 02: SFr-9 @ Sea-12, 09-17- 2017 | Start | Finish | Penalty | No XP | Wilson | Rawls | Prosisie | Baldwin | Wagner | Sherman | Carson | Lockett | Darboh | Ryan | Walsh |
|--|--------------|---------------|----------------|--------------|---------------|--------------|-----------------|----------------|---------------|----------------|---------------|----------------|---------------|-------------|--------------|
| (4:52 - 1st) (Shotgun) T.Rawls left tackle to SF 37 for 7 yards (N.Bowman). | | 1.78 | | | | 0.620 | | | | | | | | | |
| o 3rd and 11 at SF 37 | 1.78 | | | | | | | | | | | | | | |
| (4:31 - 1st) R.Wilson pass short middle to A.Darboh to SF 21 for 16 yards (D.Johnson; J.Tartt) [D.Buckner]. | | 4.12 | | | 1.170 | | | | | | | | 1.170 | | |
| o 1st and 10 at SF 21 | 4.12 | | | | | | | | | | | | | | |
| (4:01 - 1st) T.Rawls left guard to SF 21 for no gain (S.Thomas). | | 3.62 | | | | -0.500 | | | | | | | | | |
| o 2nd and 10 at SF 21 | 3.62 | | | | | | | | | | | | | | |
| (3:26 - 1st) (Shotgun) R.Wilson pass short right to T.Lockett to SF 13 for 8 yards (R.Robinson). | | 4.26 | | | 0.320 | | | | | | | 0.320 | | | |
| o 3rd and 2 at SF 13 | 4.26 | | | | | | | | | | | | | | |
| (3:26 - 1st) (Shotgun) R.Wilson pass short middle to T.Lockett to SF 7 for 6 yards (N.Bowman; E.Reid). | | 5.30 | | | 0.520 | | | | | | | 0.520 | | | |

| Game 02: SFr-9 @ Sea-12, 09-17-2017 | Start | Finish | Penalty | No XP | Wilson | Rawls | Prosise | Baldwin | Wagner | Sherman | Carson | Lockett | Darboh | Ryan | Walsh |
|--|--------------|---------------|----------------|--------------|---------------|---------------|----------------|----------------|---------------|----------------|---------------|----------------|---------------|--------------|--------------|
| o 1st and Goal at SF 7 | 5.30 | | | | | | | | | | | | | | |
| (2:14 - 1st) T.Rawls right end to SF 11 for -4 yards (N.Bowman). | | 4.32 | | | | -0.980 | | | | | | | | | |
| o 2nd and Goal at SF 11 | 4.32 | | | | | | | | | | | | | | |
| (1:39 - 1st) R.Wilson pass short left to D.Baldwin to SF 9 for 2 yards (R.Robinson). | | 4.20 | | | -0.060 | | | -0.060 | | | | | | | |
| o 3rd and Goal at SF 9 | 4.20 | | | | | | | | | | | | | | |
| (0:57 - 1st) (Shotgun) R.Wilson pass incomplete short middle to T.McEvoy (K.Williams). | | 1.24 | | | -2.960 | | | | | | | | | | |
| o 4th and Goal at SF 9 | 1.24 | | | | | | | | | | | | | | |
| (0:49 - 1st) Blair Walsh 27 Yd Field Goal | | 3.00 | | | | | | | | | | | | | 1.760 |
| DRIVE NET (SUV: Finish minus Start & Sum of Players) | 4.67 | 4.67 | 0.000 | 0.000 | -2.790 | -0.860 | 0.000 | -0.060 | 4.610 | 0.000 | 0.000 | 0.840 | 1.170 | 0.000 | 1.760 |
| CUMULATIVES (SUV: Finish minus Start & Sum of Players) | 5.55 | 5.55 | 0.800 | 0.000 | -7.400 | -0.760 | 0.670 | 0.455 | 4.610 | 0.000 | -0.395 | 1.850 | 1.170 | 1.770 | 2.780 |

Table 12. SUVs for Seattle Drives 02 and 04 in Game 08, vs. Washington, Nov.2, 2017

| DRIVE 02 (Was-17 @ Sea-14, 11-02-2017) | Start | Finish | Penalty | Wilson | Baldwin | Lockett | Ryan | Walsh | Lacy | Jones |
|---|--------------|---------------|----------------|---------------|----------------|----------------|---------------|--------------|---------------|--------------|
| (8:26 - 1st) K.Cousins FUMBLES (Aborted) at WAS 47, RECOVERED by SEA-N.Jones at WAS 42. N.Jones to WAS 42 for no gain (C.Roullier). <i>[Jones recovers fumble at Was 42 (-1.61 to 2.58).]</i> | -1.61 | 2.58 | | | | | | | | 4.190 |
| o 1st and 10 at WSH 42 | 2.58 | | | | | | | | | |
| (8:21 - 1st) (Shotgun) E.Lacy left tackle to WAS 40 for 2 yards (Z.Brown; S.McGee). | | 2.40 | | | | | | | -0.180 | |
| o 2nd and 8 at WSH 40 | 2.40 | | | | | | | | | |
| (7:48 - 1st) E.Lacy left tackle to WAS 39 for 1 yard (S.McGee; P.Smith). | | 2.06 | | | | | | | -0.340 | |
| o 3rd and 7 at WSH 39 | 2.06 | | | | | | | | | |
| (7:08 - 1st) (Shotgun) R.Wilson pass incomplete short left to J.Graham [A.Lanier]. | | 0.90 | | -1.160 | | | | | | |
| o 4th and 7 at WSH 39 | 0.90 | | | | | | | | | |
| (7:03 - 1st) J.Ryan punts 33 yards to WAS 6, Center-T.Ott, downed by SEA-L.Willson. | | 0.60 | | | | | -0.300 | | | |
| o 1st and 10 at WSH 6 <i>[Was on offense, but SUV assigned as negative of offesnive value, i.e., -(-0.60).]</i> | 0.60 | | | | | | | | | |
| (6:48 - 1st) Kirk Cousins sacked in the end zone by Bobby Wagner for a Safety <i>[Included with Drive 02 since Safety occurred on first play after punt.]</i> | | 2.00 | | | | | | | | |
| DRIVE NET (SUV: Finish minus Start & Sum of Players) | 3.61 | 3.61 | 0.000 | -1.160 | 0.000 | 0.000 | -0.300 | 0.000 | -0.520 | 4.190 |
| CUMULATIVES (SUV: Finish minus Start & Sum of Players) | 2.07 | 2.07 | -1.600 | -4.240 | 0.390 | 0.000 | 2.450 | 0.000 | -0.520 | 4.190 |

| DRIVE 04 (Was-17 @ Sea-14, 11-02-2017) | Start | Finish | Penalty | Wilson | Baldwin | Lockett | Ryan | Walsh | Lacy | Jones |
|--|--------------|---------------|----------------|---------------|----------------|----------------|-------------|--------------|-------------|--------------|
| (2:06 - 1st) T.Way punts 53 yards to SEA 24, Center-N.Sundberg. T.Lockett to SEA 45 for 21 yards (C.Carter). | 0.53 | 2.40 | | | | 1.870 | | | | |
| o 1st and 10 at SEA 45 | 2.40 | | | | | | | | | |
| (1:54 - 1st) E.Lacy left tackle to WAS 47 for 8 yards (D.Swearinger). | | 2.28 | | | | | | | -0.120 | |
| o 2nd and 2 at WSH 47 | 2.28 | | | | | | | | | |
| (1:54 - 1st) M.Tobin reported in as eligible. PENALTY on SEA, Illegal Substitution, 5 yards, enforced at WAS 47 - No Play. | | 1.77 | -0.510 | | | | | | | |
| o 2nd and 7 at SEA 48 | 1.77 | | | | | | | | | |
| (1:13 - 1st) (Shotgun) E.Lacy up the middle to WAS 49 for 3 yards (W.Compton). | | 1.66 | | | | | | | -0.110 | |
| o 3rd and 4 at WSH 49 | 1.66 | | | | | | | | | |
| (0:29 - 1st) (Shotgun) R.Wilson pass short middle intended for D.Baldwin INTERCEPTED by K.Fuller at WAS 43. K.Fuller to SEA 33 for 24 yards (D.Brown). The Replay Official reviewed the runner was not down by contact ruling, and the play was REVERSED. (Shotgun) R.Wilson pass short middle intended for D.Baldwin INTERCEPTED by K.Fuller at WAS 43. K.Fuller to WAS 43 for no gain (D.Baldwin). | | -1.67 | | -3.330 | | | | | | |

| | | | | | | | | | | |
|---|--------------|--------------|---------------|---------------|--------------|--------------|--------------|---------------|---------------|--------------|
| DRIVE NET (SUV: Finish minus Start & Sum of Players) | -2.20 | -2.20 | -0.510 | -3.330 | 0.000 | 1.870 | 0.000 | 0.000 | -0.230 | 0.000 |
| CUMULATIVES (SUV: Finish minus Start & Sum of Players) | -1.48 | -1.48 | -2.110 | -8.485 | 1.145 | 2.600 | 2.450 | -2.460 | -0.210 | 4.190 |

Table 13. SUVs for Seattle Drive 11 in Game 02 vs. San Francisco, Sept. 17, 2017

| DRIVE 11 (SFr-9 @ Sea-12, 09-17-2017) | Start | Finish | Penalty | Wilson | Rawls | Prosis | Baldwin | Wagner | Carson | Lockett | Willson | Darbo | Graham | P Richardson | Ryan | Wals |
|--|--------------|---------------|----------------|---------------|--------------|---------------|----------------|---------------|---------------|----------------|----------------|--------------|---------------|---------------------|-------------|-------------|
| o 11:36 - 4th) B.Pinion kicks 66 yards from SF 35 to SEA - 1. T.Lockett to SEA 18 for 19 yards (D.Watson; A.Colbert). <i>[Start assumed to be at Sea 25 if accepting Touchback.]</i> | 0.59 | 0.16 | | | | | | | | -0.430 | | | | | | |
| o 1st and 10 at SEA 18 | 0.16 | | | | | | | | | | | | | | | |
| (11:31 - 4th) (Shotgun) R.Wilson pass short right to T.Lockett to SEA 23 for 5 yards (K.Williams). | | 0.47 | | 0.155 | | | | | | 0.155 | | | | | | |
| o 2nd and 5 at SEA 23 | 0.47 | | | | | | | | | | | | | | | |
| (11:01 - 4th) (No Huddle, Shotgun) R.Wilson right end to SEA 27 for 4 yards (R.Armstrong). | | 0.21 | | -0.260 | | | | | | | | | | | | |
| o 3rd and 1 at SEA 27 | 0.21 | | | | | | | | | | | | | | | |
| (10:29 - 4th) | | 1.13 | | 0.920 | | | | | | | | | | | | |

| DRIVE 11 (SFr-9 @ Sea- 12, 09-17-2017) | Star t | Finis h | Penalt y | Wilso n | Rawl s | Prosis e | Baldwi n | Wagne r | Carso n | Locke tt | Willso n | Darbo h | Graha m | P Richardson | Rya n | Wals h |
|--|-------------------|--------------------|---------------------|--------------------|-------------------|---------------------|---------------------|--------------------|--------------------|---------------------|---------------------|--------------------|--------------------|-------------------------|------------------|-------------------|
| R.Wilson scrambles right end ran ob at SEA 34 for 7 yards (E.Harold). | | | | | | | | | | | | | | | | |
| o 1st and 10 at SEA 34 | 1.13 | | | | | | | | | | | | | | | |
| (9:55 - 4th) (No Huddle, Shotgun) R.Wilson pass short right to D.Baldwin to SEA 43 for 9 yards (R.Armstrong). | | 1.67 | | 0.270 | | | 0.270 | | | | | | | | | |
| o 2nd and 1 at SEA 43 | 1.67 | | | | | | | | | | | | | | | |
| (9:26 - 4th) (Shotgun) C.Carson left tackle to SF 43 for 14 yards (J.Ward). | | 2.52 | | | | | | | 0.850 | | | | | | | |
| o 1st and 10 at SF 43 | 2.52 | | | | | | | | | | | | | | | |
| (8:53 - 4th) (Shotgun) R.Wilson scrambles right end to SF 38 for 5 yards (R.Robinson). | | 2.82 | | 0.300 | | | | | | | | | | | | |
| o 2nd and 5 at SF 38 | 2.82 | | | | | | | | | | | | | | | |
| (8:32 - 4th) (No Huddle, Shotgun) PENALTY on | | 2.02 | -0.800 | | | | | | | | | | | | | |

| DRIVE 11 (SFr-9 @ Sea- 12, 09-17-2017) | Star t | Finis h | Penalt y | Wilso n | Rawl s | Prosis e | Baldwi n | Wagne r | Carso n | Locke tt | Willso n | Darbo h | Graha m | P Richardson | Rya n | Wals h |
|---|-------------------|--------------------|---------------------|--------------------|-------------------|---------------------|---------------------|--------------------|--------------------|---------------------|---------------------|--------------------|--------------------|-------------------------|------------------|-------------------|
| SEA-J.Britt, False Start, 5 yards, enforced at SF 38 - No Play. | | | | | | | | | | | | | | | | |
| o 2nd and 10 at SF 43 | 2.02 | | | | | | | | | | | | | | | |
| (8:26 - 4th) R.Wilson scrambles left end ran ob at SF 32 for 11 yards (S.Thomas). | | 3.24 | | 1.220 | | | | | | | | | | | | |
| o 1st and 10 at SF 32 | 3.24 | | | | | | | | | | | | | | | |
| (8:03 - 4th) (Shotgun) R.Wilson pass incomplete deep left to A.Darboh. PENALTY on SF-D.Johnson, Defensive Pass Interference, 20 yards, enforced at SF 32 - No Play. | | 4.84 | 1.600 | | | | | | | | | | | | | |
| o 1st and 10 at SF 12 | 4.84 | | | | | | | | | | | | | | | |
| (7:58 - 4th) (Shotgun) C.Carson right guard to SF 9 for 3 yards (R.Armstrong; N.Bowman). | | 4.90 | | | | | | | 0.060 | | | | | | | |
| o 2nd and 7 at SF 9 | 4.90 | | | | | | | | | | | | | | | |
| (7:19 - 4th) | | 4.40 | | -0.500 | | | | | | | | | | | | |

| DRIVE 11 (SFr-9 @ Sea- 12, 09-17-2017) | Star t | Finis h | Penalt y | Wilso n | Rawl s | Prosis e | Baldwi n | Wagne r | Carso n | Locke tt | Willso n | Darbo h | Graha m | P Richardson | Rya n | Wals h |
|---|-------------------------|--------------------------|---------------------------|--------------------------|-------------------------|---------------------------|---------------------------|--------------------------|--------------------------|---------------------------|---------------------------|--------------------------|--------------------------|-------------------------------|------------------------|-------------------------|
| (Shotgun) R.Wilson pass incomplete short right to C.Carson. | | | | | | | | | | | | | | | | |
| o 3rd and 7 at SF 9 | 4.40 | | | | | | | | | | | | | | | |
| (7:06 - 4th) (Shotgun) Paul Richardson 9 Yd pass from Russell Wilson <i>[TD assumed to be worth 7.00, with 6/7 accrued to scorer(s) and 1/7 to XP.]</i> | | 7.00 | | 1.114 | | | | | | | | | | 1.114 | | |
| (Blair Walsh PAT failed) <i>[XP credit deducted from Finish.]</i> | 7.00 | 6.63 | | | | | | | | | | | | | | 0.000 |
| DRIVE NET (SUV: Finish minus Start & Sum of Players) | 6.04 | 6.04 | 0.800 | 3.219 | 0.000 | 0.000 | 0.270 | 0.000 | 0.910 | -0.275 | 0.000 | 0.000 | 0.000 | 1.114 | 0.000 | 0.000 |
| CUMULATIVES (SUV: Finish minus Start & Sum of Players) | 6.87 | 6.87 | 1.660 | -12.606 | -0.760 | 0.815 | 1.465 | 4.610 | -0.545 | 2.540 | 0.555 | 1.170 | -0.170 | 1.664 | 3.690 | 2.780 |

Table 14. SUVs for Seattle Drive 13 in Game 14 vs. L.A. Rams, Dec. 14, 2017

| DRIVE 13 (LAR-42 @ Sea-7, 12-14- 2017) | Start | Finis h | Penalt y | Wilso n | Baldwi n | Locke tt | Willso n | Darbo h | Graha m | P Richardso n | Ryan | Wals h | McEv oy | McKiss ic | Wilhoi te | Davi s |
|---|--------------|--------------------------|---------------------------|--------------------------|---------------------------|---------------------------|---------------------------|--------------------------|--------------------------|--|-------------|-------------------------|--------------------------|----------------------------|----------------------------|-------------------------|
| | | | | | | | | | | | | | | | | |

| DRIVE 13 (LAR-42 @ Sea-7, 12-14- 2017) | Start | Finis h | Penalt y | Wilso n | Baldwi n | Locke tt | Willso n | Darbo h | Graha m | P Richardso n | Ryan | Wals h | McEvo y | McKiss ic | Wilhoi te | Davi s |
|---|----------------|--------------------|---------------------|--------------------|---------------------|---------------------|---------------------|--------------------|--------------------|------------------------------|-------------|-------------------|--------------------|----------------------|----------------------|-------------------|
| (10:30 - 4th) J.Hekker punts 49 yards to SEA 5, Center- J.McQuaide, downed by LA- S.Ebukam. | | -0.70 | | | | | | | | | | | | | | |
| o 1st and 10 at SEA 5 | -0.70 | | | | | | | | | | | | | | | |
| (10:14 - 4th) Penalty on Russell Wilson enforced in end zone for Safety. J.Ryan kicks 59 yards from SEA 20 to LA 21. P.Cooper pushed ob at SEA 49 for 30 yards (J.Coleman). <i>[Safety (-2.00) is added onto change in possession to LAR at Sea 49 (-2.16).]</i> | | -4.16 | -3.460 | | | | | | | | | | | | | |
| DRIVE NET (SUV: Finish minus Start & Sum of Players) | -3.46 | -3.46 | -3.460 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| CUMULATIV ES (SUV: Finish minus Start & Sum of Players) | - 12.6 5 | - 12.65 | -8.900 | - 22.00 4 | 0.180 | 3.685 | 1.406 | -0.010 | -0.330 | -0.605 | 10.56 0 | 0.469 | -2.245 | 0.665 | 4.620 | - 0.14 0 |

Table 15. Cumulative SUVs for Seattle Seahawks through Five Games, 02, 05, 08, 11 and 14, in 2017

| Player | Cumulative SUV (Through 1 Game) | Number of Plays, with Penalties & XPs | SUV per Play |
|--------------|---------------------------------|---------------------------------------|--------------|
| Seahawks | 8.37 | 98 | 0.085 |
| Walsh | 2.780 | 3 | 0.927 |
| P Richardson | 1.664 | 2 | 0.832 |
| Ryan | 3.690 | 7 | 0.527 |
| Prosise | 0.815 | 3 | 0.272 |
| Baldwin | 1.465 | 6 | 0.244 |
| Lockett | 2.540 | 13 | 0.195 |
| Willson | 0.555 | 3 | 0.185 |
| Penalty | 1.050 | 9 | 0.117 |
| Carson | 1.565 | 20 | 0.078 |
| Rawls | -0.760 | 6 | -0.127 |
| Wilson | -12.606 | 50 | -0.252 |
| Wagner | 4.610 | 1 | 4.610 |
| Darboh | 1.170 | 1 | 1.170 |
| Sherman | 0.000 | 1 | 0.000 |
| Graham | -0.170 | 1 | -0.170 |
| No XP | | | |

| Player | Cumulative SUV (Through 2 Games) | Number of Plays, with Penalties & XPs | SUV per Play |
|--------------|----------------------------------|---------------------------------------|--------------|
| Seahawks | 25.20 | 184 | 0.137 |
| Walsh | 7.130 | 7 | 1.019 |
| Ryan | 9.670 | 13 | 0.744 |
| P Richardson | 2.719 | 5 | 0.544 |
| Baldwin | 3.045 | 10 | 0.305 |
| Lockett | 4.575 | 19 | 0.241 |
| Graham | 1.175 | 7 | 0.168 |
| McKissic | 0.760 | 5 | 0.152 |
| Carson | 1.565 | 20 | 0.078 |
| Lacy | 0.195 | 10 | 0.020 |
| Penalty | 0.000 | 15 | 0.000 |
| Rawls | -0.415 | 16 | -0.026 |
| Wilson | -32.991 | 94 | -0.351 |
| Thomas | 12.120 | 2 | 6.060 |
| Wagner | 4.610 | 1 | 4.610 |
| Thorpe | 4.290 | 1 | 4.290 |
| S Richardson | 5.990 | 2 | 2.995 |
| Darboh | 1.170 | 1 | 1.170 |
| Pocic | 0.790 | 1 | 0.790 |
| Prosise | 0.815 | 3 | 0.272 |
| Willson | 0.555 | 3 | 0.185 |
| Sherman | 0 | 1 | 0.000 |
| Vannet | -0.310 | 2 | -0.155 |
| McEvoy | -2.260 | 1 | -2.260 |
| No XP | | | |

| Player | Cumulative SUV (Through 3 Games) | Number of Plays, with Penalties & XPs | SUV per Play |
|--------------|----------------------------------|---------------------------------------|--------------|
| Seahawks | 24.40 | 290 | 0.084 |
| Ryan | 13.150 | 19 | 0.692 |
| P Richardson | 4.509 | 8 | 0.564 |
| Baldwin | 6.748 | 16 | 0.422 |
| Lockett | 8.460 | 29 | 0.292 |
| Graham | 3.455 | 12 | 0.288 |
| McKissic | 1.420 | 10 | 0.142 |
| Walsh | 0.940 | 10 | 0.094 |
| Carson | 1.565 | 20 | 0.078 |
| Rawls | 1.540 | 27 | 0.057 |
| Lacy | -0.015 | 17 | -0.001 |
| Wilson | -41.201 | 153 | -0.269 |
| Penalty | -10.980 | 29 | -0.379 |
| Thomas | 12.120 | 2 | 6.060 |
| Thorpe | 4.290 | 1 | 4.290 |
| Jones | 4.190 | 1 | 4.190 |
| Wagner | 6.010 | 2 | 3.005 |
| S Richardson | 5.990 | 2 | 2.995 |
| Darboh | 1.170 | 1 | 1.170 |
| Pocic | 0.790 | 1 | 0.790 |
| Willson | 1.412 | 4 | 0.353 |
| Prosise | 0.815 | 3 | 0.272 |
| Sherman | 0.000 | 1 | 0.000 |
| Vannet | -0.310 | 2 | -0.155 |
| McEvoy | -1.670 | 2 | -0.835 |
| No XP | | | |

| Player | Cumulative SUV (Through 4 Games) | Number of Plays, with Penalties & XPs | SUV per Play |
|--------|----------------------------------|---------------------------------------|--------------|
|--------|----------------------------------|---------------------------------------|--------------|

| Player | Cumulative SUV (Through 5 Games) | Number of Plays, with Penalties & XPs | SUV per Play |
|--------|----------------------------------|---------------------------------------|--------------|
|--------|----------------------------------|---------------------------------------|--------------|

| | | | | | | | |
|--------------|---------|-----|--------|--------------|---------|-----|---------|
| Seahawks | 37.43 | 379 | 0.099 | Seahawks | 25.23 | 457 | 0.055 |
| Ryan | 17.550 | 25 | 0.702 | Ryan | 29.210 | 34 | 0.859 |
| P Richardson | 7.539 | 12 | 0.628 | P Richardson | 7.144 | 14 | 0.510 |
| Graham | 5.369 | 15 | 0.358 | Baldwin | 6.683 | 20 | 0.334 |
| Baldwin | 6.503 | 19 | 0.342 | Graham | 5.039 | 16 | 0.315 |
| Lockett | 10.440 | 38 | 0.275 | Lockett | 15.215 | 49 | 0.311 |
| McKissic | 2.640 | 18 | 0.147 | McKissic | 5.005 | 27 | 0.185 |
| Carson | 1.565 | 20 | 0.078 | Carson | 1.565 | 20 | 0.078 |
| Rawls | 1.540 | 27 | 0.057 | Rawls | 1.540 | 27 | 0.057 |
| Walsh | 0.211 | 15 | 0.014 | Walsh | 0.680 | 16 | 0.043 |
| Lacy | -1.385 | 37 | -0.037 | Lacy | -1.385 | 37 | -0.037 |
| Wilson | -46.784 | 193 | -0.242 | Wilson | -70.808 | 233 | -0.304 |
| Penalty | -9.890 | 35 | -0.283 | Penalty | -20.420 | 43 | -0.475 |
| Thomas | 12.120 | 2 | 6.060 | Thomas | 12.120 | 2 | 6.060 |
| Thorpe | 4.290 | 1 | 4.290 | Wilhoite | 4.620 | 1 | 4.620 |
| Jones | 4.190 | 1 | 4.190 | Thorpe | 4.290 | 1 | 4.290 |
| Wagner | 10.570 | 3 | 3.523 | Jones | 4.190 | 1 | 4.190 |
| S Richardson | 5.990 | 2 | 2.995 | Wagner | 10.570 | 3 | 3.523 |
| Darboh | 1.170 | 1 | 1.170 | S Richardson | 5.990 | 2 | 2.995 |
| Pocic | 0.790 | 1 | 0.790 | Pocic | 0.790 | 1 | 0.790 |
| Willson | 1.412 | 4 | 0.353 | Darboh | 1.160 | 2 | 0.580 |
| Prosise | 0.815 | 3 | 0.272 | Willson | 2.818 | 5 | 0.564 |
| Sherman | 0.000 | 1 | 0.000 | Prosise | 0.815 | 3 | 0.272 |
| McEvoy | -0.365 | 4 | -0.091 | Sherman | 0.000 | 1 | 0.000 |
| Vannet | 1.147 | 5 | -0.155 | Davis | -0.140 | 8 | -0.0175 |
| No XP | | | | Vannet | 1.147 | 5 | -0.155 |
| | | | | McEvoy | -2.610 | 5 | -0.522 |
| | | | | No XP | | | |

Table 16. Comparison of SUVs and Selected Traditional Statistics, Including Composite Normalization, for Eight Running Backs and Receivers with Most Opportunities over Five Representative Games

| Player | Cumulative SUV | SUV per Play |
|--------------|----------------|--------------|
| P Richardson | 7.144 | 0.510 |
| Baldwin | 6.683 | 0.334 |
| Graham | 5.039 | 0.315 |
| Lockett* | 3.705 | 0.247 |
| McKissic | 5.005 | 0.185 |
| Carson | 1.565 | 0.078 |
| Rawls | 1.540 | 0.057 |
| Lacy | -1.385 | -0.037 |

| Player | Avg-Rush | Avg-Rec | Total Pts | Total Yds | Att+Rec |
|-----------------|----------|---------|-----------|-----------|---------|
| Doug Baldwin | | 13.2 | 50 | 983 | 77 |
| Paul Richardson | | 16.0 | 36 | 703 | 44 |
| Tyler Lockett | | 12.3 | 18 | 613 | 55 |
| Jimmy Graham | | 9.1 | 62 | 520 | 57 |
| J.D. McKissic | 4.1 | 7.8 | 18 | 453 | 80 |
| Mike Davis | 3.5 | | 0 | 371 | 83 |
| Chris Carson | 4.2 | | 6 | 267 | 56 |
| Thomas Rawls | 2.7 | | 0 | 251 | 67 |

| | | |
|----------------|--------------|--------------|
| Mean | 3.662 | 0.211 |
| Std Dev | 2.911 | 0.178 |

| | | | | |
|-------------------|-------------|--------------|-------------|--------------|
| Eddie Lacy | 2.6 | 0 | 226 | 75 |
| Mean | 3.42 | 11.68 | 21.1 | 487.4 |
| StdDev | 0.75 | 3.27 | 23.2 | 13.6 |

| Normalized | Cumulative | per | Both |
|---------------------|--------------|--------------|--------------|
| P Richardson | 0.884 | 0.954 | 0.919 |
| Baldwin | 0.850 | 0.756 | 0.803 |
| Graham | 0.682 | 0.721 | 0.701 |
| McKissic | 0.678 | 0.442 | 0.560 |
| Lockett* | 0.506 | 0.580 | 0.543 |
| Carson | 0.236 | 0.227 | 0.231 |
| Rawls | 0.233 | 0.193 | 0.213 |
| Lacy | 0.041 | 0.081 | 0.061 |

*Excludes Returns

| Normalized | Avg-Rush | Avg-Rec | Total Pts | Total Yds | Att+Rec | Both |
|------------------------|--------------|--------------|--------------|--------------|--------------|------|
| Doug Baldwin | 0.679 | 0.893 | 0.977 | 0.791 | 0.835 | |
| Paul Richardson | 0.906 | 0.739 | 0.807 | 0.053 | 0.626 | |
| J.D. McKissic | 0.817 | 0.118 | 0.447 | 0.445 | 0.849 | |
| Jimmy Graham | 0.216 | 0.961 | 0.552 | 0.254 | 0.496 | |
| Mike Davis | 0.542 | 0.182 | 0.320 | 0.895 | 0.485 | |
| Tyler Lockett | 0.576 | 0.447 | 0.693 | 0.209 | 0.481 | |
| Chris Carson | 0.850 | 0.258 | 0.188 | 0.231 | 0.382 | |
| Eddie Lacy | 0.138 | 0.182 | 0.147 | 0.746 | 0.303 | |
| Thomas Rawls | 0.169 | 0.182 | 0.171 | 0.529 | 0.263 | |

Table 17. Selected 2015-16 Shooting Percentages for NCAA Men’s Division I Basketball (from Reference 11)

| rank | team | 3-pt | rank | team | 2-pt | rank | team | free |
|------|-------------|-------|------|--------------|-------|------|----------------|-------|
| 1 | Michigan St | 43.4% | 1 | Belmont | 62.6% | 1 | Connecticut | 79.3% |
| 2 | Oklahoma | 42.2% | 2 | Villanova | 57.4% | 2 | Villanova | 78.2% |
| 3 | S Methodist | 42.0% | 3 | Marshall | 57.2% | 3 | Norfolk St | 78.1% |
| 4 | Indiana | 41.5% | 4 | Iowa State | 56.7% | 4 | WI-Milwkee | 77.5% |
| 5 | Kansas | 41.3% | 5 | St Marys | 56.4% | 5 | NW State | 77.4% |
| 6 | St Marys | 41.0% | 6 | Indiana | 56.2% | 6 | St Bonavent | 77.3% |
| 7 | Wofford | 40.9% | 7 | Maryland | 55.8% | 7 | Incarnate Word | 77.1% |
| 8 | N Florida | 40.9% | 8 | Utah | 55.5% | 8 | Oakland | 77.0% |
| 9 | IPFW | 40.3% | 9 | E Washingt | 55.4% | 9 | Denver | 77.0% |
| 10 | Virginia | 40.2% | 10 | Richmond | 55.4% | 10 | Maryland | 76.9% |
| 11 | Oakland | 39.8% | 11 | Weber State | 55.3% | 11 | Monmouth | 76.8% |
| 12 | Arkansas | 39.7% | 12 | Wm & Mary | 54.7% | 12 | Davidson | 76.3% |
| 13 | E Kentucky | 39.5% | 13 | N Florida | 54.7% | 13 | High Point | 76.0% |
| 14 | Butler | 39.3% | 14 | Ste F Austin | 54.5% | 14 | N Iowa | 75.8% |
| 15 | Lehigh | 39.3% | 15 | Creighton | 54.5% | 15 | Gonzaga | 75.8% |
| 16 | Middle Tenn | 39.2% | 16 | Gonzaga | 54.3% | 16 | Oral Roberts | 75.7% |
| 17 | Harvard | 39.1% | 17 | Denver | 54.3% | 17 | Pittsburgh | 75.6% |

| rank | team | 3-pt | rank | team | 2-pt | rank | team | free |
|------|----------------|-------|------|----------------------|-------|------|--------------|-------|
| 18 | Incarnate Word | 38.9% | 18 | Furman | 54.2% | 18 | Wofford | 75.4% |
| 19 | Jacksonville | 38.9% | 19 | E Kentucky | 54.2% | 19 | Ohio | 75.4% |
| 20 | USC | 38.7% | 20 | Hawaii | 54.1% | 20 | Geo Wshgtn | 75.3% |
| 21 | Iowa State | 38.7% | 21 | N Carolina | 53.9% | 21 | Virginia | 75.2% |
| 22 | Colorado | 38.6% | 22 | Winthrop | 53.9% | 22 | Albany | 75.2% |
| 23 | Duke | 38.5% | 23 | Boise State | 53.7% | 23 | Georgetown | 75.1% |
| 24 | E Washingtn | 38.4% | 24 | Rice | 53.4% | 24 | Winthrop | 75.1% |
| 25 | BYU | 38.4% | 25 | Massachusetts Lowell | 53.2% | 25 | Neb Omaha | 74.9% |
| 26 | Denver | 38.3% | 26 | Evansville | 53.2% | 26 | Rice | 74.9% |
| 27 | E Tenn St | 38.3% | 27 | Miami (FL) | 53.2% | 27 | Miami (FL) | 74.9% |
| 28 | Vanderbilt | 38.2% | 28 | Duquesne | 53.1% | 28 | Toledo | 74.8% |
| 29 | Akron | 38.2% | 29 | Notre Dame | 52.9% | 29 | Hartford | 74.8% |
| 30 | Vermont | 38.2% | 30 | Kentucky | 52.9% | 30 | Ste F Austin | 74.8% |
| 31 | AR Lit Rock | 38.2% | 31 | Purdue | 52.8% | 31 | TN Tech | 74.7% |
| 32 | Charlotte | 38.2% | 32 | Portland St | 52.7% | 32 | N Carolina | 74.7% |
| 33 | Drake | 38.2% | 33 | Kansas | 52.7% | 33 | S Dakota St | 74.7% |
| 34 | Ohio | 38.2% | 34 | Oregon | 52.6% | 34 | Illinois | 74.6% |
| 35 | High Point | 38.2% | 35 | Vermont | 52.6% | 35 | Purdue | 74.4% |
| 36 | Columbia | 38.1% | 36 | UAB | 52.6% | 36 | Texas Tech | 74.2% |
| 37 | Princeton | 38.1% | 37 | Miss State | 52.6% | 37 | Notre Dame | 74.2% |
| 38 | Arizona | 38.1% | 38 | Virginia | 52.6% | 38 | Mercer | 74.2% |
| 39 | Oral Roberts | 38.0% | 39 | Neb Omaha | 52.6% | 39 | TX A&M-CC | 74.1% |
| 40 | Michigan | 38.0% | 40 | Elon | 52.6% | 40 | Canisius | 74.1% |
| 316 | Nicholls St | 30.9% | 316 | NC A&T | 44.8% | 316 | St Peters | 65.8% |
| 317 | Presbyterian | 30.8% | 317 | Georgia | 44.7% | 317 | Nicholls St | 65.7% |
| 318 | Miami (OH) | 30.8% | 318 | Seattle | 44.7% | 318 | California | 65.6% |
| 319 | Jackson St | 30.8% | 319 | Ark Pine Bl | 44.7% | 319 | Maine | 65.6% |
| 320 | Alcorn State | 30.7% | 320 | Incarnate Word | 44.7% | 320 | Hampton | 65.6% |
| 321 | Hampton | 30.5% | 321 | Indiana St | 44.7% | 321 | WI-Grn Bay | 65.6% |
| 322 | U Penn | 30.4% | 322 | SE Missouri | 44.6% | 322 | CS Bakersfld | 65.4% |
| 323 | SIU Edward | 30.4% | 323 | Arkansas St | 44.5% | 323 | Gard-Webb | 65.4% |
| 324 | IL-Chicago | 30.4% | 324 | Florida A&M | 44.4% | 324 | Cornell | 65.3% |
| 325 | Loyola-MD | 30.4% | 325 | SIU Edward | 44.4% | 325 | Boston Col | 65.1% |
| 326 | Florida A&M | 30.4% | 326 | CS Fullerton | 44.4% | 326 | Radford | 65.1% |
| 327 | Miss Val St | 30.3% | 327 | Auburn | 44.3% | 327 | North Texas | 65.1% |
| 328 | Ark Pine Bl | 30.3% | 328 | Savannah St | 44.2% | 328 | San Jose St | 64.9% |
| 329 | St Fran (NY) | 30.3% | 329 | St Johns | 44.2% | 329 | Grambling St | 64.8% |
| 330 | Cal St Nrdge | 30.2% | 330 | Fla Atlantic | 44.2% | 330 | Florida | 64.8% |
| 331 | Old Dominion | 30.1% | 331 | Colorado | 43.9% | 331 | Quinnipiac | 64.7% |
| 332 | Morgan St | 30.1% | 332 | Bradley | 43.9% | 332 | Alabama | 64.3% |
| 333 | Chicago St | 30.1% | 333 | New Orleans | 43.8% | 333 | SC Upstate | 64.2% |
| 334 | Tulane | 30.0% | 334 | Delaware | 43.7% | 334 | Bryant | 64.2% |

| rank | team | 3-pt | rank | team | 2-pt | rank | team | free |
|--------------|----------------------|---------------|--------------|----------------------|---------------|--------------|----------------------|---------------|
| 335 | Kansas St | 30.0% | 335 | TX Christian | 43.7% | 335 | Fla Gulf Cst | 64.2% |
| 336 | Indiana St | 29.9% | 336 | Alabama St | 43.6% | 336 | UC Davis | 64.0% |
| 337 | San Jose St | 29.8% | 337 | Morgan St | 43.6% | 337 | SE Louisiana | 63.9% |
| 338 | LIU-Brooklyn | 29.7% | 338 | Cleveland St | 43.4% | 338 | SE Missouri | 63.9% |
| 339 | Howard | 29.5% | 339 | Howard | 43.4% | 339 | Navy | 63.8% |
| 340 | San Diego | 29.2% | 340 | Jksnville St | 43.2% | 340 | Troy | 63.4% |
| 341 | Geo Mason | 29.2% | 341 | App State | 43.1% | 341 | Auburn | 63.3% |
| 342 | Nevada | 29.1% | 342 | Delaware St | 42.4% | 342 | St Johns | 63.2% |
| 343 | SE Missouri | 28.8% | 343 | Central Conn | 42.3% | 343 | TX Southern | 63.1% |
| 344 | S Florida | 28.6% | 344 | N Arizona | 42.3% | 344 | Jackson St | 63.0% |
| 345 | Binghamton | 28.5% | 345 | Drexel | 42.3% | 345 | IL-Chicago | 61.9% |
| 346 | Alab A&M | 28.4% | 346 | Prairie View | 42.1% | 346 | Charl South | 61.3% |
| 347 | Niagara | 28.2% | 347 | Miss Val St | 42.0% | 347 | Ark Pine Bl | 61.1% |
| 348 | Bradley | 27.7% | 348 | Chicago St | 40.9% | 348 | Delaware St | 60.9% |
| 349 | Rob Morris | 27.6% | 349 | Coppin State | 40.5% | 349 | Middle Tenn | 60.6% |
| 350 | Grambling St | 27.4% | 350 | IL-Chicago | 40.3% | 350 | Harvard | 59.0% |
| 351 | Prairie View | 27.2% | 351 | Quinnipiac | 38.3% | 351 | Florida A&M | 58.9% |
| stats | <u>mean</u> | 34.54% | stats | <u>mean</u> | 48.66% | stats | <u>mean</u> | 69.89% |
| | <u>stdv</u> | 2.80% | | <u>stdv</u> | 3.26% | | <u>stdv</u> | 3.45% |
| | <u>5th%</u> | 30.05% | | <u>5th%</u> | 43.75% | | <u>5th%</u> | 64.20% |
| | <u>95th%</u> | 38.90% | | <u>95th%</u> | 54.20% | | <u>95th%</u> | 75.40% |
| | <u>median</u> | 34.5% | | <u>median</u> | 48.7% | | <u>median</u> | 69.7% |

IV. INTRODUCTION: SUV BASKETBALL

SUV for NCAA Men's Division I basketball is developed from "first principles," beginning with the concept of the worth, in points, of a possession where there is an attempted score. Reference 11 lists the shooting percentages for 351 NCAA Men's teams for the NCAA season 2015-16. Excerpts from these are listed in Table 17, accompanied by their statistics, which are used to assign SUVs to the various plays. These statistics imply the following point values of each type of shot: (1) 3-pt shot = $(3)(0.345) = 1.04 \approx 1.0$; (2) 2-pt shot = $(2)(0.487) = 0.97 \approx 1.0$; and (3) free = $(1)(0.699) = 0.7$. If we assume a possession with an attempted score corresponds to either a 3- or 2-pt attempt, the value of a possession is ~ 1.0 , which is also the value of a 3- or 2-pt attempt. A free throw is worth 0.7. A special case can be made for a lay-up/dunk in that it should have an even higher percentage for success than a free throw. A value of 80% seems reasonable (the midpoint between 70% for a free throw and an assumed 90% for an uncontested lay-up/dunk), making its value $(2)(0.8) = 1.6$.

V. SUV BASKETBALL: ASSIGNMENTS FOR PLAYS

Based on these values, we can assign an SUV to a "make" or a "miss" for each, as follows:

3-pt "make" = $3.0 - 1.0 = +2.0$; 3-pt "miss" = $0 - 1.0 = -1.0$
 2-pt "make" = $2.0 - 1.0 = +1.0$; 2-pt "miss" = $0 - 1.0 = -1.0$
 free "make" = $1.0 - 0.7 = +0.3$; free "miss" = $0 - 0.7 = -0.7$
 lay-up/dunk "make" = $2.0 - 1.6 = +0.4$; lay-up/dunk "miss" = $0 - 1.6 = -1.6$

A. Assists

For the lay-up/dunk, credit should be given for an "assist" that gets the ball right under the basket, whether this assist be from another player or the shooter himself. Consistent with the rest of the 2-pt shots, the value of a lay-up/dunk should be 1.0. Therefore, the "assist" should be +0.6, bringing the total SUV for a "made" lay-up/dunk to $0.4 + 0.6 = 1.0$ and that for a "miss" to $-1.6 + 0.6 = -1.0$. Thus, a player who "drives" for a lay-up attempt earns $0.4 + 0.6 = 1.0$ in SUV if successful, but loses $-(-1.6 + 0.6) = 1.0$ if he fails. Likewise, "assists" for 3- and 2-pt shots that are successful should be recognized. Thus, when either of these is "made," the SUV earned is split equally between the scorer and "assist" (i.e., +1.0 each on a successful 3-pt shot; +0.5 each on a 2-pt shot).

Consistent with the lay-up/dunk valuation, a "tap-in," by definition successful, is also worth an overall SUV of +1.0, but here the +0.4/+0.6 split goes to the shooter (who missed) and the "tapper" (who scored), i.e., the reverse of a successful lay-up/dunk. Of course, if the shooter taps in his own miss, he gets the full +1.0. For goaltending, if offensive, the goaltender, not the shooter, earns the -1.0. If defensive, then the shooter earns the full SUV (or half if there was an "assist") as if the shot was made without the goaltending. Rebounds, offensive or defensive, equate to gaining possession in a "free ball" situation, so are worth +1.0.

B. Turnovers, Fouls, Steals, etc.

A "self-induced" turnover, such as anything out of bounds, a clock violation, traveling, double-dribbling, getting "tied-up" and losing possession, changes your team's possession to that of the other team, with an SUV = $-1.0 - 1.0 = -2.0$. A defensive foul that results in two free throws for the opponent can have any of four results: (1) both shots missed, with a probability of $(0.3)^2 = 0.09$; (2) and (3) one shot made, one missed, with a probability of $(2)(0.7)(0.3) = 0.42$; and (4) both shots made, with a probability of $(0.7)^2 = 0.49$. As required, the probabilities sum to 1.0. Thus, the SUV for a defensive foul resulting in two shots becomes $(0)(0.09) - (1)(0.42) - (2)(0.49) = -1.4$. For a three-shot foul, it becomes $(0)(0.3)^3 - (1)(3)(0.7)(0.3)^2 - (2)(3)(0.7)^2(0.3) - (3)(0.7)^3 = -2.1$ (note that there are three ways each to score only 1 point or 2). For a "1 + 1" situation, the SUV is $(0)(0.3) - (1)(0.7)(0.3) - (2)(0.7)^2 = -1.19 \approx -1.2$. For non-shooting fouls, there is still a negative SUV as each one counts toward the opponent reaching the "1 + 1" bonus. After six such non-shooting fouls, the opponent earns a "1 + 1" on the seventh, so a reasonable SUV for a non-shooting foul is $-1.2/7$ or $-1.4/7$, both of which equate to ~ -0.2 . Offensive fouls that yield opponent foul shots cost the fouler's team a possession, so the SUV is reduced by another 1.0, bringing the SUVs for a "1 + 1" and 2-shot free throw opportunity to $-1.2 - 1.0 = -2.2$ and $-1.4 - 1.0 = -2.4$, respectively. In a non-shooting situation, the offensive foul still costs the fouler's team possession and yields it to the opponent, so it equates the same as a turnover, i.e., -2.0. A technical or intentional foul not only provides the 2-shot free throw opportunity, but costs possession after that, so there is an additional decrement of 1.0 in SUV, i.e., $-2.4 - 1.0 = -3.4$.

A steal is equivalent to a turnover, but it is not considered "self-induced." Therefore, the "stealer's" SUV is only -1.0 while the "stealer" earns +1.0. A successfully blocked shot, where there is a change of possession, yields a -1.0 SUV for the shooter (and is offset by the +1.0 for successfully rebounding the block). If the blocker recovers the ball, he earns the full +1.0 for possession change. If a teammate recovers, the SUV is split between the blocker (+0.5) and the "recoverer" (+0.5). Finally, breaking a full-court press changes a "contested" possession into an "actual" possession, so earns the "breaker" +1.0 SUV (which may be split if more than one player deserves the credit). The SUVs for all of these plays of these are summarized in Figure 4.

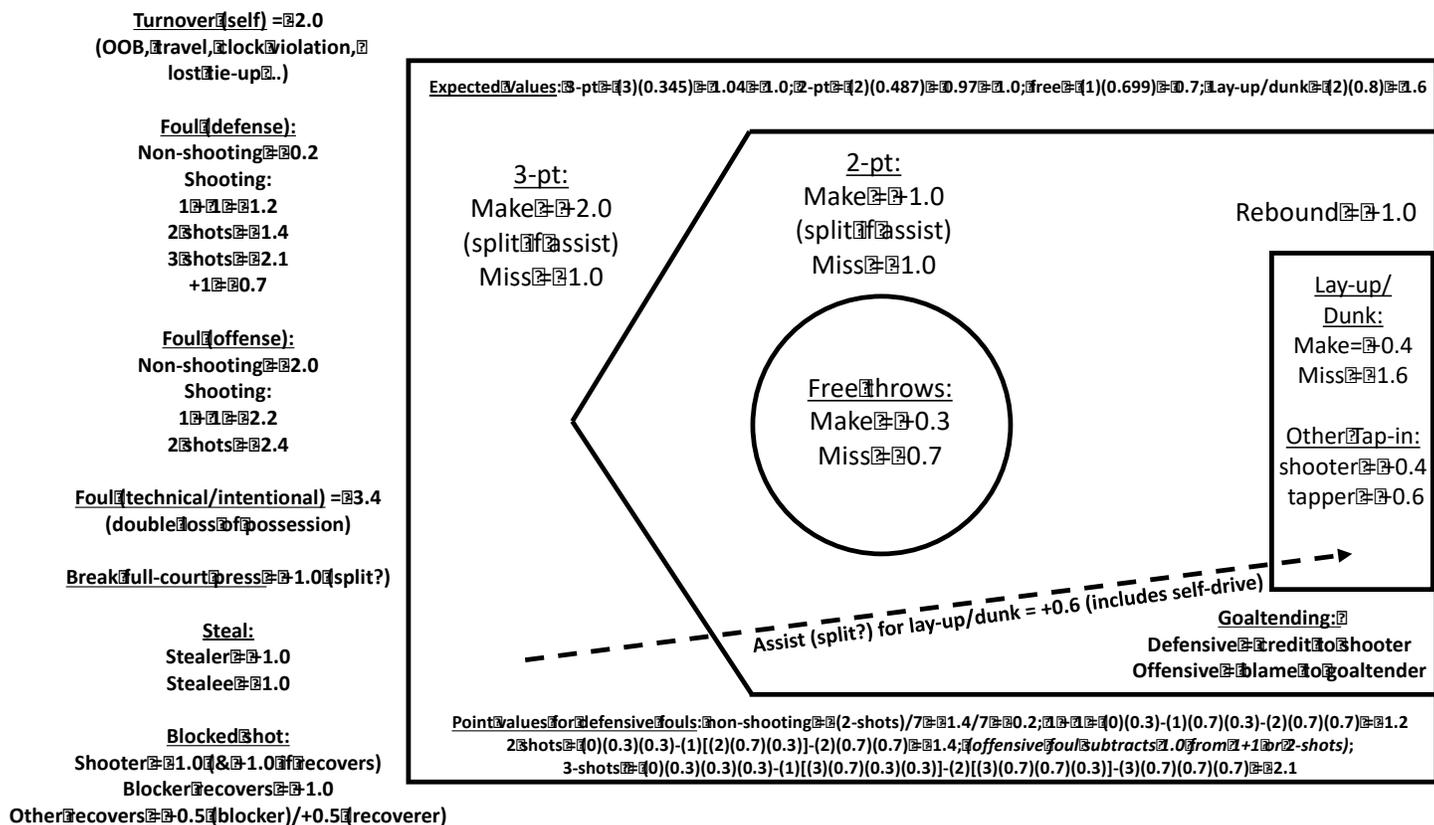


Figure 4. SUV Chart for NCAA Men's Division I Basketball

C. Real Game Examples

Two of the more recent NCAA Men's Championship games have been selected to illustrate the use of SUV for basketball (see References 12 and 13 for play-by-play). The first, Connecticut's 60-54 victory over Kentucky in 2014, illustrates a relatively low-scoring game. The second, Villanova's buzzer-beating 77-74 win over North Carolina in 2016, illustrates a fairly high-scoring game. Excerpts from both games, including final overall SUVs, are shown in Tables 18 and 19, including the overall SUVs for two players from each team (as shown by the yellow and green highlighting).

An illustrative series from 1:52 to 1:31 of the second half of the Villanova-North Carolina (Table 19) game demonstrates the use of the SUV for basketball:

- 1:52 –Justin Jackson commits personal foul (shooting, 2 shots) = -1.4 (Jackson [green highlight, since Jackson is a tracked player])
- 1:52 –Justin Hart misses first free throw (-0.7), but makes the second (+0.3), both in green highlight since Hart is a tracked player
- 1:38 –Mikal Bridges blocks Marcus Paige's 2-point lay-up, but North Carolina recovers = -1.0 (Paige [yellow highlight since Paige is a tracked player])
- 1:31 –Marcus Paige makes 3-point jump shot with assist from Brice Johnson = +1.0 (Paige [yellow highlight]) and +1.0 (no highlight, since Johnson is not a tracked player)

A play at 0:09 from the first half of the same game illustrates a play where tracked players from both teams record SUVs. Josh hart blocks Justin Jackson's 2-point lay-up, earning a +1.0 for Hart and -1.0 for Jackson.

C.1 Summary

A parallel approach to that for football is also applied for the two example games here. This time, we combine the higher and lower scorers separately for the winner and losers as shown in Table 20: (1) winning higher scores = Napier + Booth = Nooth, (2) losing higher scorers = Young + Paige = Yaige, (3) winning lower scorers = Daniels + Hart = Dart, and (4) losing lower scorers = Harrison + Jackson = Harjack. "Plays" include shot attempts, assists, rebounds, fouls, etc.

Again, it may be inappropriate to compare all players together, as they have different roles which may give some more opportunities for positive SUVs (negative ones) than others. Still, since "play-makers" can get credits for positive non-shooting "plays," e.g., steals and assists; "rebounders/defenders" for positive "plays" such as rebounds, both offensive and defensive, blocks, and tap-ins; and, of course, "shooters" for 2- and 3-pointers; plus free throws for all, comparison among all four is more even than it

might be for football. In the examples, there is clear dominance in both cumulative and average SUV by Nooth, and clear “non-dominance” by Harjack. Both Yaige and Dart performed comparably, with a slight edge to Dart for amassing a similar cumulative SUV with less “plays” (indicated by the higher average).

VI. SUV BASKETBALL: “PROOF OF PRINCIPLE”

As with the “Proof of Principle” for baseball and football, the goal again is to track the performance of an individual team. However, rather than select a substantial portion of an entire season (typically around 30 games, excluding any post-season participation), here the five-game run of the Loyola of Chicago Ramblers through the 2018 NCAA Division I Men’s Basketball Tournament is tracked, as it represents a complete microcosm for which the SUV results can be compared to the traditional overall statistics. Over those five games, Loyola won four to reach the Final Four as a Number 11 seed, defeating the following: (1) Miami of Florida 64-62 on March 15, 2018; (2) Tennessee 63-62 on March 17, 2018; (3) Nevada 69-68 on March 22, 2018; and (4) Kansas State 78-62 on March 24, 2018. Their run ended on March 31, 2018, with a loss to Michigan, 69-57. The play-by-play for Loyola for each of these games is taken from Reference 14, with a selected segment reproduced in Table 21 to show the assignment of the SUV statistics to the individual players. Reference 3 contains the complete SUV analyses for all five games.

An interesting and illustrative series for Loyola at the start of the second half of Game 2 vs. Tennessee (below) shows the assignment of the SUVs via Table 21. Cameron Krutwig is key to the first four plays. First, he misses a layup, an SUV of -1.6. However, since a layup is always scored either from an assist by another player or by the scorer himself driving to the basket (self-assist), an additional SUV of +0.6 is always associated with it. Since there is no indication in the play-by-play whether Krutwig’s attempt was the result of another’s assist or his own drive, the +0.6 is placed in the category “Unassigned,” necessary since the missed shot must have a total SUV = -1.0 (as shown in the “Team” column). (Had Krutwig converted the layup, he would have received an SUV of +0.4 and the assister an SUV of +0.6 which, if Krutwig himself, e.g., on a drive, would have given him the full SUV of +1.0.) Krutwig subsequently misses (SUV = -0.7) then converts a free throw (SUV = +0.3), and later pulls down a defensive rebound (SUV = +1.0). Next, Marques Townes misses a three-point shot (SUV = -1.0) then, after a Donte Ingram defensive rebound (SUV = +1.0), converts a layup, assumed to be self-assisted since no other player is credited, as is typical for the play-by-play format when there is an assist. Thus, Townes receives both the layup scorer’s SUV of +0.4 and that of the assister, +0.6, for the full total of +1.0.

Clayton Custer is key to the next three plays. First, he scores three points off an assist from Donte Ingram, splitting the SUV of +2.0 equally between both. He follows with an unassisted three-pointer, for full credit of +2.0. However, next he fouls, resulting in two shots for the opponent and an SUV of -1.4. The opponent missed the second free throw, and Ben Richardson pulled down the defensive rebound (SUV = +1.0). Krutwig subsequently committed an offensive foul, equivalent to a turnover, for an SUV = -2.0. Ingram next misses a three-pointer (SUV = -1.0). Finally, Richardson converts a two-pointer with an assist from Custer, splitting the SUV of +1.0 equally between them. Hopefully, the assignment of SUVs is fairly straightforward. Any anomalies are explained in *bold purple italics* with the play.

A. SUV Analyses

All players’ SUVs were tracked cumulatively through the five games, as shown in Table 22.

B. Comparison vs. “Traditional” Statistics

To provide insights relative to the traditional statistics, the SUVs for the seven players with the most minutes over the five games (highlighted in yellow) are compared against their cumulative “traditional” statistics, compiled in Table 23. The statistics selected for comparison are shown in red, a total of nine in all, again representing both “longevity” (“MIN” = Minutes; “SUM+” = total of rebounds [“REB”], assists [“AS”], steals [“ST”] and blocks [“BLK”]; “Sum-“ = total of turnovers [“TO”] and personal fouls [“PF”]; and total points scored [“PTS”]) and “per Opportunity” (field goal percentage [FG-%], free throw percentage [FT-%], “SUM+” per Minute [“+PM” or “+/M”], “SUM-“ per Minute [“-PM” or “-/M”] and points per Minute [“PPM” or “Pt/M”]). As before for both baseball and football, the statistics for the various categories were normalized, then these normalized values were averaged (“Comp” column). For the SUV comparison, two statistics were considered: Cumulative SUV and SUV per Opportunity, again corresponding to both longevity and “per Opportunity,” respectively, and averaged (“Comp” column). The results from the comparison of the normalized statistics are presented in Table 23. The results show some significant differences in the rankings, particularly for Townes and Williamson. Townes ranks second using traditional statistics, but sixth using SUV. Williamson is the reverse, second using SUV but seventh for traditional. Richardson also stands out as quite a positive performer using the SUV.

Table 21. SUVs from Selected Play-by-Play for Loyola vs. Tennessee at Start of Second Half, March 17, 2018

| Game 2, Loyola-Chi (63) vs. Tennessee (62), 03-17-2018 | | Custer | Ingram | Jackson | Krutwig | Negron | Richardson | Satterwhite | Skokna | Townes | Williamson | Unassigned | Team | |
|--|-------|---------------|---------------|----------------|----------------|---------------|-------------------|--------------------|---------------|---------------|-------------------|-------------------|-------------|---|
| Cameron Krutwig misses two point layup (<i>Unassigned assist credited</i>) | 19:31 | | | | -1.6 | | | | | | | 0.6 | -1.0 | 2 |
| Cameron Krutwig misses regular free throw 1 of 2 | 18:57 | | | | -0.7 | | | | | | | | -0.7 | 1 |
| Cameron Krutwig makes regular free throw 2 of 2 | 18:57 | | | | 0.3 | | | | | | | | 0.3 | 1 |
| Cameron Krutwig defensive rebound after block | 18:39 | | | | 1.0 | | | | | | | | 1.0 | 1 |
| Marques Townes misses three point jump shot | 18:26 | | | | | | | | | -1.0 | | | -1.0 | 1 |
| Donte Ingram defensive rebound | 18:01 | | 1.0 | | | | | | | | | | 1.0 | 1 |
| Marques Townes makes two point reverse layup | 17:52 | | | | | | | | | 1.0 | | | 1.0 | 1 |
| Clayton Custer makes three point jump shot (Donte Ingram assists) | 17:20 | 1.0 | 1.0 | | | | | | | | | | 2.0 | 2 |
| Donte Ingram makes three point pullup jump shot | 16:56 | | 2.0 | | | | | | | | | | 2.0 | 1 |
| Clayton Custer shooting foul (Jordan Bowden draws the foul) - 2 shots | 16:39 | -1.4 | | | | | | | | | | | -1.4 | 1 |
| Ben Richardson defensive rebound | 16:39 | | | | | | 1.0 | | | | | | 1.0 | 1 |
| Cameron Krutwig offensive foul | 16:15 | | | | -2.0 | | | | | | | | -2.0 | 1 |

| | | | | | | | | | | | | | |
|---|-------|------------|-------------|--|--|------------|-------------|-------------|------------|--|--|--|-------------|
| (Grant Williams draws the foul) | | | | | | | | | | | | | |
| Donte Ingram misses three point jump shot | 15:35 | | -1.0 | | | | | | | | | | -1.0 |
| Ben Richardson makes two point jump shot (Clayton Custer assists) | 14:45 | 0.5 | | | | 0.5 | | | | | | | 1.0 |
| Ramblers turnover (shot clock violation) | 13:48 | | | | | | | | | | | | |
| Aundre Jackson personal foul (Derrick Walker draws the foul) - no shot | 13:36 | | | | | | -0.2 | | | | | | |
| Cameron Krutwig personal foul (Derrick Walker draws the foul) - no shot | 13:26 | | | | | | | -0.2 | | | | | |
| Lucas Williamson makes three point jump shot (Cameron Krutwig assists) | 12:26 | | | | | | | | 1.0 | | | | |
| Ramblers defensive rebound | 12:04 | | | | | | | | | | | | |
| Aundre Jackson makes two point layup (Cameron Krutwig assists) | 11:42 | | | | | | 0.4 | 0.6 | | | | | |
| Aundre Jackson misses two point layup (<i>Unassigned assist credited</i>) | 11:01 | | | | | | -1.6 | | | | | | |
| Lucas Williamson defensive rebound | 10:48 | | | | | | | | | | | | |
| Cameron Krutwig makes two point | 10:36 | | | | | | | | 1.0 | | | | |

1
2

| | | | | | | | | | | | | | |
|--|-------|--|--|--|--|--|--|-------------|-------------|--|--|--|--|
| jump shot | | | | | | | | | | | | | |
| Marques Townes defensive rebound | 10:10 | | | | | | | | | | | | |
| Bruno Skokna makes three point jump shot (Marques Townes assists) | 10:03 | | | | | | | | | | | | |
| Audre Jackson personal foul (Grant Williams draws the foul) - no shot | 9:43 | | | | | | | -0.2 | | | | | |
| Cameron Krutwig misses two point layup | 9:03 | | | | | | | | -1.6 | | | | |

Table 22. Cumulative SUVs for Loyola through Each of Five NCAA Tournament Games

| Game 1, Loyola-Chi (64) vs. Miami-FL (62), 03-15-2018 | Custer | Ingram | Jackson | Krutwig | Negron | Richardson | Satterwhite | Skokna | Townes | Williamson | Unassigned | Team |
|--|---------------|---------------|----------------|----------------|---------------|-------------------|--------------------|---------------|---------------|-------------------|-------------------|--------------|
| Cumulatives (Game) | 3.0 | 0.4 | -6.0 | 1.0 | 0.0 | 6.3 | -3.0 | -0.8 | -8.1 | -1.2 | 7.2 | -1.2 |
| Number of Opportunities (Game) | 17 | 26 | 15 | 17 | 0 | 17 | 3 | 2 | 17 | 15 | 10 | 113 |
| SUV per Opportunity (Game) | 0.18 | 0.02 | -0.40 | 0.06 | | 0.37 | -1.00 | -0.40 | -0.48 | -0.08 | 0.72 | -0.01 |

| Game 2, Loyola-Chi (63) vs. Tennessee (62), 03-17-2018 | Custer | Ingram | Jackson | Krutwig | Negron | Richardson | Satterwhite | Skokna | Townes | Williamson | Unassigned | Team |
|---|---------------|---------------|----------------|----------------|---------------|-------------------|--------------------|---------------|---------------|-------------------|-------------------|-------------|
| Number of Opportunities (Game) | 13 | 17 | 25 | 18 | 0 | 15 | 0 | 3 | 19 | 11 | 9 | 109 |
| SUV per Opportunity (Game) | 0.05 | -0.12 | -0.11 | -0.18 | | 0.02 | | 0.20 | 0.34 | 0.38 | 0.49 | 0.08 |
| Cumulatives (Thru 2 Games) | 3.7 | -1.7 | -8.7 | -2.3 | 0.0 | 6.6 | -3.0 | -0.2 | -1.7 | 3.0 | 11.6 | 7.3 |
| Number of Opportunities (Thru 2 Games) | 30 | 43 | 40 | 35 | 0 | 32 | 3 | 5 | 36 | 26 | 19 | 222 |
| SUV per Opportunity (Thru 2 Games) | 0.12 | -0.04 | -0.22 | -0.07 | | 0.21 | -1.00 | -0.04 | -0.05 | 0.12 | 0.61 | 0.03 |

| Game 3, Loyola-Chi (69) vs. Nevada (68), 03-22-2018 | Custer | Ingram | Jackson | Krutwig | Negron | Richardson | Satterwhite | Skokna | Townes | Williamson | Unassigned | Team |
|--|---------------|---------------|----------------|----------------|---------------|-------------------|--------------------|---------------|---------------|-------------------|-------------------|-------------|
| Cumulatives (Game) | 0.9 | -3.8 | -0.6 | 1.0 | 0.0 | -2.2 | 2.0 | -5.2 | -0.5 | -2.0 | 12.2 | 1.8 |
| Number of Opportunities (Game) | 23 | 9 | 18 | 15 | 0 | 17 | 2 | 7 | 27 | 10 | 21 | 120 |
| SUV per Opportunity (Game) | 0.04 | -0.42 | -0.03 | 0.07 | | -0.13 | 1.00 | -0.74 | -0.02 | -0.20 | 0.58 | 0.02 |
| Cumulatives (Thru 3 Games) | 4.6 | -5.5 | -9.3 | -1.3 | 0.0 | 4.4 | -1.0 | -5.4 | -2.2 | 1.0 | 23.8 | 9.1 |
| Number of Opportunities (Thru 3 Games) | 53 | 52 | 58 | 50 | 0 | 49 | 5 | 12 | 63 | 36 | 40 | 342 |
| SUV per Opportunity (Thru 3 Games) | 0.09 | -0.11 | -0.16 | -0.03 | | 0.09 | -0.20 | -0.45 | -0.03 | 0.03 | 0.60 | 0.03 |

| Game 4, Loyola-Chi (78) vs. KS St. (62), 03-24-2018 | Custer | Ingram | Jackson | Krutwig | Negron | Richardson | Satterwhite | Skokna | Townes | Williamson | Unassigned | Team |
|--|---------------|---------------|----------------|----------------|---------------|-------------------|--------------------|---------------|---------------|-------------------|-------------------|-------------|
| Cumulatives (Game) | -4.8 | 4.0 | 1.5 | 4.5 | 0.0 | 9.5 | -3.6 | 1.0 | -3.1 | 1.4 | 4.0 | 14.4 |
| Number of Opportunities | 22 | 22 | 8 | 19 | 0 | 26 | 4 | 1 | 24 | 21 | 6 | 131 |

| | | | | | | | | | | | | | |
|---|--------------|--------------|--------------|-------------|-------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|--|
| (Game) | | | | | | | | | | | | | |
| SUV per Opportunity (Game) | -0.22 | 0.18 | 0.19 | 0.24 | 0.37 | -0.90 | 1.00 | -0.13 | 0.07 | 0.67 | 0.11 | | |
| Cumulatives (Thru 4 Games) | -0.2 | -1.5 | -7.8 | 3.2 | 0.0 | 13.9 | -4.6 | -4.4 | -5.3 | 2.4 | 27.8 | 23.5 | |
| Number of Opportunities (Thru 4 Games) | 75 | 74 | 66 | 69 | 0 | 75 | 9 | 13 | 87 | 57 | 46 | 473 | |
| SUV per Opportunity (Thru 4 Games) | 0.00 | -0.02 | -0.12 | 0.05 | 0.19 | -0.51 | -0.34 | -0.06 | 0.04 | 0.60 | 0.05 | | |

| Game 5, Loyola-Chi (57) vs. Michigan (69), 03-31-2018 | Custer | Ingram | Jackson | Krutwig | Negron | Richardson | Satterwhite | Skokna | Townes | Williamson | Unassigned | Team |
|--|---------------|---------------|----------------|----------------|---------------|-------------------|--------------------|---------------|---------------|-------------------|-------------------|--------------|
| Cumulatives (Game) | -6.5 | 2.1 | -2.9 | -4.6 | -1.0 | -4.6 | -0.4 | -2.8 | -3.6 | -0.4 | 4.6 | -20.1 |
| Number of Opportunities (Game) | 18 | 21 | 16 | 29 | 2 | 16 | 2 | 3 | 23 | 6 | 7 | 131 |
| SUV per Opportunity (Game) | -0.36 | 0.10 | -0.18 | -0.16 | -0.50 | -0.29 | -0.20 | -0.93 | -0.16 | -0.07 | 0.66 | -0.15 |
| Cumulatives (Thru 5 Games) | -6.7 | 0.6 | -10.7 | -1.4 | -1.0 | 9.3 | -5.0 | -7.2 | -8.9 | 2.0 | 32.4 | 3.4 |
| Number of Opportunities (Thru 5 Games) | 93 | 95 | 82 | 98 | 2 | 91 | 11 | 16 | 110 | 63 | 53 | 604 |
| SUV per Opportunity (Thru 5 Games) | -0.07 | 0.01 | -0.13 | -0.01 | -0.50 | 0.10 | -0.45 | -0.45 | -0.08 | 0.03 | 0.61 | 0.01 |

Table 23. Comparison of SUVs and Selected Traditional Statistics, Including Composite Normalization, for Seven Loyola Players with Most Minutes over Five NCAA Tournament Games

| NAME | Min | FG% | FT% | Sum+ | +/M | Sum- | -/M | Pts | Pt/M | |
|------------------|-------|------|------|------|------|-------|-------|------|------|------|
| Cameron Krutwig | 109 | 0.58 | 0.73 | 38 | 0.35 | -18 | -0.06 | 52 | 0.48 | |
| Aundre Jackson | 89 | 0.58 | 1.00 | 16 | 0.18 | -16 | -0.11 | 59 | 0.66 | |
| Clayton Custer | 179 | 0.56 | 0.75 | 31 | 0.17 | -20 | -0.04 | 61 | 0.34 | |
| Lucas Williamson | 117 | 0.40 | 0.43 | 26 | 0.22 | -13 | -0.08 | 23 | 0.20 | |
| Ben Richardson | 168 | 0.54 | 0.80 | 44 | 0.26 | -19 | -0.08 | 41 | 0.24 | |
| Marques Townes | 147 | 0.49 | 0.92 | 41 | 0.28 | -21 | -0.06 | 54 | 0.37 | |
| Donte Ingram | 147 | 0.37 | 0.40 | 39 | 0.27 | -19 | -0.07 | 35 | 0.24 | |
| Mean | 136.6 | 0.50 | 0.72 | 33.6 | 0.25 | -18.0 | -0.07 | 46.4 | 0.36 | |
| Std Dev | 32.7 | 0.09 | 0.23 | 9.9 | 0.06 | 2.7 | 0.02 | 14.0 | 0.16 | |
| Normalized | | | | | | | | | | Comp |
| Cameron Krutwig | 0.20 | 0.82 | 0.52 | 0.67 | 0.95 | 0.50 | 0.78 | 0.66 | 0.76 | 0.65 |
| Marques Townes | 0.63 | 0.44 | 0.81 | 0.77 | 0.70 | 0.13 | 0.69 | 0.71 | 0.52 | 0.60 |
| Clayton Custer | 0.90 | 0.76 | 0.55 | 0.40 | 0.11 | 0.23 | 0.89 | 0.85 | 0.45 | 0.57 |
| Ben Richardson | 0.83 | 0.66 | 0.64 | 0.85 | 0.60 | 0.36 | 0.40 | 0.35 | 0.24 | 0.55 |
| Aundre Jackson | 0.07 | 0.81 | 0.89 | 0.04 | 0.14 | 0.77 | 0.03 | 0.82 | 0.97 | 0.50 |
| Donte Ingram | 0.63 | 0.06 | 0.08 | 0.71 | 0.62 | 0.36 | 0.44 | 0.21 | 0.23 | 0.37 |
| Lucas Williamson | 0.27 | 0.12 | 0.10 | 0.22 | 0.34 | 0.97 | 0.41 | 0.05 | 0.16 | 0.29 |

| Loyola Player | Cumu | SUV/Op | |
|------------------|-------|--------|------|
| Ben Richardson | 9.3 | 0.10 | |
| Lucas Williamson | 2.0 | 0.03 | |
| Donte Ingram | 0.6 | 0.01 | |
| Cameron Krutwig | -1.4 | -0.01 | |
| Clayton Custer | -6.7 | -0.07 | |
| Marques Townes | -8.9 | -0.08 | |
| Aundre Jackson | -10.7 | -0.13 | |
| Mean | -2.3 | -0.022 | |
| Std Dev | 7.0 | 0.08 | |
| Normalized | | | Comp |
| Ben Richardson | 0.95 | 0.94 | 0.95 |
| Lucas Williamson | 0.73 | 0.76 | 0.74 |
| Donte Ingram | 0.66 | 0.64 | 0.65 |
| Cameron Krutwig | 0.55 | 0.54 | 0.55 |
| Clayton Custer | 0.26 | 0.26 | 0.26 |
| Marques Townes | 0.17 | 0.23 | 0.20 |
| Aundre Jackson | 0.11 | 0.08 | 0.10 |

B.1 Sensitivity Analyses

To examine these differences, a pair of sensitivity analyses were performed, focusing on the SUV statistics suspected of playing the primary role in these differences. First, not all missed shots are the same. Missed two-pointers and three-pointers receive an SUV of -1.0. However, missed lay-ups, unless self-assisted, receive an SUV of -1.6, i.e., there is more “negativity” assigned to missing a layup, supposedly the easiest of shots. Second, turnovers, including offensive fouls, are severely penalized, receiving an SUV of -2.0. Third, personal fouls resulting in shots for the opponent also receive more negative SUVs than missed shots (other than self-assisted layups): ranging from -1.2 to -2.1. Finally, missing one free throw (SUV = -0.7) offsets converting a pair (+0.6, or +0.3 each). These “negatives” are not necessarily reflected strongly in traditional statistics, unlike the SUV.

The sensitivity analyses addressed the first two categories: SUV = -1.6 for other than self-assisted missed layup and turnovers. For the first analysis, ALL missed layups were assumed to be self-assisted, reducing the negativity of the SUV from -1.6 to -1.0. The results are shown in Table 24. Note that Townes now trades ranks with Custer, with a significantly reduced negative SUV (now only -2.9 vs. previous -8.9). The effect on Williamson is minor. The second analysis further reduces the negativity of a turnover from -2.0 to -1.0 (assigning the remaining -1.0 to “Unassigned”), with the results in Table 25. While Custer and Townes switch positions again, note that Townes now acquires a very positive SUV of +8.1. Williamson’s SUV also increases, although the net result since all players experience increases is a drop from second to fourth.

Interestingly, both sensitivity analyses preserve Richardson at the top and Jackson at the bottom. Therefore, while aggregation of the traditional statistics appears to suggest all but Ingram and Williamson of being fairly equally positive contributors (Composite normalized statistics in a fairly tight range from 0.50 to 0.65), the SUV Composites show Richardson as a stand-out top performer, with Williamson, Ingram and Krutwig next (range from 0.74 to 0.55), followed by Custer, Townes and Jackson. The differences in ranks are most likely the result of SUV assigning relatively significant “negatives” to detrimental plays, both offensively (missed layups and turnovers) and defensively (fouls that result in opponent free throws).

VII. CONCLUSION

Following the development and “Proof of Principle” for the SUV statistic for major league baseball, similar endeavors were made for both professional football and men’s college basketball. Both followed the philosophy of assigning a value to each discrete entity that characterizes each sport: each at-bat for baseball; each play, comprised of field position, down and “yards to go” for a first down in football; each play in basketball that results in a shot (made or missed), foul, or turnover. As with baseball, the SUV statistics for football and basketball proved to be functional in measuring individual player performance via one overarching statistic. Results from the “Proof of Principle” exercises showed very good agreement with traditional statistics for football while uncovering some possibly unique insights that would lead to different conclusions in basketball from traditional statistics. For the latter, the SUV appears to incorporate the effect of “negative” outcomes more effectively than traditional basketball statistics.

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Table 24 And 25. SUV Sensitivity Analyses for (1) Assuming ALL Missed Layups to be Self-Assisted, and (2) Further Reducing the Negativity of a Turnover

| Lovola Player | Cumu | SUV/Op | All missed layups now -1.0 instead of split of -1.6/+0.6 |
|-----------------------|-------|--------|--|
| Ben Richardson | 9.9 | 0.11 | |
| Lucas Williamson | 2.6 | 0.04 | |
| Cameron Krutwig | 2.2 | 0.02 | |
| Donte Ingram | 0.6 | 0.01 | |
| Marques Townes | -2.9 | -0.03 | |
| Clayton Custer | -4.3 | -0.05 | |
| Audre Jackson | -4.1 | -0.05 | |
| Mean | 0.6 | 0.01 | |
| Std Dev | 5.0 | 0.06 | |
| Normalized | | | Comp |
| Ben Richardson | 0.97 | 0.96 | 0.97 |
| Lucas Williamson | 0.66 | 0.72 | 0.69 |
| Cameron Krutwig | 0.63 | 0.60 | 0.61 |
| Donte Ingram | 0.50 | 0.49 | 0.50 |
| Marques Townes | 0.24 | 0.27 | 0.26 |
| Clayton Custer | 0.166 | 0.167 | 0.167 |
| Audre Jackson | 0.176 | 0.151 | 0.164 |

| Lovola Player | Cumu | SUV/Op | All missed layups now -1.0 instead of split of -1.6/+0.6 AND turnovers/offensive fouls now split of -1.0/-1.0 instead of -2.0 |
|-----------------------|------|--------|--|
| Ben Richardson | 15.9 | 0.17 | |
| Cameron Krutwig | 14.2 | 0.14 | |
| Lucas Williamson | 6.6 | 0.10 | |
| Donte Ingram | 8.6 | 0.09 | |
| Clayton Custer | 7.7 | 0.08 | |
| Marques Townes | 8.1 | 0.07 | |
| Audre Jackson | 1.9 | 0.02 | |
| Mean | 9.0 | 0.10 | |
| Std Dev | 4.7 | 0.05 | |
| Normalized | | | Comp |
| Ben Richardson | 0.93 | 0.94 | 0.93 |
| Cameron Krutwig | 0.86 | 0.82 | 0.84 |
| Donte Ingram | 0.47 | 0.43 | 0.45 |
| Lucas Williamson | 0.31 | 0.54 | 0.43 |
| Clayton Custer | 0.39 | 0.37 | 0.38 |
| Marques Townes | 0.42 | 0.30 | 0.36 |
| Audre Jackson | 0.07 | 0.06 | 0.06 |

Can Self-Efficacy By Enlarging The Image Of Smoking Deadly Disease On Packaging Reduce Students' Motivation To Smoke ?

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Abstract- Smoking is the biggest public health problem in the world. Many studies have only focused on preventing smoking behaviour, but the one which is also important is reviewing what triggers the students' motivation to smoke and then stopping their behaviour. The main predictors of behavior change are seen from motivation.

The purpose of the study is to analyze the factors that influence students' smoking intentions at Widya Dharma University of Klaten. The quantitative research method was carried out with a cross-sectional causal analysis approach. The sample used was 200 students of Widya Dharma University with purposive sampling technique. The research instrument used interviews and questionnaires. The final results found a causal model as an identification effort in the form of the influence of smoking knowledge as an active smoker and the value of self-efficacy assessing the danger of smoking through packaging images with smoking motivation. Future research should focus on reducing the motivation and causes of students' smoking

Keywords : *Motivation, planned behavior theory, smoking students*

I. INTRODUCTION

Smoking is one of the biggest public health problems in the world. Smoking is estimated to kill 5 million people per year for active smokers and former smokers, and kill 600.000 passive smokers [1]. Approximately one person dies every six seconds due to smoking [2].

Cigarette smoke contains more than 4000 toxic chemicals and more than 40 kinds of carcinogen that are at risk for cancer. Three main ingredients which are dangerous are nicotine, tar and carbon monoxide [3]. Smoking is a risk factor for the incidence of diseases such as cardiovascular disease, cancer, stroke, bronchitis, asthma, pneumonia and other respiratory diseases [4].

Smoking is suspected of killing 400.000 people in Indonesia each year due to smoking-related diseases [5]. Indonesia ranks third as the country with the largest number of smokers in the world after China and India as well as the fifth country with the largest level of cigarette consumption after China, the United States, Russia and Japan [6]. Nationally in 2010 the number of smokers aged 15 years and over was 34.7% with male smokers as much as 65.9% and women as much as 34.1%. [7]

Many studies are focused on preventing smoking behavior. However, one which is also important is analyzing how smokers then stop their behavior. Quitting smoking is a radical behavior change [8]. The addictive effect/nicotine addiction is one of the biggest obstacles in the process. Quitting smoking is influenced by four aspects, namely physiological, psychological, environmental and social factors. [9]

Seeing the fact of the high number of smoking male students of Widya Dharma University, the researcher needs special handling in the field of behavioral science. This is worth being researched. From a number of background problems above, it can be drawn the research problem: "What variables have an effect on motivating students of Widya Dharma University to smoke based on Theory of Planned Behavior?"

II. LITERATURE REVIEW

Intention is the main predictor of behavior [10]. Theory of Planned Behaviour states that intention is influenced by attitudes, subjective norms and self-control. [10] [12]

Theory of Planned Behaviour (TPB) is the development of Theory of Reasoned Action (TRA). TRA/TPB was first put forward by Fishbein and Ajzen in 1980, so it was also called the Fishbein-Ajzen theory. [13] This theory emphasizes the importance of intention in behavior. Furthermore, TPB tries to explore the relationship between intention and subjective attitudes and norms and perceived behavioral control that surrounds individuals. [13]

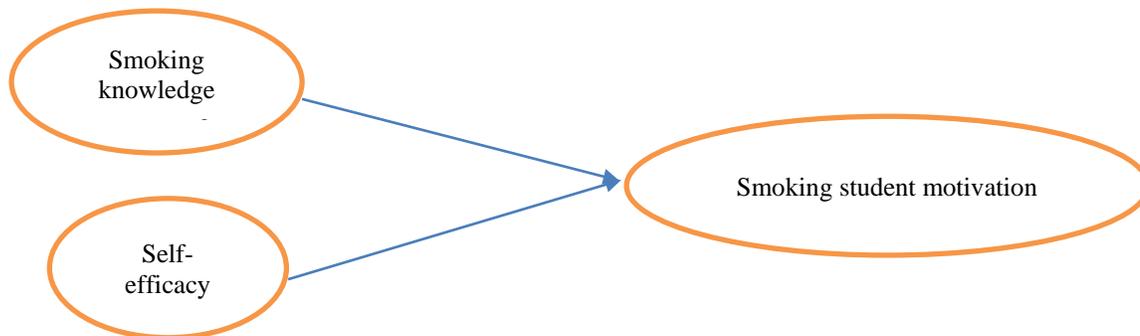
There are three things that must be considered in TPB that can influence the intention to behave, namely attitude toward behaviour, subjective norms and perceived behavioral control. Attitudes are influenced by two aspects, namely a person's beliefs about what happens when they perform the expected behavior (behavioral belief) and an evaluation of whether the output results are related (evaluation of behavioral outcomes). [13]

Subjective norms are the result of one's beliefs about what other people or social groups think about their behavior (normative belief) combined with motivation to adjust to social norms (motivation to comply) which underlies a person behaving in accordance with the norms expected by his social environment. [13]

Another variable that influences intention is the existence of self-control which is influenced by the belief in the factors that make it easier or more difficult to behave (control belief) and how much power has to be possessed to use (perceived power) based on factors that can facilitate behavior. [13]

III. RESEARCH METHODS

1. Research Model



2. Data Collection Method

This study uses primary data, namely data related to the variables under study. Data were collected through questionnaires obtained from sources who had knowledge of the topic under study. Besides that, secondary data were also used in the form of library resources, notes, archives and documents.

3. Data Collection Techniques

- Interviews, conducted to obtain matters relating to the general description of the institution and the strategic planning that had been done.
- To obtain information about service satisfaction, researcher distributed questionnaires to students who smoked.
- Library Studies, conducted to obtain supporting data needed.

4. Sampling Method

In this study, the survey method was used as the main tool. Thus not all individuals in the population were examined because of limited time, cost and accessibility. Population, what is meant by the population in this study are all students of Widya Dharma University who smoked. Samples, subject characteristics used as samples in this study were 200 students of Widya Dharma University who smoked taken by purposive sampling. Respondents accessed in this study were students/adult groups, with the consideration that they had a good understanding in measuring self-motivation.

5. Data Analysis

In this study three analyzes were carried out in the form of quantitative data description, quantitative regression test, correlation with several modifications to the improvement of question items for objects.

IV. RESULTS AND DISCUSSION

1. Distribution of Respondents

The study was conducted in March to April 2019 at Widya Dharma University of Klaten with the characteristics of the respondents' data were all men, the age of the majority of respondents was 22 years, the most study programs came from the Faculty of Economics and semester 6. So it was concluded that the majority of respondents were adults, conscious and possessed sufficient knowledge related to smoking motivation and the majority came from the Faculty of Economics which had the dominant number of students in Widya Dharma University.

2. Test Validity

A measurement scale is said to be valid if the scale is able to measure what should be measured. For example the nominal scale that is non parametric is used to measure nominal variables, not to measure interval variables that are parametric. There were 3 (three) types of measurement validity, namely: a. Content validity, here concerned the level of scale items that reflected the concept domain that was being studied. Dimensions in a particular concept domain could not all be

calculated because the domain sometimes had multidimensional properties, b. construct validity, was related to the degree to which the scale reflected and acted as the concept being measured. This validity was theoretical and statistical, c criterion validity, this validity concerned the level problem where the scale being used was able to predict a variable designed as a criterion. To calculate the validity of a questionnaire, correlation technique was used which compared between the score values and tables.

In the initial stage of the study the respondents' answers were tested then compared to r statistical table. From the test results, all valid data were obtained. Thus it is said that all items in the questionnaire question were valid.

3. Reliability Test

The item reliability test is used to determine the extent to which measurements can provide the same or consistent results if re-measurements are made on the same subject. This test was carried out through 3 methods, namely: a. retest, done by testing questionnaires to certain groups, b. parallel test, gave questionnaires to certain groups, then the group was tested with instruments whose content was equivalent. Then the values of the two tests were correlated, 3. Split-half test was done by dividing the scores randomly in even and odd forms of all respondents' answers.

Table 1 List of reliability test items

| Factor | Cronbach Alpha | required Cronbach Alpha | Status |
|------------|----------------|-------------------------|----------|
| Knowledge | 0.839 | 0.8 | Reliable |
| Efficacy | 0.896 | 0.8 | Reliable |
| Motivation | 0.903 | 0.8 | Reliable |

The reliability test results show all dimensions of the three factors were greater than the Cronbach alpha value required, which is 0.6. So that the three dimensions passed the test by being stated reliable, and can be used in the advanced test stage.

4. Quantitative Regression Test

Table 2 Model Summary Model

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1 | .706 ^a | .498 | .439 | .725 |

a. Predictors: (Constant), Self-efficacy, smoking knowledge

The R square output of 49.8 percent shows the percentage of the contribution of influence of respondents' knowledge with smoking and self-efficacy on smoking motivation was as much as 49.8 percent or variations in the independent variables used in the model were able to explain 49.8 percent of independent variables, the remaining was influenced by other variables such as subjective norms and others.

Table 3 ANOVA^a

| Model | Sum of Squares | Df | Mean Square | F | Sig. |
|--------------|----------------|----|-------------|-------|-------------------|
| 1 Regression | 8.871 | 2 | 4.436 | 8.446 | .003 ^b |
| Residual | 8.929 | 17 | .525 | | |
| Total | 17.800 | 19 | | | |

a. Dependent Variable: Smoking Intention

b. Predictors: (Constant), Self-efficacy, smoking knowledge

The test F tests whether the independent variables simultaneously affect the independent variables, it was obtained F count of 8.446 and greater than F table 3.592. This means that knowledge of smoking and self-efficacy simultaneously influenced the students' motivation to smoke.

Table 4. Regression Coefficients^a

| Model | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|-------------------|-----------------------------|------------|---------------------------|-------|------|
| | B | Std. Error | Beta | | |
| 1 (Constant) | 6.238 | 1.622 | | 3.846 | .001 |
| Smoking knowledge | .375 | .100 | .648 | 3.756 | .002 |
| Self-efficacy | -.149 | .114 | -.225 | 3.305 | .009 |

a. Dependent Variable: Smoking Intention

Regression test obtained the equation $Y = 6.238 + 0.0375 X_1 - 0.149 X_2$ with significant 0.002 and 0.09, which means that the independent variables were significant and the value of t count was all greater than t table 2.110. From this test the value of alternative hypothesis means that partially the knowledge of smoking and self-efficacy affected the motivation of smoking students with a positive coefficient of smoking knowledge and negative coefficient of self-efficacy.

The results show that knowledge and value of self-efficacy are indicators that influence the motivation of smoking students of Widya Dharma University. The value of self-efficacy has a negative coefficient on student motivation to smoke, meaning that the more aware the respondent of various deadly diseases that can be life-threatening due to nicotine will reduce the respondents' motivation to smoke. This is in accordance with Tisnowati et al's research [14] that respondents who are aware, actually they believe in the risks and adverse consequences of smoking that can endanger themselves.

V. CONCLUSION AND SUGGESTION

The results show that knowledge and self-efficacy factors significantly influence the students' motivation to smoke. The most dominant factor that influences the students' motivation to smoke is the respondents' knowledge of smoking.

Recommendation that can be given is that it needs further research on other factors related to student motivation to smoke such as subjective norm variables. Research also does not stop at motivation, but also at the stage of analyzing student smoking behavior. From interviews to respondents it was obtained information that they saw pictures of deadly diseases caused by smoking, making them worry about their health. This statement is in accordance with the Research of the Indonesian Public Health Expert Association [15] where different public opinions were obtained regarding images on cigarette packaging due to deadly diseases with size portions of 40 percent, 75 percent and 90 percent. Photographs of the danger of a deadly disease due to smoking can continue to be enlarged on cigarette packaging so that respondents are more aware and reduce smoking motivation

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The Development of Pop Up 3D General Map Using Discovery Learning Models to Improve Creativity and Learning Outcomes of Social Studies Grade V Elementary School

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Abstract- The researcher was interested in developing learning media "3D Pop Up general map". This study aims to develop a 3D Pop Up general map media and describe the feasibility and effectiveness of improving the creativity and learning outcomes of social studies material in the Indonesian geographical characteristics of grade V elementary school. This research was conducted in Ujung IX/ 34 SDN, Semampir, Surabaya in the second semester of the 2018-2019 academic year. The development of learning media in this study uses a 4-D model. In this study used instruments in the form of validation sheets, student activity observation sheets during learning, teacher and student response questionnaires to the media, student learning creativity observation sheets, and learning outcomes tests, affective and psychomotor observation sheets. The results of the study show: (1) the learning media developed meet the criteria: (a) the validity shown through the validator's assessment of the learning media is very good; (b) feasibility is shown through teacher and student responses to positive media questionnaires; (c) effectiveness, indicated by student activities in learning in the ideal time span, observations of student learning creativity when learning increases, completeness of cognitive, affective and psychomotor learning outcomes also increases. Thus the "3D Pop Up general map" can be used as an alternative to social studies learning in the fifth grade of elementary school.

Index Terms- Pop Up 3D General Map; Discovery Learning Models; Creativity; Learning Outcomes; Social Studies

I. INTRODUCTION

Changes are part of an exchange, increase or decrease in value of a thing. According to Tilaar (2012, p.32) there are three major changes in power that change human life today, namely: first, democracy; second, the progress of science and technology; and third, globalization. One of the efforts to change is by revising the education curriculum in Indonesia.

In the 2013 revised edition of Curriculum, it was more oriented towards strengthening the character of students who had been strengthened by Presidential Regulation Number 87 of 2017 concerning Strengthening Character Education. This requires the teacher to be able to strengthen the character of the students by

applying the main values of character that is religious, nationalist, independent, cooperative and good competence in learning activities. In addition to this, students must also be prepared to face global challenges, one of which is the industrial revolution 4.0. The availability of 21st Century skills can be a character enhancer for students, because it contains basic literacy competencies, critical thinking and problem solving, creativity and communication. Strengthening character education is the foundation of national education that strengthens the 2013 Curriculum.

One effort to familiarize and develop several competencies such as critical thinking, problem solving, creative and communication skills by involving students directly in solving contextual problems and poured in an idea in the form of creative representative work. In order to support this, we need a learning media that can inspire and activate students in the learning process. This is similar to the opinion of Asyhar (2011, p. 8) who concluded that "learning media are all things that are useful for sending messages from learning sources to recipients in a structured manner, so as to create a learning atmosphere that is conducive, effective and efficient."

Researchers tried to create 3D-based learning media with Pop Up drawing techniques, based on the opinions of these experts. The meaning of Pop Up pictures according to Rubin (2015, p.87) states that Pop Up means an imagination that when opened, paved, or lifted, will give rise to an impression with a three-dimensional appearance.

The choice of media is also associated with the level of cognitive development of students. The media is considered to have a match if applied to fifth grade elementary school students. This is based on the theory of Piaget (2010, p. 176) who states that at the age of 7-11 years, children are at the level of concrete operational thinking, which means children have the competence to think critically and logically.

Elementary school students in the 2013 Curriculum, the substance of the material on social studies subjects is suitable to be applied in 3D media with Pop Up techniques applied to the theme 9 Around Us which decomposes on the 2 Objects in Economic Activities and Subtem 3 Humans and Objects in the Environment. In the theme and sub-theme KD which contains the substance of social studies subjects namely KD 3.1 and KD 4.1

Based on this, the example of 3D Pop Up media that is considered appropriate is by making a general map that displays non-physical conditions (tribe, art, economic life, social, means of communication and transportation) and physical conditions in the form of geographical conditions (natural environment such as: mountains, oceans, lakes, beaches and plains). This media was chosen because the study sample had never used the Pop Up media which was modified by displaying a general map and cultural elements as its supporters in learning.

In the early stages of graphic media design in the form of front and back cover, blind maps of islands in Indonesia such as Sumatra, Java, Kalimantan, Papua, Sulawesi, Bali and Nusa Tenggara using the corel draw application, determine the size of the media which is then printed on ivory paper 310 grams in the form of a book, preparing the necessary images both in the form of 2D images and 3D images. 2D images are printed on sticker paper which includes natural features of mountains, highlands, lowlands, beaches, lakes and rivers, as well as images of airports and ports as modes of transportation. While 3D images made with the impression of Pop Up are printed using duplex paper and on the back are given steofofoam corks that have been glued together as a barrier to stand.

In addition to the media and subject matter chosen, to further optimize the learning outcomes and creativity of students, it is necessary to design learning according to syntax by using one of the learning models in the 2013 Curriculum. The intended learning model is Discovery Learning. According to Budiningsih (2005, p.43), "Discovery Learning Model is an effort to learn to understand concepts, meanings, and correlations through the process of discovery and search independently so that conclusions can be drawn." The existence of Pop Up based 3D general map learning media developed and applied using the Discovery Learning learning model also makes it the basis for solving problems in conventional and classical learning. The cognitive aspects that learners get not only in stage (C1), but to reach the stage (C5), which is able to create a creative work, as expressed by Bloom's on the taxonomy in Suyono (2011, p.169).

One of the foundations that also strengthens this research is the previous research entitled " Development Media of Pop Up Book in Event Value Nationalism Education Around Proklamasi to Enhance Critical Thinking of Grade V Elementary Students" by Aeni (2017) stating that "1) Media Pop Up Book is stated as valid and very useful for its feasibility as an enrichment book in clarifying the values of nationalism. 2) The use of Pop Up media is very helpful for students in clarifying the values of nationalism. 3) There is an increase in critical thinking of students using Pop Up media. "

This study aims to find out: 1) the process of developing the media; 2) media feasibility; 3) the effectiveness of the 3D general map media with the Discovery Learning model in improving the creativity and learning outcomes of social studies material in the geographical characteristics of Indonesian elementary school students.

The theoretical contribute provided in this study include: 1) providing information in the form of a process of finding answers to questions scientifically; 2) explore in-depth understanding of the substance of research which includes the content of social studies learning in the material geographical characteristics of Indonesia. While the practical contribute

include: 1) for researchers it is useful to increase understanding of practice (professional development) by expert teams and to improve the situation where practice is implemented; 2) for other researchers it can be useful as a source of inspiration for compiling research; 3) for schools it can be useful to inspire educators to overcome problems in teaching and as an effort to improve the quality of learning in schools; 4) for educators to be inspired to carry out learning by using innovative learning models and media in delivering material and giving their assignments. So that it can activate students and improve their learning outcomes.

II. RESEARCH METHODS

The approach of this research is quantitative research. Research using quantitative methods is research that focuses on the use of variables and the relationship between variables one with other variables Riyanto (2007, p.152). Quantitative methods focus on using numbers with random sampling and data processed with statistics that aim to test hypotheses.

This research is included in the type of research and development (R & D) which aims to develop learning media. Learning media developed in this study are Pop Up based 3D general map media on IPS material characteristic of geographical conditions. According to Sugiyono (2010, p. 407) development research is a type of research that aims to create certain works, test the validity, efficiency and efficiency of the work. The media developed in this study used a 4-D model consisting of 4 stages, namely define, design, develop and dessiminate.

The population in this study was carried out on the fifth grade students of Surabaya UJUNG IX SDN, which consisted of 134 VA students, VB, VC, and VD. While the random sample chosen came from the VB class which amounted to 33 people, with a total of 15 male students and 18 female students.

The VB class was chosen as the research sample as the implementation class and the VD class was chosen as the trial class based on the results of the initial study, namely the Social Studies learning outcomes data in 3.1 KD KD 4.1 showed lower values compared to VA and VC classes.

Research on the development of *Pop Up* 3D general map learning media was carried out at UJUNG IX SDN located on Jl. Sawahpulo No. 1, Semampir District, Surabaya. In April 2019.

Based on the design and design of the research, the development research procedures are as follows: 1) Define stage (defining), the objective at this stage is to determine and provide definitions of learning needs by analyzing the purpose and scope of the material. description of activities at this stage include: initial-end analysis, student analysis, concept analysis, material analysis and assignments, formulation / specification of learning objectives. 2) Stage design, the drafting phase of the learning media includes the following steps: test preparation, media development, format selection, initial design of learning media. 3) Stage develop, the development stage serves to produce the second draft text that has been improved based on expert advice and the data obtained from the experiment dealing with learning media includes the following activities: a) Appraisal of experts learning, the media that have been designed in draft I will be evaluated or verified by a team of experts, the verifiers are people who have competence in the field of social studies

subjects and interested parties with the preparation of a general map of 3D Pop Up, as well as parties who can provide constructive criticism and suggestions in compiling learning media. The criticism and explanation will later be taken into consideration to improve draft I which then continues to draft II. The following are the validated components including: content validation, display validation, language validation, practical validation and validation of efficiency and effectiveness. b) Limited trial, the implementation of learning media trials was carried out after producing draft II on the research subject. The Observer was asked to write down all the actions obtained from the activities and responses of the students. These results will be useful as material for improving learning media in this study. Limited testing was conducted on social studies subjects regarding the geographic characteristics of students of SDN UJUNG IX in VD class, Surabaya. This media trial design uses one group pre-test post-test design in the following table:

Table 2.1 One Group Pre-test Post-test Design

| Class | Pretest | Perlakuan | Posttest |
|-------|---------|-----------|----------|
| Trial | T1 | X | T2 |

Information:

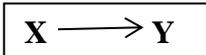
T1: Initial test to see student mastery before learning takes place, used to test the sensitivity of the test item.

T2: Final test to see the mastery of students after learning take place.

X : Treatment in the trial class

T1 = T2

Research design at the development stage uses a trial design with one data collection. This design is described as follows:



X: Treatment, namely social studies learning with a general map of 3D Pop Up through the Discovery Learning learning model in the sub-topics of Indonesia's geographical characteristics.

Y: The results of the observation after the treatment was done, namely describing the activities of the students, the implementation of the lesson plan using the Discovery learning model with the 3D Pop Up general map media (educator activities), the value of creativity, and student learning outcomes (attitudes, skills and knowledge).

Zainal (2009, p.129)

r_{xy} Data collected from the media development comes from the development procedure data using a 4D model that includes the stages of defining (designing), the design stage (design), the stage of development (develop), and the stage of distribution (desseminate). In addition to these data, there are also media validation data and learning tools derived from expert evaluations in the form of validation sheets.

sheets.

The collected data comes from the student response questionnaire and evaluation of the questionnaire responses by educators to this learning media. In the questionnaire response to the media used there are 4 alternative answers for each item statement, namely very good, good, sufficient, and lacking. Measurements in the questionnaire response to the media of this study using scoring rules. The data collected comes from data on the value of creativity and learning outcomes of students which includes the realm of knowledge, attitudes, and skills.

This study uses a validation sheet for the development of media and learning devices by validators, media validation sheets derived from student and teacher response questionnaires to the media, validation sheets for media use effectiveness obtained from student creativity assessment sheets and student learning outcomes assessment sheets.

Data from the validation by experts were identified by considering the results of evaluations, criticisms and expert suggestions regarding learning devices. The validated devices included RPP, LKPD, THB knowledge, observation sheets, teaching materials, 3D Pop Up general map media, media response questionnaires, and grades creativity. Validation analysis of learning devices using validity test. According to Sugiyono (2014, p.121), the instrument is said to be valid if the tool to obtain data is also valid. If it is valid, the instrument is ready to be used to measure all things that can be measured. The validity test in this study uses component identification by checking scores per item with the final score derived from the total score of each item. If there are components that do not meet the requirements, then the component needs to be examined more deeply. Sugiyono (2012, p. 124), said there are two conditions that need to be fulfilled, namely:

1) If $\geq 0,3$, then the question item from the questionnaire is declared valid

2) If ≤ 0.3 , then the question item from the questionnaire is invalid. The correlation formula based on *Pearson Product Moment* according to Sugiyono (2014: 183) is as follows:

= Correlation coefficient

= Number of multiplications of variables x and y

= Number of variable values x

= Number of variable values y

= Number of powers of the value of variable x

= Number of powers of two variable values y n

= Number of samples

The correlation coefficient interpretation is based on a guideline table on the validity of learning devices.

$$R_{xy} = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

Table 2.2 Guidelines for Providing Validity Interpretations

| Relationship Level | Coefficient Interval |
|--------------------|----------------------|
| 0,0 – 0,25 | Less Valid |
| 0,26 – 0,50 | Valid enough |
| 0,51 – 0,75 | Reliable |
| 0,76 – 1,00 | Very Valid |

Learning devices are said to be good, if each device is in the "valid" category, or "very valid". Sugiyono (2014: 121) said that the reliability test carried out repeatedly on the same object, will get the same data. In this study the reliability of each instrument used the cronbach 'alpha (α) coefficient with the help of SPSS. The instrument is reliable if the value of cronbach 'alpha (α) is greater than 0.6. According to Saifuddin Azwar (2007: 78) the formula used is as follows:

$$\alpha = \left[\frac{k}{k-1} \right] \left[1 - \frac{\sum S_j^2}{S_x^2} \right]$$

= Value of reliability
 = Number of questions
 = Amount of item variance
 = Total variance

Table 2.3 Guidelines for Providing Interpretation of Reliability

| Relationship Level | Coefficient Interval |
|--------------------|----------------------|
| 0,0 – 0,25 | Less Valid |
| 0,26 – 0,50 | Valid enough |
| 0,51 – 0,75 | Reliable |
| 0,76 – 1,00 | Very Valid |

This study uses descriptive quantitative data analysis techniques with percentage techniques.

Percentage of learning creativity = $\frac{\text{the number of each scores for each subject score}}{\text{maximum score}} \times 100\%$

Finding the average learning creativity of students with the formula:

$$x = \frac{\text{the percentage of the creativity value students}}{\text{number of students}}$$

Arikunto (2006, p.282) argues that quantitative data in the form of numerical processing results are obtained in a total way and compared with the desired amount to get a percentage result. Determination of values is categorized according to Hadi in Arikunto, (2011, p. 250) are: very high (81% -100%), high (61% -80%), sufficient (41% - 60%), low (21% - 40%), very low (<21%). This technique is often called quantitative descriptive

analysis with percentage techniques. Based on the explanation above, the results of calculating the percentage of this study are converted into the following categories:

Table 2.6 Categories of IPS Learning Creativity Students in Class V

| Category | Percentage |
|-----------|------------|
| Very high | 81%-100% |
| High | 61%-80% |
| Enough | 41%-60% |
| Low | 21%-40% |
| Very low | < 21% |

Data obtained from the learning outcomes test is then processed to determine individual completeness.

$$\text{Cognitive completeness} = \frac{\text{total for each subject score}}{\text{total maximum score}} \times 100\%$$

Individually the students are declared complete if the average achievement of the indicators has met the minimum completeness criteria (KKM) that have been set. Individuals are said to be complete if they have reached $KKM \geq 75\%$ (Ministry of National Education, 2006). The questions used in students' cognitive tests are tested for their validity, reliability, and sensitivity to ensure the accuracy of the questions used.

$$\text{Affective completeness (Ka)} = \frac{\text{total for each subject score}}{\text{total maximum score}} \times 100\%$$

Table 2.7 Criteria for affective completeness

| Score | Criteria |
|--------------------------|-----------|
| $1,00 \leq Ka \leq 1,50$ | Less |
| $1,50 < Ka \leq 2,50$ | Enough |
| $2,50 < Ka \leq 3,50$ | Good |
| $3,50 < Ka \leq 4,00$ | Very Good |

(Permendikbud No. 104 of 2014)

Individually students are declared complete if the affective value achievement meets the minimum criteria of "good".

$$\text{Psychomotor completeness (Kp)} = \frac{\text{total for each subject score}}{\text{total maximum score}} \times 100\%$$

Table 2.8 Criteria for affective completeness

| Score | Criteria |
|--------------------------|-----------|
| $1,00 \leq Ka \leq 1,50$ | Less |
| $1,50 < Ka \leq 2,50$ | Enough |
| $2,50 < Ka \leq 3,50$ | Good |
| $3,50 < Ka \leq 4,00$ | Very Good |

(Permendikbud No. 104 of 2014)

Individually students are declared complete if the psychomotor value achievement meets the minimum criteria of "good".

III. RESULT AND DISCUSSION

The feasibility of the 3D Pop Up general map media can be seen from the results of the questionnaire responses of educators and students to the media in the trial class (class VB SDN UJUNG IX / 34). Based on the results of filling in the educator's response questionnaire to the media, the average score was 88.33% with the positive response category. Based on the results of filling in the questionnaire responses of students to the media it is known that the average value of the percentage of responses from 24 students is in the range of 80 - 90%, while 9 students are in the range of 91 - 100%. so that it can be

concluded that the response of students to the media is positive. The results of this study are also supported by research conducted by Sholikhah (2017) which states that:

"The results of a large group trial based on student responses to the Pop Up Book learning media are positive, with an average percentage of 96.9%. While the results of teacher questionnaire responses in large groups, the results obtained that the percentage of each indicator is more than 65% with a positive category.

In addition to filling out the questionnaire, the feasibility study was also measured by observing the activities of the pilot and implementation classes in the IPS learning activities using the 3D Pop Up general map media. Data on student activities during learning in the trial class and implementation class are presented in the following table.

Table 3.1
Observation Results of Student Activities in the Trial Class

| Observed Aspects | Percentage of student activity | | | |
|---|--------------------------------|-------|---------|-----------------|
| | Meeting | | Average | Ideal Range (%) |
| | 1 | 2 | | |
| Listen to the educator's explanation of the purpose of learning | 9,52 | 10,71 | 10,12 | 9% ≤ P ≤ 11% |
| Understanding contextual issues in the LKPD | 28,57 | 27,38 | 27,98 | 27% ≤ P ≤ 33% |
| Resolve contextual problems | 29,76 | 28,57 | 29,17 | 27% ≤ P ≤ 33% |
| Discuss / ask friends / Educators | 20,24 | 20,24 | 20,24 | 18% ≤ P ≤ 22% |
| Make Conclusion | 10,71 | 10,71 | 10,71 | 9% ≤ P ≤ 11% |
| Behavior that isn't relevant | 1,19 | 2,38 | 2,38 | 0% ≤ P ≤ 5% |

Table 3.2
Observation Results of Student Activities in the Trial Class

| Observed Aspects | Percentage of student activity | | | |
|---|--------------------------------|-------|---------|-----------------|
| | Meeting | | Average | Ideal Range (%) |
| | 1 | 2 | | |
| Listen to the educator's explanation of the purpose of learning | 9,52 | 9,52 | 9,52 | 9% ≤ P ≤ 11% |
| Understanding contextual issues in the LKPD | 27,38 | 28,57 | 27,98 | 27% ≤ P ≤ 33% |
| Resolve contextual problems | 30,95 | 30,95 | 30,95 | 27% ≤ P ≤ 33% |
| Discuss / ask friends / Educators | 19,05 | 19,05 | 19,05 | 18% ≤ P ≤ 22% |
| Make Conclusion | 10,71 | 9,52 | 10,12 | 9% ≤ P ≤ 11% |
| Behavior that isn't relevant | 2,38 | 2,38 | 2,38 | 0% ≤ P ≤ 5% |

In the table, it can be seen that all aspects of student activities at meeting 1 and meeting 2 reach tolerance, because they are within the ideal time span. This means that the activities of students meet good criteria. The following figure shows the activities of students during learning.



Discuss activities with group class



Finishing LKPD with group class



Presentation about media peta umum 3D Pop Up
creativity assessment sheet which includes aspects of giving ideas, solving problems, accuracy of information and product display. The results of the observations are presented in the following table:

| Creativity Value of Trial Class | | Creativity Value of Implementation Class | |
|---------------------------------|-----------------|--|-----------------|
| Before use media | After use media | Before use media | After use media |
| 61% | 80,11% | 64% | 84,84% |

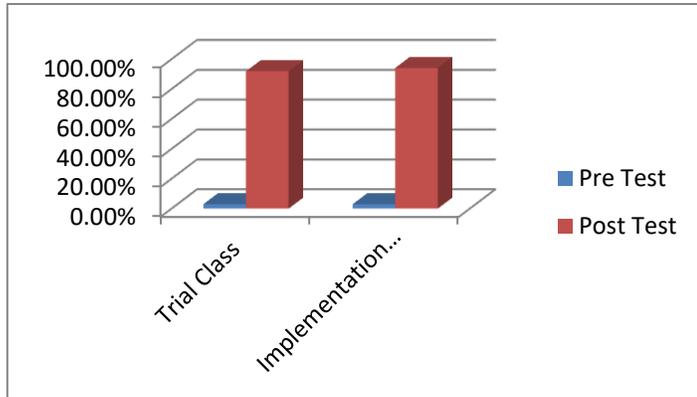
This situation is in accordance with the opinion of Kumar Shah (2016, p.84) which states that elementary school students like to study social studies with cooperative learning, field trips, working in groups and actively, thinking critically, conducting group discussions, using question and answer techniques and presentation

The effectiveness of learning media is measured using a sheet of observation of the value of creativity. The researcher first compared the value of creativity of students both in the pilot class and the implementation class with the data on the creativity value of IPS material in KD 3.1 in semester 1. Based on these data, the average percentage value of the creativity of the pilot class was 61% and the implementation class was 64%. So that it can be concluded that IPS learning creativity in general is in the sufficient category.

When carrying out learning activities using the 3D Pop Up general map media as many as two meetings, students are observed by observers and the observer's assessment of the value of creativity both products and processes is written on the

The results showed that the average percentage of the creativity value of the experimental class after using the 3D Pop Up general map media increased to 80.11% and 84.84% in the implementation class. So that it can be concluded that the value of the creativity of social studies learning of students in VB and VD classes after learning to use the 3D Pop Up general map media is in the high category. The following figure shows the creativity of students after making general map 3D Pop Up.

In addition to the value of creativity, the effectiveness of learning media is also measured using learning outcomes that include



knowledge, attitudes and skills. In the realm of knowledge, a comparison is used in the form of questions about pre test and post test. The following is the data on the average score of the learning outcomes in both the trial and implementation classes.

Diagram 3.1 Classical Completion of Pre Test and Post Test

Based on the diagram above shows the value of the classical pre-test completeness in the trial class is 3.03% and in the implementation class 2.94%. This shows that students' initial knowledge in this material is in the "less" category. While the value of classical completeness post test in the trial class was 91.93% and in the implementation class 94.12%. This shows that students' knowledge after learning using the 3D Pop Up general map media has increased and is in the "very high" category.

On the aspects of skills and attitudes of students showed a significant increase, as evidenced by the acquisition of the results of classical skills observations in the trial class of 91.43% and 88.24% in the implementation class. Whereas the attitudinal aspect of the results of observations in the trial class was 81.43% and in the implementation class was 82%. The percentage is in the very good category.

Based on these data, the 3D Pop Up general map media is said to be effectively used as an alternative to elementary school social studies learning class V. This is in line with the opinion of Hobri (2010, P.28), that effective learning can be created within students actively involved in organizing and discovery of information (knowledge), students are not only passive in receiving the knowledge conveyed by educators but they can actively respond.

IV. CONCLUSION

Based on data analysis and discussion of research results, conclusions are obtained as follows:

1. This development research obtained results in the form of a general 3D Pop Up map media with Discovery Learning models and learning tools that can value the creativity and learning outcomes of social studies on the subject of Indonesia's

geographical condition in the fifth grade of elementary school. The common 3D Pop Up media map that was developed has passed the validation stage and is declared "valid" by the validator.

2. The feasibility of 3D Pop Up general map media developed after going through the stages of validation and field trials can be seen from the responses of students and educators to the developed media obtaining an average percentage of more than 80% with a positive response category and having a "positive time tolerance" "In the learning activities of students, so that it is said to be" feasible "to use.

3. The effectiveness of the use of 3D Pop Up general map media in social studies learning, the subject matter of Indonesia's geographical conditions in grade V elementary school can be seen from the learning outcomes in the realm of "categorized" in the realm of "good" skills and attitudes. While the value of creativity is in the "high" category, so the media is "effective" to use.

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Prevalence of Moral Distress in Medical Officers at National Cancer Institute Sri Lanka

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Abstract- Moral distress occurs when the doctor's perception of ethically suitable action cannot be implemented due to situational constraints at health care settings (Ferrell, 2006). Moral distress can also be defined as emotional stress of the health care worker due to ethically conflicting situations (Kälvemark, Höglund, Hansson, Westerholm, & Arnetz, 2004). The study was conducted in the National Cancer Institute Maharagama (NCIM), in Sri Lanka. The NCIM is the premium centre for cancer care in Sri Lanka. The grade medical officers working at NCIM were included in the study as the grade medical officers play a key role in treating cancer patients. The purpose of the study was to assess the prevalence of moral distress. A descriptive cross sectional study was conducted among all grade medical officers working in clinical areas of the NCIM. A structured self-administered questionnaire was used to collect data. A total of 160 grade medical officers were included in the study and 132 questionnaires were returned after completion of the questionnaire. The response rate was 82.5%. The prevalence of moral distress among the study population was 91.2% while 3.8% had severe moral distress and 9.8% had no moral distress. The majority of the grade medical officers had very mild moral distress (48.5%). Mild moral distress was seen among 33.3% of the grade medical officers and 4.5% of the grade medical officers had moderate moral distress. The study revealed a prevalence of 91.2% moral distress among grade medical officers at NCIM. However the majority of the grade medical officers had only very mild moral distress.

Index Terms- Moral distress, moral distress scale, factors contributing to moral distress.

Introduction

Providing health care is filled with value conflicts. Legal regulations and scarce resources may contribute to difficult ethical dilemmas and cause moral distress to health care providers. Moral distress is defined as emotional stress of the health care worker due to ethically conflicting situations (Kälvemark, Höglund, Hansson, Westerholm, & Arnetz, 2004). Good quality health care cannot be provided only with scientific and technical proficiency. But also it includes professional's ability and attitude towards value conflicts. The traditional work environment of doctors such as increased work load, lack of time and increased work related stress can limit the doctors to work according to ethical and professional ideals (Hospital & Psychology, 1997). The term moral distress was initially explained in nurses in 1980s by the researcher Andrew Jameton. He used the term moral distress as a feeling of nurses which resulting from a situation where the nurse knowing of right thing to do and the constraints makes it impossible to carry out the desired action (Jameton, 1984). Later the same researcher identified moral distress in other health care professionals such as doctors (Jameton, 1993).

Studies have been conducted in many countries about moral distress in last three decades. Most of the studies were limited to nurses as it was initially described in nurses and nurses were leading a middle care role in health services (Corley, Elswick, Gorman, & Clor, 2001). Later it has been identified that doctors also suffer with the same situations specially doctors in middle management level with the rise of patient rights and improvements in technology and knowledge in medical field (Jameton, 1993).

A study on moral distress of doctors was conducted among Norwegian doctors revealed 51% of doctors experiencing moral distress (Førde & Aasland, 2007). Moral distress of doctors in university hospitals in Iran was conducted in 2014 and identified moral distress among doctors in moderate amount (Abbasi et al., 2014).

Cancer is the second leading cause of death in Sri Lanka according to Annual health bulleting of Sri Lanka 2015. National Cancer Institute, Sri Lanka, is the premium Institute for cancer care in Sri Lanka. It consists of eight hundred beds and on average one

thousand out patients are treated daily. The moral distress of the health care workers is a researchable area in health care management. Medical Officers are one of the main components of health care providers in Sri Lanka.

Aim of the study

The aim of the study was to determine the prevalence of moral distress among the medical officers dealing with cancer patients at National Cancer Institute Sri Lanka.

Methods

A descriptive cross sectional study was conducted among the population of doctors working directly with cancer patients at National Cancer Institute Sri Lanka. The whole population of doctors working in the Institute was included to the study. Doctors working in Blood bank, Pathology, Haematology and all the consultants were excluded from the study.

The study instrument was a structured self-administered questionnaire. The questionnaire was developed by adopting the moral distress scale for physicians (Hamric, Borchers, & Epstein, 2012). A total of 21 items were categorized lik-ert scale from zero (never) to 4 (very frequent) for the frequency and zero (none) to 4 (great extend) for the disturbance of moral distress. Item number 1 and 16 were modified to the local setting with by experts in the field using modified Delphi technique. The data obtained for each item was computed to a composite score by multiplying frequency score by the disturbance score and for each item in the scale the score ranged from 0 to 16. The total composite score (for the 21 items in the scale) ranged from 0 to 336 by aggregating all 21 items. The cut off points for the moral distress levels from the composite score was determined by experts since there was no literature on cut off points for the moral distress levels in the scale. The experts included three consultant psychiatrists who were requested to suggest cut-off points for moral distress scale and after discussing with all 3 experts final decision was arrived to divide the score in the following manner.

Table: 3.1 Composite score for different levels of moral distress

| MORAL DISTRESS COMPOSITE SCORE | MORAL DISTRESS LEVEL |
|--------------------------------|--------------------------|
| 0-42 | No moral distress |
| 43-84 | Very mild moral distress |
| 85-168 | Mild moral distress |
| 169-252 | Moderate moral distress |
| 253-336 | Severe moral distress |

The principal investigator collected data by visiting National Cancer Institute, Maharagama. The contact person for all the activities related to the conduct of the study was the principle investigator. The contact details and the phone numbers of the principle investigator were given in the information sheet.

Since all the grade medical officers were fluent in English the questionnaires, consent forms and the information sheets were prepared in English language.

Participants of the study were informed of the nature and the purpose of the study by providing the information sheet. All the participants were given a consent form prior to distribution of the questionnaire. Consent was obtained by an informed written consent form. The participants were informed of the option to withdraw from the study at any given point of the study. The questionnaires were distributed among the subjects following the collection of filled and signed voluntary informed written consent form by the principle investigator.

The respondents were given 10 days to fill and hand over the questionnaires to the principle investigator and allowed to contact the principle investigator for any clarifications. An identical envelop was given to all the respondents along with the questionnaire to place the questionnaire and seal it with glue after completing to ensure the anonymity. The respondents were asked not to write names and any identification letters or numbers on the given envelop.

Principle investigator collected the questionnaires by physically meeting the respondents after ten days of distributing. The respondents delayed to submit the questionnaires were given two reminders in two weeks apart and the respondents who failed to submit were considered as non-respondents.

All the collected questionnaires were kept under lock and key by the principle investigator and only the principal investigator and the supervisor had access to the filled questionnaire sheets.

A total of 160 medical officers were included in the study and out of them four medical officers refused to take part in the study. Questionnaires were distributed among 156 grade medical officers and 132 questionnaires were returned and 24 respondents failed to return the filled questionnaire after two reminders sent two weeks apart.

Each question of the questionnaire was pre-coded. The questionnaires were corroborated prior to data entry for completeness. The data entering and analysing was carried out using the computerized statistical software SPSS version 20.0. The results were described

according to the study objective. Approval to conduct the study at National Cancer Institute Maharagama, was obtained from the Director Cancer Institute. Consent was taken from Prof Anne B Hamric to use the moral distress scale after adaptation to local setting.

RESULTS

The study included 132 (n=132) participants and the response rate was 82.5%. The prevalence of moral distress was 91.2%. The mean moral distress score value was 91.79 with a standard deviation of 58.80. The minimum MDS score was 17 while the maximum was 316 while the highest item scored in the MDS was “Witness diminished patient care due to poor team communication” and the lowest item scored in MDS was for “Let medical students perform painful procedures on patients solely to increase their skills”. Severity of moral distress was analysed by defining four categories. The majority of the study population (58.3%) was classified as having very mild moral distress whereas severe moral distress was seen among 3.8%.

Table 4.7: Distribution of moral distress according to severity

| Severity of moral distress | Frequency | Percentage (%) |
|-----------------------------------|------------|----------------|
| No moral distress (0-42) | 13 | 9.8 |
| Very mild moral distress (43-84) | 64 | 48.5 |
| Mild moral distress (85-168) | 44 | 33.3 |
| Moderate moral distress (169-252) | 6 | 4.5 |
| Severe moral distress (253-336) | 5 | 3.8 |
| Total | 132 | 100.0 |

DISCUSSION

The study of moral distress amongst health care workers has been limited to western countries and initial studies with regard to moral distress were conducted amongst nurses. However with time it has been seen that moral distress is not limited to nurses but encompasses all other health care professionals including doctors (Jameton, 1993). International studies on moral distress have been conducted for the past three decades whereas in Sri Lanka no studies have been conducted with regard to moral distress among health care professionals. According to a study conducted by Jameton in 1993 it was revealed that middle level health care workers including doctors suffer with moral distress (Jameton, 1993).

A prominent qualitative study conducted amongst Norwegian doctors in 2008 including all the categories of doctors working in the health care system in Norway revealed occurrence of moral distress amongst doctors (Førde& Aasland, 2008). However this was a qualitative study and there was no scale used to measure the level of moral distress. Another study conducted in Iran used a scale to measure the moral distress but was limited to university doctors(Abbasi et al., 2014).

This study used a validated scale to measure the moral distress of grade medical officers and the contributing factors were determined by a questionnaire. This study was limited to grade medical officers and the study setting was limited to one large institution where the doctors are more prone to moral distress. Since the middle level health care workers are more susceptible to moral distress study included all the grade medical officers involved in clinical care whereas the other studies were conducted amongst all the categories doctors.

The prevalence of moral distress of grade medical officers at National Cancer Institute Maharagama, was 92.5% which varied from no or very mild moral distress to severe moral distress. However most of the participants had only very mild moral distress which is a negligible amount of moral distress compared to mild, moderate and severe moral distress. Severe moral distress was found among 3.8% of the participants while 33.3% had mild and 4.5% had moderate moral distress.

The item with the highest moral distress score was “witness diminished patient care quality due to poor team communication” and the item with the lowest moral distress score was “let medical students perform painful procedures on patients solely to increase their skill”.

A study conducted among Iranian university doctors revealed the highest scoring item for moral distress was ‘diminished patient care due to poor team communication’ (Abbasi et al., 2014). The same finding was obtained in the study conducted among grade medical officers working in the NCIM as well. Sri Lankan doctors also reported that the biggest cause for moral distress was due to poor team communication. However, a study conducted among Norwegian doctors revealed that most of the doctors were morally distressed due

to long waiting times (Førde & Aasland, 2008). The working environment and the culture of the patients in different countries would have contributed to these different findings.

The situation which cause least moral distress among Iranian university doctors was “increasing the dose of sedatives which would hasten the death of the patient”(Abbasi et al., 2014). However the Sri Lankan Cancer Institute grade medical officers had the lowest score as a cause leading to moral distress for “medical students performing painful procedures”. This may be due to the fact that the university attached doctors are more exposed to medical students and teaching, and therefore the score for the medical students performing painful procedures wasn’t the lowest in Iranian university doctors whereas in cancer care medical students have very minimal role and the low frequency of the situations would have contributed to the difference.

The study conducted among Iranian university doctors did not identify the prevalence or the extent of moral distress but it described the frequency and disturbance of the situations causing moral distress (Abbasi et al., 2014). The study conducted among the Norwegian doctors revealed the percentages of morally distressing situation by a qualitative study and was unable to describe the extent of the problem (Førde & Aasland, 2008). Identifying the prevalence and the severity of the moral distress among the study population was achieved in this study will help to compare and carry out further studies to identify the problem among other health care professionals in different populations.

Limitations

The unavoidable limitations should be taken in to consideration while making inferences from the study findings.

The underreporting of moral distressing situations, due to the nature of information could have taken place. The sensitive nature of information can incriminate the respondents to underreport.

The data was collected retrospectively and the recall bias would have been inevitable.

As the study was conducted only for grade medical officers and from a specific institute, the results of the study cannot be generalized to the population of medical officers.

In the validation of the questionnaire, only face, content and consensual validity could be assessed due to time constraints.

A major limitation of the study was inadequate literature on moral distress of doctors as it is identified in recent past and most of the researches were on nurses.

There was no literature on cut-off points for different levels of moral distress and these levels were decided by obtaining expert opinion. This was a limitation of the study as due to time constraints a wider expert circle could not be used.

Despite all the limitations discussed above this was the first study conducted in Sri Lanka on moral distress of grade medical officers in National Cancer Institute Maharagama. The findings of this study can invariably aid the future researchers to explore the depth of moral distress of health care workers at different settings and for different categories of health care workers

CONCLUSIONS AND RECOMMENDATIONS

The prevalence of moral distress among the grade medical officers at NCIM was 91.2 %. The majority (48.5%) of the grade medical officers at NCIM had very mild moral distress while 9.8% had no moral distress. Severe moral distress was found among 3.8% of the population of grade medical officers. Mild moral distress was seen among 33.3% of the grade medical officers and 4.5% of the population had moderate moral distress.

Further studies which will go beyond the population of this study will be needed to understand the contributing factors of moral distress among health care professionals. The nurses, consultants and other health care staff can be included for further studies in different settings in Sri Lanka.

Further studies are needed to understand the effects and consequences of moral distress by which the grievance of moral distress can be better understood.

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Influence of Learning Model Type Cooperative Scramble with Picture Media on Motivation and Student's Learning Outcomes of IPS Class 2 SDN 2 Tropodo

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Abstract- This study aims to determine the effect of the Scramble type cooperative learning model with image media on the motivation and learning outcomes of grade 2 elementary school students. This research was conducted at the SDN Tropodo 2 Waru Sidoarjo Regency 2018/2019. This type of research experiment uses a quantitative approach, with nonequivalent (pretest and posttest) design control group design. This study uses two classes namely the experimental class and the control class. The study sample was class 2A as the experimental class and 2B as the control class. The instruments used were motivation observation sheets and learning outcomes tests. Data analysis techniques used included normality test, homogeneity test, and independent sample t-test. The results of the study showed that there was an effect of learning model the scramble type cooperative on media images on the motivation and learning outcomes of grade 2 elementary school students. value of gain normalized Motivated experiment class 0.174, control class 0.115 value gain normalized of student learning outcomes experimental class 0.192, control class 0.141 test results independent samples t-test motivation showed t count of 7.845 > t table of 1,677. the results of the test of independent samples t-test of learning outcomes indicate that the value of t count is 5.254 > t table of 1,677. It can be concluded that the learning model scramble type cooperative with image media influences the motivation and learning outcomes of grade 2 students in elementary school.

Index Terms- Cooperative Scramble Model, Image Media, Motivation, Observation, Learning Outcomes

I. INTRODUCTION

Education is an effort to prepare students to be active and positive in their present and future lives. In Indonesia the application of education refers to the national education system (Sisdiknas) 20 of 2013 which is an integrated whole of all educational units and activities that are interrelated to seek the achievement of national education goals. The course of education held in schools is formally preceded by basic education which is a formal education, until tertiary education cannot avoid learning activities because it is the main activity with the teacher as the main role holder in learning. In the educational environment can

not be separated from learning activities, the main and main activities are activities that direct the development of student behavior (Hidayah, 2004: 13). learning activities

School direct students to be able to accept and understand knowledge gained from teacher explanations in learning activities. The process of changing behavior and one's changes is obtained through education, through training and learning efforts sought to mature people. the quality of education must continue to be improved. Developing countries all over the world try to improve the quality of education which is a central issue including Indonesia. The government seeks the quality of education in various ways such as: curriculum change, teacher upgrading, improved educational facilities and infrastructure, but in reality the government's efforts have not achieved maximum results. Therefore, to improve human resources (HR) education is a very important tool, in ensuring the sustainability of a nation's development (Tirtarahardja and Sulo, 2008: 263).

According to RI Law No. 2 of 1989 concerning National Education System explained that the level of basic education is education held to provide basic provisions needed to live in society in the form of knowledge, development of attitudes, and basic skills (Tirtarahardja and Sulo, 2008: 265). Basic Education according to RI Law No. 20 of 2003 Article 17 paragraph 1 and 2 constitutes basic education in the form of elementary schools (SD) and madrasah ibtidaiyah (MI) or other forms of equals and junior high schools (madrasah tsanawiyah) (MTs).), or other equivalent forms (Susanto, 2013: 69). The level of basic education discussed is specifically for elementary education. The purpose of elementary education is intended as a process of developing the most basic abilities of each student. Every student actively learns because there is an encouragement in themselves and an atmosphere that provides convenience (conducive) for optimal development of themselves (Mirasa quoted Susanto, 2013: 70).

Based on the observations of researchers on students in grade 2A and 2B the first problem encountered was during social studies learning, there were still many less motivated students who were still less active and still looked less interactive. These problems are seen when the learning process is in progress. Students are only fixated on textbooks, less interesting learning, and there are students who are free from teacher observation so

that students are only busy with their own work Postgraduate Thesis Social Sciences Education Faculty of Teacher Training and Education University

Lampungin 2014 stated that in social studies learning students are less active, teachers plays a major role in teaching . Furthermore, from the results of interviews conducted by researchers to the second grade teacher of SD Negeri Tropodo 2, students are known to have difficulty in remembering and understanding the material taught. The teacher has explained and explained but the students still do not understand the material so the teacher feels difficult when doing the learning. This can be seen from the learning outcomes of students, especially on the material position and role of family members. In addition to the problem of less motivated and less active students and teacher-centered learning. second problem Odd semester learning outcomes in the 2018/2019 school year, where students' social studies learning outcomes are still under the KKM, it is known from 25 students only 5 children who get 70 or above or while 12 other students get less scores from KKM or below 70 or the remaining 8 students get a score of less than 60 or when there are questions from the teacher regarding this material many who cannot answer correctly must be reminded by the previous explanation.

One effort to overcome problems in learning, teachers must be able to design learning models that are meaningful to students. For this reason, teachers must be creative in designing learning models that allow students to participate, be active and creative about the material being taught, for example cooperative learning models (Susanto, 2013: 93). The cooperative learning model prioritizes collaboration in solving problems to apply knowledge and skills in order to achieve learning goals, all models are characterized by the structure of tasks, structure of goals, and structure of rewards (Daryanto and Rahardjo, 2012: 241). One innovative and interesting learning model is the learning model *cooperative Scramble cooperative*. According to Vita Septiana (2011: 9), *Scramble* is a learning model that can train students' creative power by arranging words, sentences, or discourses that are randomly arranged in a new arrangement that is meaningful and perhaps better than the original. This learning model allows students to learn while playing. Students can be creative at the same time can learn and think, learn things casually and do not make students become bored in the learning process so that students will be more active in the learning process

This is a result of the teacher's pattern in the conventional learning process and has not given students the opportunity to convey the idea, so the learning is still monotonous and dominated by teachers. Only give correct and wrong opinions to students. in completing the IPS question. The success of students in social studies learning so far still looks very lacking, it is this factor that encourages researchers to make improvements in the learning process which so far still looks lacking.

II. COOPERATIVE LEARNING MODEL SCRAMBLE

Learning is an activity to gain knowledge and change mindset and behavior as a result of experience and practice. Slameto (2003: 2) suggests learning is a business process carried out by someone to obtain a change in new behavior as a whole,

as a result of his own experience in interaction with his environment. Dimiyati and Mujiono (2006: 18) learning is a complex internal process, which is involved in internal processes which include affective elements, in the affective dimension related to attitudes, values, appreciation, and adjustment of social feelings. Furthermore Sagala (2008: 18)

Djamarah and Zain (2010: 28) states that learning is a process of changing behavior thanks to experience and practice. This means that the purpose of the activity is a change in behavior, both concerning knowledge, skills and attitudes even covering all aspects of the organism or person. Learning is a deliberate process and aims for students to get learning outcomes. In this activity learning occurs because of the interaction of students and teachers. Sudjana (2004: 28) Learning can be interpreted as any systematic and deliberate effort to create interaction *educational* between two parties, namely between students (learning citizens) and educators (learning resources) who conduct learning activities. While according to Hamalik (2004: 77) states in the system approach, learning is a unity of the components of learning that cannot be separated from one another, because each other supports each other. These components can support the quality of learning. Learning as a system, meaning that a whole of the components that interact and interrelate with each other and with the whole itself to achieve the learning objectives that have been set before

According to Johnson in cooperative learning is a model that prioritizes cooperation, namely cooperation between students in groups to achieve learning goals (Ismail, 2002: 12) in student learning divided into small groups and directed to study the material that has been determined, learning activities are mostly student-centered, students discuss to solve problems. The purpose of forming cooperative groups is to provide opportunities for students to be actively involved in the thinking process in teaching and learning activities.

The cooperative learning model *scamble* is learning by using the question cards provided in accordance with the questions and matched with the answer cards that are done (Fadmawati, 2009)

According to Hesti Damayanti (2019: 3-4), *Scramble* is a model of learning carried out in groups requiring collaboration in work on the problem exercise as an emphasis with critical thinking so that solving the problem can be easily searched.

Learning Theory Underlying Learning Model *Scramble Cooperative* with Media Figure Suprijono (2017) states that the cooperative learning model has changed from Piaget's cognitive constructivism theory to Vygotsky's social constructivism. It is about understanding concepts from individuals to groups, social interactions, and socio-cultural activities. Piaget's constructivist theory is that students build knowledge using transformation, construction, organization, and prior reorganization of knowledge or information. Referring to Piaget's constructivist theory, the division learning model of student achievement is very suitable to be applied in the concrete operational stage. Effective strategies that can be used in the concrete operational phase are: (1) students are involved in operational tasks such as compiling and sorting; (2) students practice organizing and grouping; (3) students make conclusions (Santrock, 2014). In addition, the syntax corresponds to the student achievement division learning model, which involves the presentation of

classes, groups, quizzes, individual progress scores, and group awards (Slavin, 2005). The syntax of class presentations provides real examples or situations according to the concrete operational stage (Santrock, 2014). When students complete worksheets students and students practice compiling, grouping, and drawing conclusions.

Arends (2016) states that the cooperative learning model is a learning model based on Vygotsky's constructivism theory. Vygotsky states that learning is not only the workings of our brains, but also determined by several factors that influence learning such as social and cultural development. This is similar to Kim's opinion (2018) in his journal stating that the student achievement division learning model uses Vygotsky's constructivism learning theory. Suprijono (2017) states that Vygotsky's theory supports cooperative learning models found in the learning process through interactive dialogue and social interaction learning models.

2.2 Motivation and Learning Outcomes

Motivation according to Schunk (in Eggen and Kauchak, 2012: 6) is a process of premature activities directed at achieving goals. Furthermore, according to Prawiro (2012: 320) motivation is an encouragement or effort in increasing activities to achieve certain goals.

Motivation is defined as a series of businesses so that certain conditions are available, so that the desire arises to do something for someone. If you don't like it, it will eliminate or avoid that feeling. (Uno, 2012: 75) Nawawi in Susanto (2013: 5) learning outcomes can be interpreted as the level of success of students in understanding the subject matter of the school which is stated by the assessment obtained from the test results in the form of scores. About certain subject matter.

States that learning outcomes are abilities possessed by students after getting taught, changing behavior is the essence of learning outcomes.

III. METHODS

This study is an experimental study that aims to discern the effect of using scramble cooperative learning models by using media images to improve student motivation and learning outcomes in elementary schools, this study consisted of class 2A as the experimental class and class 2 B as the control class held at Tropodo 2 Elementary School, Waru District, Sidoarjo Regency. This research was conducted in the second semester of the 2018/2019 academic year. This research study uses a quantitative approach whose implementation consists of three stages, namely: preparation stage, date of implementation, and data analysis. Data collection techniques in this study are by means of tests to find out the results of learning and observation. Observation is one of the data collection techniques that uses observations on research objects, where the implementation can be done directly (direct observation without tools) or indirectly (using tool intermediaries) Riyanto (2007 p. 83). Observations in this study used instruments. The observation instrument was conducted to find data about learning motivation in the learning process. Data analysis techniques used include normality test, homogeneity test, and test *independent sample t-test*

Pretest-PosttestControl Group Design

| Group | pretest (Treatment of) | Treatment | Posttest |
|------------|---------------------------|-----------|----------|
| Experimen | O1 | X1 | O2 |
| Control O3 | X2 | O4 | |

Description:

O₁=the results of *pretest* the experimental class

O₂= the results of the *posttest* experimental class

O₃ = the results of *pretest* the control class

O₄ = the result of *posttest* control class

X₁ = class treatment using learning model *scramble cooperative media-assisted image*

X₂ = class treatment using learning model *cooperative scramble without media image*

IV. RESEARCH RESULTS

Based on the results of the expert validation, the learning design consisting of syllabus, lesson plans, student worksheets, and observation sheets of student learning motivation which are forms of assessment design in good categorization, is quite valid, and feasible to use. Observations were made during group discussions and class presentations. Observation of student motivation is an observation of perseverance, seriousness, effort to obtain good grades. Students who succeed in this model, if they have applied the motivation indicators are stated in the good category. The following is an observation of the results of student motivation and learning outcomes in the experimental and control classes. Data analysis this study techniques in Data analysis techniques used normality test, homogeneity test, and *independent sample t-test*, value *gain normalized motivational class*

Normality test

| Variables | Class significant | Taraf | Description |
|--|-------------------|-------|-------------|
| 1. Motivation Control | 0.115 | 0.05 | Normal |
| 2. Motivation Experiment | 0.174 | 0.05 | Normal |
| 3. Learning Outcomes (<i>pretest</i>) | | | |
| Control | 0.124 | 0:05 | Normal |
| 4. Learning Outcomes (<i>posttest</i>) | | | |
| Controls | 0.141 | 0:05 | Normal |
| 5. Learning Outcomes (<i>pretest</i>) | | | |
| Experiment | 0.149 | 0.05 | Normal |
| 6. Learning Outcomes (<i>posttest</i>) | | | |
| Experimen | 0.192 | 0.05 | Normal |

The value of *gain normalized* motivation experimental class 0.174 and control class 0.115 values *gain normalized of*

students' learning outcomes experimental class 0.192. and control class 0.141 So it can be stated that all variables in table 4.19 are normally distributed.

Table of Test of Homogeneity of Variances

| | Levene Statistic | df1 | df2 | Sig |
|------------|------------------|-----|-----|------|
| Motivation | 2,230 | 1 | 48 | ,142 |
| Pretests | ,021 | 1 | 48 | ,886 |
| Posttes | ,008 | 1 | 48 | ,929 |

From the table above is homogeneity test data using a significance level of 0.05 or 5%. If the significance is <0.05 , the data group variance is not homogeneous, and if the significance is >0.05 , the data group variant is homogeneous. In the learning motivation variable, the significance value is $0.142 > 0.05$, so the variable is homogeneous, in the learning outcome variable (*pretest*) obtained a significance value of $0.886 > 0.05$, it can be said that the variable is homogeneous. In the variable learning outcomes (*posttest*) obtained a significance value of $0.929 > 0.05$, it can be said that the variable is homogeneous. From these three variables it can be concluded that the data is homogeneous or has met the basic assumptions of homogeneity.

The results of the analysis with the *Independent Sample T-test* on motivation obtained $t_{\text{value_count}}$ of 7.845, the value of t_{table} at (df.48) and a significant level of 0.05 of 1,677, if a comparison is made then $t_{\text{count}} < t_{\text{table}}$ with the results of *sig. 2 tailed* at 0,000 $< 0,05$ and said to accept H_0 which means that there is a significant difference. Which means there are differences in student learning motivation between the control class and the experimental class. At the *pretest*, the value of t_{count} is 0.471. The value of t_{table} at (df.62) and the real level of 0.05 is 1,677, if a comparison is made then $t_{\text{count}} < t_{\text{table}}$ with the results of *sig. 2 tailed* $0.640 > 0.05$ and said to accept H_0 which means that there is no significant difference. Which means there is no difference in student learning outcomes between the control class and the experimental class at the time of the *pretest*. While in the *Posttest*, the value of $t_{\text{arithmetic}}$ was 5.254. The value of t_{table} at (df.48) and the real level of 0.05 is 1,677, if a comparison is made then $t_{\text{count}} > t_{\text{table}}$ with the results of *sig. 2 tailed* at 0,000 $< 0,05$ and said to receive H_a which means that there are significant differences. Which means that there are differences in student learning outcomes between the control class and the experimental class at the *posttest*.

V. DISCUSSION

Based on the data analysis techniques obtained from the data from the normality test the normality test for motivation to learn motivation in the control class obtained a significant value of $0.115 > 0.05$. The motivation variable in the experimental class obtained a significant value of $0.174 > 0.05$. Then it can be concluded that the data is normally distributed. the results of the analysis of normality the prettest variable test in the control class obtained a significance value of $0.124 > 0.05$ on the posttest learning outcomes of control class students obtained a significance value of $0.141 > 0.05$, the variable learning outcomes

pretest students in the experimental class obtained a significance value of $0.149 > 0.05$, on the posttest learning outcomes of students in the experimental class obtained a significance value of $0.192 > 0.05$. So that it can be stated that all variables are normally distributed.

Based on the results of data analysis using SPSS rock shows that the T-test results obtained a value significant for learning motivation of $0,000 < 0,05$ and said to accept H_0 which means that there are significant differences. Which means there are differences in student learning motivation between the control class and the experimental class. At the *pretest*, a value of $0.640 > 0.05$ was obtained and said to be accepted H_0 , which means that there were no significant differences. Which means there is no difference in student learning outcomes between the control class and the experimental class at the time of the *pretest*. While the *Posttest* obtained a value of $0,000 < 0,05$ and said to receive H_a which means that there are significant differences. Which means that there are differences in student learning outcomes between the control class and the experimental class at the *posttest*.

During learning using learning models *cooperative scramble*. The T test in this study shows that the use of learning models *scramble cooperative* with image media can influence and simultaneously influence motivation and learning outcomes.

VI. CONCLUSION

Based on the results of research and data analysis, several conclusions of the research results can be stated as follows:

1. Is there a significant effect of the application of the learning model *cooperative scramble* with picture media on student learning motivation material social studies subjects position and role of class 2 family members SDN Tropodo 2 This can be proved by the *Independent Sample T-test* on motivation obtained $t_{\text{value_count}}$ of 7.845, t_{table} value at (df. 48) and a significant level of 0.05 of 1,677, if a comparison is made then $t_{\text{count}} < t_{\text{table}}$ with the results of *sig. 2 tailed* is $0,000 < 0,05$ and said to accept H_0 which means that there is a significant difference, meaning that there are differences in student learning motivation between the control class and experimental class
2. Is there a significant effect Application of the learning model *scramble cooperative* with image media on student achievement in social studies subjects material position and role of class 2 SDN Tropodo 2 family members at *Pretest* obtained $t_{\text{value_count}}$ of 0.471. The value of t_{table} at (df.62) and the real level of 0.05 is 1,677, if a comparison is made then $t_{\text{count}} < t_{\text{table}}$ with the results of *sig. 2 tailed* $0.640 > 0.05$ and said to accept H_0 which means that there is no significant difference. Which means there is no difference in student learning outcomes between the control class and the experimental class at the time of the *pretest*. While in the *Posttest*, the value of $t_{\text{arithmetic}}$ was 5.254. The

value of t_{table} at (df.48) and the real level of 0.05 is 1,677, if a comparison is made then $t_{count} > t_{table}$ with the results of *sig. 2 tailed* at 0,000 <0,05 and said to accept H_a which means that there are significant differences, meaning that there are differences in student learning outcomes between the control class and the experimental class at the time of *posttest*

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Wireless and Location-Based Indoor Air Quality Monitoring System

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Abstract- Poor air indoor quality can cause health problems. Monitoring of indoor air quality is currently carried out by environmental health officer by carrying a measuring instrument and making measurements directly at the location. Difficulties in monitoring indoor air quality, the limited number of environmental health officer, and the length of time needed to measure the indoor air quality are the main problems in the monitoring, recording and reporting system of indoor air quality. The old method of monitoring, recording and reporting systems needs to be replaced with wireless and location-based indoor air quality monitoring system with data obtained in real time. This study aims to develop a data collection system, provide a database management system, and build dashboards that provide information on monitoring indoor air quality. Systems development life cycle (SDLC) is a process on information system development process that can support business needs, design systems, build and send them to users. Agile development is a method of system development that is done in a simple way, the author of the idea plans the development of an existing system. Collaboration with the developer is carried out to analyze existing systems, designing the system, and implement the system. Wireless and location-based indoor air quality monitoring system can measure six air quality parameters which include dust particles, air temperature, relative humidity, carbon monoxide, and volatile organic compounds. Monitoring these parameters is done in real time and it can be a solution so that the monitoring, recording and reporting systems can be done swiftly with minimum resources.

Index Terms- air quality, indoor, monitoring, system

I. INTRODUCTION

In 2016, 91% of the world's population did not breathe clean air, while more than half of the global urban population were exposed to outdoor air pollution levels at least 2.5 times above the safety standard set by WHO. It is estimated that in 2016, outdoor air pollution in both cities and rural areas caused 4.2 million deaths worldwide, while indoor pollution caused a further 2.8 million deaths, a total of 7 million, or one in eight, deaths globally. Housing conditions, in addition to fuels used for heating and cooking, are matters of substantial importance for public health. (1). The WHO Housing and health guidelines highlight that "improved housing conditions can save lives, reduce disease, increase quality of life, reduce poverty, help mitigate climate change and contribute to the achievement of a number of Sustainable Development Goals. Housing is therefore a major entry point for inter-sectoral public health programs and primary prevention. (2).

It has been estimated that people spend about 90% of their time in both private and public indoor environments, such as homes, schools, work places, transportation vehicles, etc. therefore, indoor air quality has a significant impact on health and quality of life in general. For many people, the health risks from exposure to indoor air pollution may be greater than those related to outdoor pollution. In particular, poor indoor air quality can be harmful to vulnerable groups such as children, young adults, the elderly, or those suffering chronic respiratory and/or cardiovascular diseases. (3).

Poor indoor air quality can cause health problems, it is necessary to take continuous measures by all parties. The indoor air quality guidelines aim to provide a reference for homeowners, house occupants, housing developers, the Government, provincial governments, and district/city governments in an effort to improve air quality in the home space. These include air quality requirements, impacts, risk factors, and efforts to improve indoor air quality. Indoor air quality monitoring is carried out by environmental health workers of the health center and district/city health agencies (4). Indoor air quality monitoring system is currently carried out by health workers by carrying measuring instruments and make measurements directly at the location. Based on these conditions, wireless and location-based indoor air quality monitoring system needs to be developed so that it can provide the latest data for health workers. Health workers only need to come once to the location to install the tool and then be able to see the measurement results from the dashboard site provided.

Indoor air quality can be affected by various chemicals, including gases (i.e., carbon monoxide, ozone, radon), volatile organic compounds (VOCs), particulate matter (PM) and fibers, organic and inorganic contaminants, and biological particles such as bacteria,

fungi, and pollen. Among the factors that influence the estimation of human exposure to indoor air pollution, the pattern of human behavior and activity play a fundamental role. (3). The indoor air quality requirements as a reference for healthy air are as follows (4):

A. Physical quality parameters:

1. Particulate Matter/PM_{2.5} 35 µg/m³ (24 hours)
2. Particulate Matter/PM₁₀ ≤ 70 µg/m³ (24 hours)
3. Air Temperature 18-30 °C
4. Relative Humidity 40-60 % RH

B. Chemical quality parameters:

1. Carbon Monoxide (CO) 9,00 ppm 8 hours
2. Volatile Organic Compound (VOC) 3 ppm 8 hours

These six parameters can be measured by air quality sensors of Arduino based microcontroller. It is important to estimate these six parameters because the evidence on airborne particulate matter (PM) and its public health impact is consistent in showing adverse health effects at exposures that are currently experienced by urban populations in both developed and developing countries. The range of health effects is broad, but are predominantly to the respiratory and cardiovascular systems. The epidemiological evidence shows adverse effects of PM following both short-term and long-term exposures (5).

Temperature and humidity also have a strong and significant impact on the perception of indoor air quality, the perceived air quality decreases with increasing air temperature and humidity (6). Various studies have been conducted on the health risks of dampness and fungi in houses, and few studies in work places and schools. The paper by Lanthier-Veilleux et al. shows independent contribution of residential dampness or mold to asthma, allergic rhinitis, and respiratory infections among students at the Université de Sherbrooke, Quebec, Canada (7).

Household air pollution (HAP) from the combustion of biomass fuels are still commonly used in developing countries and release many air pollutants, such as carbon monoxide, free radicals, and PM, in particular PM_{2.5}, which may be linked to several health complications, including low birth weight, cardiovascular disease, tuberculosis, and cataracts (3). The study of Kurti et al. determined HAP exposure was associated with reduced lung function and respiratory and non-respiratory symptoms in Belizean adults and children (8). The research conducted by Medgyesi et al. shows the effects of exposure to biomass fuel cookstove emissions on women in rural Bangladesh, associated with acute elevated PM_{2.5} concentrations and decreasing pulmonary function (9).

II. RESEARCH ELABORATIONS

Data and information on air quality will be very useful if put together and organized on the database. The database is a collection of organized facts and information. Telecommunications is the transmission of electronic signals that transmit data so an institution can carry out their works through a computer network. Networks connect computers and equipment in buildings, across the country, or throughout the world. The internet is the largest computer network in the world that freely exchanging data and information (10). Data and information that is exchanged freely is managed in a database management system (DBMS). The DBMS is a collection of programs that manage database structures and control access to data stored in the database. Manipulating database includes retrieving certain data, updating databases, and generating reports from data (11).

The data manipulation language in the DBMS is used to add, change, delete, and retrieve data in the database. This language contains commands that allow users and programmers to extract data from the database to fulfill information requests and develop applications. The most widely used data manipulation language today is Structured Query Language or SQL. HTML commands are used to communicate with network servers that forward requests for data to software that translates HTML commands to SQL. The DBMS accepts SQL requests and provides the required data. Computer devices transfer information from the internal database to the network server and sending it in the form of dashboard site to users (12). Relational DBMS uses SQL to translate user requests into instructions for retrieving requested data. The entity relationship (ER) model is the current standard on database implementation. An entity represents a certain type of object in the real world which means that the entity can be distinguished so that each entity event is unique and different, a location for example, while an attribute is a characteristic of an entity. Relations between entities or relations models come from mathematical concepts known as relations which are considered as a structure consisting of intersecting rows and columns (tables) (12).

Dashboard site is a visualization instrument that provides information of data extracted from the database. Dashboard can be used for increased awareness, trends, and comparisons between existing plans and actual conditions, visualized in a nicely simplified user interface (13). User experience is one of the main features of the dashboard. Users are consumers of information presented on the dashboard (14). Dashboard criteria are classified into 7 main categories including user customization, knowledge discovery, security, information delivery, warnings, visual design, and system integration and connectivity (13).

DBMS and dashboards are established by following the cycle of systems development life cycle (SDLC). SDLC is a process to determine how an information system can support business needs, design systems, build and send them to users. SDLC follows four basic stages in the form of planning, analysis, design, and implementation. The agile methodology focuses on streamlining system development processes by eliminating a lot of modeling and documentation and the time spent on those tasks. Careful planning ensures that Agile

system development can be carried out properly. Through the simple stages of system development, the plan is included in analysis, design, and implementation. (15).

Establishing wireless and location-based indoor air quality monitoring system is done by developing a data collection and monitoring system, providing database management system, and building a real time and location-based dashboard that provides information on air quality monitoring system. Agile system development is used to create a database management system and information visualization dashboard for wireless and location-based indoor air quality monitoring system in accordance with regulations in Indonesia. Database management system is based on relational DBMS that uses SQL to translate user questions into instructions for retrieving requested data. SQL makes it possible to extract data with far less effort in the database environment. The relation model is the current standard database implementation. The database application relationship with SQL contains (11):

1. An interface that allows end users to interact with data that is presented in the form of information.
2. Collection of tables stored in the relational database.
3. SQL engine that is hidden from the end user, SQL engine executes all requests or data requests.

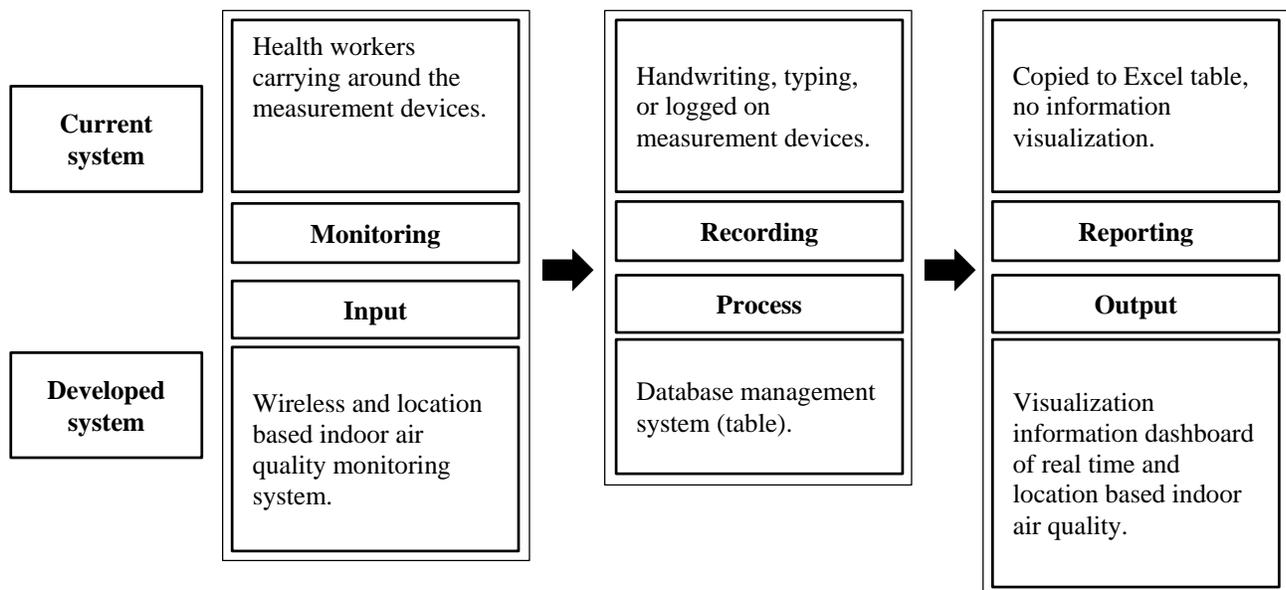
The dashboard is created as a visualization instrument, using HTML and PHP, that provides information visualized in a nicely simplified user interface. The indoor air quality dashboard contains information of six parameters of indoor air quality (particulate matters, air temperature, relative humidity, carbon monoxide, and volatile organic compound) at the place where instrument is installed with the map as a main display.

III. RESULTS OR FINDINGS

The measurement of indoor air quality is currently done by environmental health workers carrying instruments and measure directly at the location. The limitations of the current system are as follows:

1. **Input**
 Indoor air quality is measured directly by the measuring instruments, recording is done by hand writing. Selected test reports randomly carried out by agencies that have indoor air quality measuring devices. The limited number of environmental health workers and measuring time ranging from 8 to 24 hours is a limitation of current indoor air quality monitoring system.
2. **Process**
 Tables in the form of handwriting converted into Microsoft Excel format. Unstructured and scattered reporting processes randomly create data of indoor air quality.
3. **Output**
 Scattered data of indoor air quality makes it difficult to identify environmental health impacts on health. The scattered data must be sorted and searched one by one, this is time consuming and there is possibility that the data is incomplete so the information obtained is only partial.

Figure 1. Analysis of Current Systems and Developed System



Difficulties in monitoring indoor air quality, the limited number of environmental health workers, and the length of time in measuring indoor air quality are the main problems in the monitoring, recording, and reporting system of indoor air quality. The old method of monitoring, recording, and reporting systems needs to be replaced with wireless and location based indoor air quality monitoring system through data obtained in real time.

Data flow diagram (DFD) of indoor air quality monitoring system is divided into internal and public system. Both are divided by making different sub domains with DNS, access will be transferred between the two. Internal system administrators can access the entire system directly by using token/username and password to different server IPs. Public users can access the dashboard and download tables of indoor air quality data.

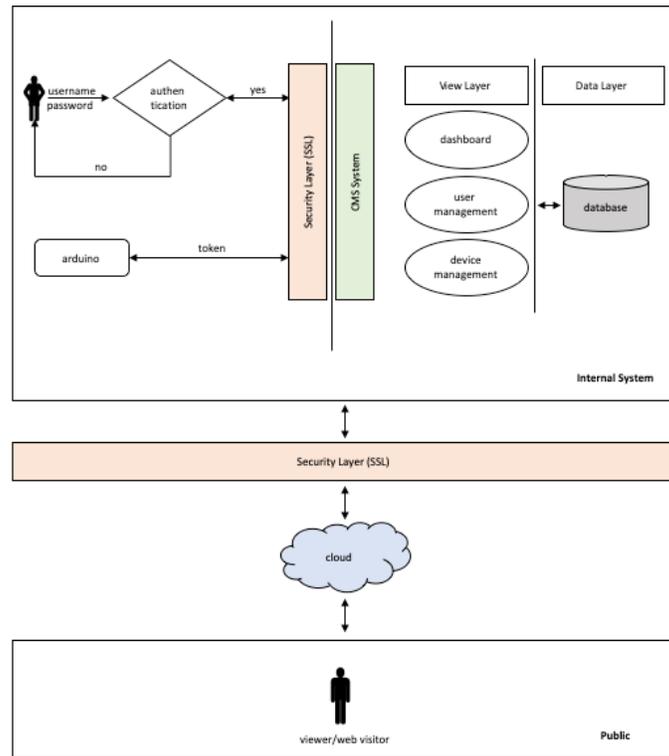


Figure 2. Data Flow Diagram Indoor Air Quality Monitoring System

DBMS tables consist of user table as data storage of CMS system user, device table that serves as a data storage for monitoring devices, measurement table as data storage for measurements and units, transaction table as data storage for all measurement results, and history table as data storage if there is a change in value on each table. All tables of data are stored in the DBMS server and can be accessed only by the site administrator. The programming language used is PHP and the table structure created using MySQL. These data tables are used to display information on the site dashboard.

The dashboard design is a simple modern design that makes it easier for users to navigate and explore the site. Mockup is made as a reference guide in creating a user interface. The results of the mockup are made into dashboards that can be accessed using a computer connected to the internet.



Figure 3. Dashboard Mockup of Indoor Air Quality Monitoring System

Data obtained from indoor air quality monitoring devices is stored with the DBMS method in table form. Downloadable table contains data of location, time, parameters, and measurement values. Data tables can be used as basic data as well as a system of recording and reporting for relevant agencies. The table is also useful for viewing the history of indoor air quality and associating it with activities that occur at a particular time. Data tables can also be used to observe the indoor air quality trends so that it can be used as a reference in policy making and to change people's behavior toward healthy life.

Table 4. PM_{2.5} Parameter of Indoor Air Quality Monitoring Data

| Parameter: PM _{2.5} | | | |
|---|-------|-------|-----------|
| Threshold: 35 µg/m ³ | | | |
| Location: Public Health Faculty, Universitas Indonesia, Depok | | | |
| Number | Time | Value | Threshold |
| 1 | 09.00 | 36 | Unsafe |
| 2 | 09.10 | 31 | Safe |
| 3 | 09.20 | 27 | Safe |
| 4 | 09.30 | 24 | Safe |

The dashboard can be accessed by visiting the address airwatch.id and the dashboard display will be adjusted automatically on bigger or smaller screen. Overall the dashboard consists of one main page with the largest display is a map. There is a flag icon on the map where the indoor air quality monitoring device is installed. The information displayed when the user selects the flag icon is the initial information of indoor air quality. Users can change the initial information by selecting the parameters that will be displayed in the upper right panel then full parameter will be displayed at the bottom.

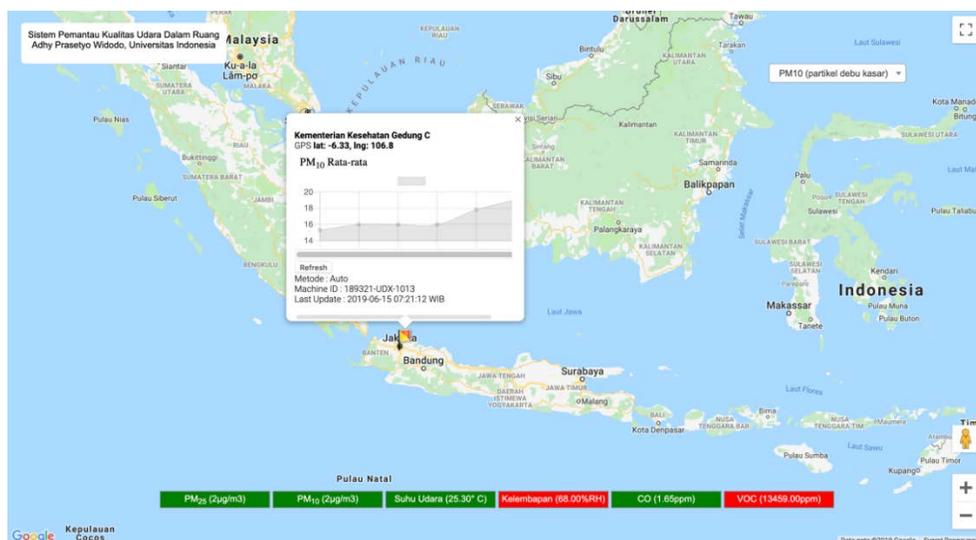


Figure 5. Dashboard of Indoor Air Quality Monitoring System

Device used on indoor air quality monitoring systems is based on Arduino microcontrollers with air quality measuring sensors and modules. Indoor air quality sensors are for the measurement of particulate matter, air temperature, relative humidity, carbon monoxide, and volatile organic compounds. The module consists of a GPS module to determine the location where a device is installed and a Wifi module to access data wirelessly via the internet. Data collected by sensors is displayed in the form of indoor air quality parameter information on the dashboard site.

The programming platform used to develop the system is PHP and MySQL. This is a native version of PHP so there will be limitations in scalability. Compared with other programming platforms, PHP is classified as lacking in performance and operational input/output. This can be a potential problem if accessed by many users and site visitors at the same time. The advantages of the PHP programming platform are its instant characteristic and PHP have a huge library support. PHP is also easy to understand, so it can be easily integrated with other systems. The MySQL database manipulation program is still the best relational DBMS for site applications. The MySQL database programming platform can be used on a small and large scale program.

The cost of the developed system can be reduced because there are several sensors in one device compared to the device currently used. The cost of measurement is cheaper because it can be done remotely without transportation expenses. The air quality monitoring

equipment is quite practical because it only requires access to electricity (DC current) and internet (Wifi network) for its operation. Everyone can access the information from dashboard whenever and wherever they are. Data storage of measurement results is made automatic and real time. The developed system can be upgraded and adjusted to the regulation threshold or new regulation threshold. Long-term monitoring can be done easily because the device only needs to be installed, it doesn't have to be held continuously like currently available devices. Reading the results is easier because it can use a bigger screen, it can be done automatically in real time and history can be saved to be accessed later.

Air quality monitoring can be easily carried out in a home room, workspace, or public space such as a place to eat, lodging, school, industry, health care facilities, and other public spaces in accordance with applicable regulations. The environmental health workers only need to come to install and carry out supervision and maintenance of the installed devices. Environmental health workers have been trained and have facilities to transmit data and access environmental health information digitally. This makes the Health Agencies and Health Centers ready to implement indoor air quality monitoring system. The data and information obtained can be integrated with the existing environmental health quality monitoring system.

The most important thing in the dissemination of information today is the need to ensure that information is considered as a communication and participation, not just simple actions in presenting data, regardless of their usefulness or relevance to the recipient (16). The indoor air quality monitoring system can be used as a decent decision support system as an intervention to improve health. Monitoring pollutant levels indoor is important for environmental health efforts and energy efficiency (17).

Indoor air quality measured in an industrial environment provides consistent data flow for reliable management of building automation systems and provides a platform for informed decision making (18). Easy intervention that can be done by the homeowner or the person in charge of the building can have a tremendous positive effect on indoor air quality in many situations. This is an important practice that can be instructed to the person in charge or manager of the house or building through the dashboard on indoor air quality (19).

IV. CONCLUSIONS

Automatic indoor air quality monitoring system can be a long-term measurement solution and a solution to the limited number of environmental health workers. Wireless and location based indoor air quality monitoring system equipped with a database management system (DBMS) can support environmental health workers in carrying out monitoring, recording, and reporting of indoor air quality. The indoor air quality monitoring dashboard can measure and monitor six air quality parameters including dust particles, air temperature, relative humidity, carbon monoxide, and volatile organic compounds in real time and location-based.

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Self-Efficacy As Predictor Of Counsellors' Job Satisfaction In Delta And Edo States

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Abstract- This study investigated self-efficacy as predictor of counsellors' job satisfaction in Delta and Edo States. The study was guided by five research questions and three hypotheses were tested at 0.05 level of significance. The research design was predictive correlational survey. The population of the study is 359 practising guidance counsellors in all public secondary schools in Edo and Delta states. Delta state has 217 counsellors and Edo state 142 counsellors. The sample of the study was being made up of all practising counsellors in public secondary schools in Secondary schools in Edo and Delta States. Since the population of 359 is small and manageable, the entire population was studied. Two instruments were used to collect data for this study. These are General Self-Efficacy Scale (GSE) and Job Satisfaction Questionnaire (JSQ). The research adopted the three instruments for the study. The researcher and other research assistances administered the instruments through direct delivery method. The researcher with the help of 11 well-trained research assistants, distributed the questionnaire to the respondents and collected completed copies from them. Out of the 359 copies of the questionnaires distributed only 343 (95.5 %) copies were retrieved from the respondents. For data analyses, research question 1-2 was answered using aggregate scores while simple regression analysis was used to answer research question 3- 5. The null hypothesis were tested using simple analyses. Findings from the study revealed that, self-efficacy is a significant predictor of job satisfaction of secondary school counsellors in Delta and Edo States. It was recommended that since self-efficacy, Job satisfaction is dependent upon certain factors among which are the job itself, opportunity for advancement, recognition management of Post Primary Schools should endeavour to design the counselling job in such a way that it will be more meaningful, interesting, challenging and offers counsellors opportunity to take the responsibilities of their job outcomes. This will ensure greater job satisfaction and devotion to performing task well.

Index Terms- Self-efficacy, counsellor, job satisfaction

I. INTRODUCTION

A Background to the Study

A sound educational system is the backbone of any developed country and the school personnel are the crux around which the entire educational system revolves. The success of any educational system depends on the class and capability of the school personnel such as the counsellors, social workers, administrative personnel

and teachers who are requisite to the system and thus, they are important force in the development of a society. The role of counsellors in the school system cannot be overemphasized. Counselling is a socially conscientious occupation, highly responsible and officious. It demands scholarly, emotional, physical, rigorous and unrelenting efforts. For counsellors to be able to provide this essential educational service to the students, they must be interested and willing to contribute meaningfully to the students' personal growth and psychological development. Therefore, the study of job satisfaction among counsellors are essential to the improvement of productivity among school counsellors in a developing country like Nigeria.

Satisfaction with a job has always been an important aspect for practitioners, human resource managers and academia. For that reason, job satisfaction significantly affect major organizational outcomes, such as individual performance, organizational productivity, employee absenteeism, employee commitment, job involvement, and employee engagement (Khagendra, Gopal & Vikas, 2016). However, Oyewumi, Ibitoye and Sanni (2012) and O'Donnell (2014) maintain that too many counsellors who initially begin their profession with eagerness and optimistic hope are looking for a change in direction after only three to five years while experienced counsellors suffering from lack of job satisfaction are retiring or leaving the profession to seek other employments where they will be satisfied. Job satisfaction are indispensable in the lives of counsellors because they form a fundamental reason for working in life. Almost every counsellor works to satisfy his/her needs. Counsellors' job satisfaction therefore is the ability of the counselling job to meet counsellors' needs and improve their job performance. It is important that organizations ensure job satisfaction of their employees. This is because it will be unhealthy for an organization to allow its workforce to be dissatisfied with their work situation before it expedites action.

Job satisfaction of employees are crucial to the success of any institution. It enhances organizational commitment, organizational citizenship behaviour and employee wellbeing. Counsellors who are satisfied with their jobs usually have a high degree of professional competence. They feel qualified in terms of their knowledge of subject matter and counselling skills, and they feel secured about therapeutic processes. The effectiveness of the counselling process depends largely on the job satisfaction of counsellors employed in the system (Moyosola & Abel, 2014). Hence, Khanna (2010) described job satisfaction as a positive attitude by an employee towards his job as well as his personal

life. This definition demonstrates that job satisfaction involve activities within and outside workplace. Thus, how an individual lives and associates in the environment are directly and indirectly influenced by work settings.

Job satisfaction has been linked both to situation factors and personal factors. Situational factors include job-related conditions such as pay, opportunities for promotion and working conditions, and characteristics such as task identity, task significance, skill variety, autonomy, and feedback. On the other hand, personal factors include personality disposition, traits, self-esteem, motivation, and emotions. Positive factors such as high energy, pleasurable engagement, and enthusiasm are positively related to job satisfaction while negative factors such as distress, unpleasant engagement and nervousness are negatively related to job dissatisfaction among secondary school counsellors.

Secondary school counsellors in Delta and Edo states, Nigeria, have been indifferent to guidance functions in the school system because government and principals have not given the service the attention it deserves. A visit to most schools in the area of study clearly shows that many schools have no counsellors and where they exist, the counsellor – students ratio does not conform to national standards of one counsellor to five hundred students (1: 500). It has also been observed that in most schools counsellors have no private offices where they can attend to their clients. Rather, counsellors are in the general staff room where they attend to general school matters instead of counselling issues. Where the counsellor is fortunate to have a small office, it lacks basic physical facilities. Counsellors are compelled to carry a full teaching load, in addition to being a member of students' disciplinary committee or supervise students serving punishments. Furthermore, Greenglass and Burke (2014) observe that secondary school environments may include both job dissatisfaction and stress for counsellors due to demands from administrators, colleagues, compounded by work overload, student misconduct, and a lack of recognition for accomplishments. Although in some cases, job stress creates job dissatisfaction for counsellors, such dissatisfaction may be muted due to factors as low autonomy and self-efficacy. Jepson and Forrest (2015) suggest that most counsellors in secondary schools are not limited to counselling alone but with heavy teaching work load assigned to counsellors and students' attitude toward the profession contributes to counsellors' job dissatisfaction resulting in negative health outcomes, emotional exhaustion, de-personalization, reduced personal accomplishment, and lower levels of self-efficacy. The consequences of job dissatisfaction are absenteeism from school's work, aggressive behaviour towards colleagues and learners, early exodus from the counselling profession and emotional withdrawal from work. Some factors reported to be contributing to job dissatisfaction include: salary structure, working conditions, attitude of parents, students' attitudes toward learning, loss of job and lives, promotion, workload and so on (Borzaga & Tortia, 2013).

Moreover, Olayiwola (2013) noted that, it is essential for counsellors who are fundamental part of counselling and guidance services to view themselves as professionally competent in respect to self-efficacy. Self-efficacy is the personal disposition of the job holder. In the definition of Bandura (1997), it is the belief in one's capabilities in executing a course of action and it affects a person's choice of behaviour, motivation, perseverance and facilitative

thought patterns. In the context of this study, counsellor self-efficacy is defined as a counsellor's appraisal of his/her own capability to bring about desired outcomes from clients' engagement in the therapeutic process and applying psychological principle in the appropriate manner, and even among those clients who may be difficult or unmotivated. A strong sense of self-efficacy enhances human accomplishment and personal well-being in many ways. People with high assurance in their capabilities, approach difficult tasks as a challenge to be mastered rather than as threats to be avoided. Such an efficacious outlook fosters intrinsic interest and deep commitment. They heighten and sustain their efforts in the face of failure. They quickly recover from failure and setbacks and attribute failures to insufficient effort or deficient knowledge and skills which are acquirable. They approach threatening structure with assurance that they can overcome them. Such efficacious outlook produces personal accomplishment, reduces stress and lows vulnerability to depression. A counsellor with low self-efficacy avoids difficult tasks which he views as personal threats.

Trentham, Silvern and Brogdon (2009) posit prediction between self-efficacy and job satisfaction that, people who hold strong self-efficacy beliefs tend to be more satisfied with their jobs and demonstrate more commitment and have lower absenteeism. Seyithan (2015) observes that there is a predictor between teachers' self-efficacy and job satisfaction. Although there is evidence demonstrating an association between teachers' self-efficacy and student, little is known about how self-efficacy is related to counsellors' job satisfaction. Counsellors' self-efficacy is one of the most important factors effecting counsellors' job satisfaction during their challenging counselling years. Hence, Bilali (2013) found that female and male teachers had similar levels of self-efficacy. The study report that there was no significant difference in the level of sense of efficacy across gender; that is, both female and male teachers had similar levels of self-efficacy.

In addition, Klassen and Chiu (2010) report that female teachers had lower self-efficacy than male teachers and found that male teachers had higher self-efficacy than female teachers did. Similarly, Aktaú, Kurt, Aksu and Ekici (2013) used regression analysis to examine biology teachers' self-efficacy and gender in Turkey. Gender accounted for 11.4% of the total variance in education process self-efficacy perception. Counsellors who have high levels of self-efficacy are more open to new ideas, exhibit greater levels of planning and organization, tend to experiment with new counselling strategies with their clients, and have clear goals with higher levels of aspiration (Guskey, 2013). Counsellors with greater self-efficacy have greater desires for counselling and are more likely to continue staying in counselling profession. Although self-efficacy of counsellor has many benefits in education, yet not much is known about its predictor of counsellors' job satisfaction.

Statement of the Problem

A number of factors contribute to the job satisfaction of workers in any organisation. These include the nature of job and achievement, recognition, responsibility and advancement, status and security. These factors are also applicable to the counsellors in the school system. The level of job satisfaction contributes to how effective an individual performs his or her job. Job

satisfaction has been linked to personal factors. Personal factors include personality disposition, traits, self-esteem, self-efficacy, locus of control and marital status may have positive or negative impact on counsellors' job satisfaction. Positive factors such as high energy, pleasurable engagement, and enthusiasm are positively related to job satisfaction while negative factors such as distress, unpleasant engagement and nervousness are negatively related to job dissatisfaction among secondary school counsellors.

These problems tend to have negative effects on the degree of counsellors' job satisfaction. These include: current pressure from working with more challenging students and needs, increased administrative and managerial tasks, time constraint, shortage of funds, increased counsellor-student ratios, inadequate facilities, which might have affected negatively on counsellor self - efficacy, locus of control and marital status. Job satisfaction at work is pliable. This means that it might not be a continuous experience. Hence, a counsellor who is satisfied with his/her work today might be dissatisfied with it tomorrow or vice versa.

This implies that consistent research is required to ascertain the job satisfaction status of secondary school counsellors' at a particular period of time. The prediction of self-efficacy, locus of control and marital status of counsellors on job satisfaction have not been systematically investigated in Nigeria. The study of job satisfaction among teachers has been widely researched. The studies have indicated that majority of teachers are satisfied with their jobs, however, little is known about job satisfaction of school counsellors. To this extent, it becomes imperative to investigate how Self-Efficacy Predict Counsellors' Job Satisfaction in Delta and Edo States, Nigeria.

Purpose of the Study

The purpose of this study was to determine self-efficacy as predictors of counsellors' job satisfaction in Delta and Edo States, Nigeria. Specifically, the research sought to investigate:

1. The self-efficacy scores of the secondary school counsellors.
2. The job satisfaction scores of the secondary school counsellors?
3. Whether secondary school counsellors' self-efficacy predict their job satisfaction.
4. Whether secondary school male counsellors' self-efficacy predict their job satisfaction.
5. Whether secondary school female counsellors' self-efficacy predict their job satisfaction.

Scope of the Study

The scope of the study is delimited to self-efficacy as predictor of counsellors' job satisfaction in Delta and Edo States, Nigeria. The study is limited to secondary schools male and female counsellors. Its content scope are self-efficacy as predictors of counsellors' job satisfaction. The independent variable is self-efficacy while job satisfaction is the dependent variable. The geographical scope of the study is Delta and Edo States, Nigeria.

Research Questions

The study were guided by the following research questions:

1. What are the self-efficacy scores of the secondary school counsellors in Delta and Edo States, Nigeria?

2. What are job satisfaction scores of the secondary school counsellors in Delta and Edo States, Nigeria?
3. How do secondary school counsellors' self-efficacy predict their job satisfaction in Delta and Edo States, Nigeria?
4. How do secondary school male counsellors' self-efficacy predict their job satisfaction in Delta and Edo States, Nigeria?
5. How do secondary school female counsellors' self-efficacy predict their job satisfaction in Delta and Edo States, Nigeria?

Hypotheses

The following null hypotheses were tested at 0.05 levels of significances.

1. Secondary school counsellors' self-efficacy do not significantly predict their job satisfaction in Delta and Edo States, Nigeria.
2. Secondary school male counsellors' self-efficacy do not significantly predict their job satisfaction in Delta and Edo States, Nigeria.
3. Secondary school female counsellors' self-efficacy do not significantly predict their job satisfaction in Delta and Edo States, Nigeria.

II. REVIEW OF RELATED LITERATURE

Job Satisfaction

Job satisfaction is so important in that its absence often leads to weariness and reduced job productivity as well as job commitment. Locke (2006) defines job Satisfaction as an enjoyable or optimistic emotional state, resulting from the evaluation of one's job or job experiences. Fajana (2013) refers to job satisfaction as the general job attitude of employees. It is therefore significant for workers to be content or satisfied with their work, given the amount of time they give to it through their working lives. Educational institutions should hold the belief that if their employees are satisfied with their jobs, they will translate that satisfaction into high productivity. Judge (2007) defines job satisfaction as a sentimental or exciting response toward various facets of one's job. Job satisfaction is positively correlated with motivation, job involvement, organizational citizenship behaviour, organizational commitment, life satisfaction, mental health, and job performance. Job satisfaction is a worker's sense of achievement and success on the job.

It is generally perceived to be directly linked to productivity as well as to personal well-being. Job satisfaction implies doing a job one enjoys, doing it well and being rewarded for one's efforts. Job satisfaction further implies enthusiasm and happiness with one's work. Armstrong (2006) views job satisfaction as the attitude and feelings people have about their work. Positive and favourable attitudes towards the job indicate job satisfaction. Negative and unfavourable attitudes towards the job indicate job dissatisfaction. Kaliski (2017) opines that job satisfaction is the key ingredient that leads to recognition, income, promotion, and the achievement of other goals that lead to a feeling of fulfilment. Statt (2015) defines job satisfaction as the extent to which a worker is comfortable with the rewards he or she gets out of his own her job, particularly in terms of intrinsic motivation. In the

context of the study, job satisfaction is seen as the optimistic attitude one has towards performing a task in one's job.

Counsellor Self-Efficacy

The concept of self-efficacy does not indicate the actual skills that a person may have, but the degree of his/her belief in them. In short, Bandura (2009) defined self-efficacy as the degree to which individuals consider themselves capable of performing a particular activity. It is a generative mechanism responsible for integrating cognitive, behavioural, and social resources in such a way that, in part, determines people's actions, the decision to engage in a task, to put forth effort, and to persevere under difficult conditions. Moyosola and Abel (2014) defined self-efficacy as self-efficacy as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives. In the context of this study, self-efficacy is defined as the belief an individual has in his ability to undertake any task with competency.

Counsellor self-efficacy is an assessment of his/her own capability to bring about desired outcomes from students' counselling session and learning, even among those students who may be difficult or unmotivated. Oyewumi, Ibitoye and Sanni (2012) defined counsellors self-efficacy as a counsellor's 'judgement of his/her own capability to bring about desired outcomes from students' engagement and learning, even among those students who may not be difficult or unmotivated'. However, a counsellor with low self-efficacy avoids difficult tasks which he views as personal threats. Such counsellor usually has low aspirations and weak commitment to the goals they have set for themselves in their chosen profession. Bandura (2009) stated that there are four main sources of a person's self-efficacy: mastery experiences, vicarious experiences, social (verbal) persuasion, and somatic and emotional states in judging one capability (physiological arousal).

Larson and Daniels (2009) defined counsellor self-efficacy as a counsellor's beliefs or evaluation of his or her capacities to effectively counsel a client in the near future. Hence, Gkolia, Belias, and Koustelios (2016) opine that counsellor's self-efficacy is strongly related with job satisfaction, which provides motives, vision and opportunities for flexible and adaptive behaviour in the counselling session. In the context of this work, counsellor self-efficacy can further be described as personal judgment of one's capabilities to organize and execute course of action to attain success and satisfaction in the counselling profession.

Self-Efficacy and Job Satisfaction

Efficacy perceptions still predict subsequent job satisfaction, even in studies where efficacy perceptions have been altered. Bandura (1977a) notes that although active mastery yields the greatest increase in self-efficacy, correlations between self-efficacy and performance remain high for non-enactive modes such as modelling. Several studies have found self-efficacy to be a better predictor of subsequent job satisfaction and performances than past behaviour (Bandura, 1977a; Bandura, 1982). Studies conducted by Feltz (2013) provided some evidence that as experience with a task increases, past performance becomes more predictive than self-efficacy. It needs to be noted that Feltz's study involved a task in which subjects were unable to observe their performance and no feedback was provided. Under these

circumstances, self-efficacy may have lacked veridicality. Locke, Frederick, and Bobko (1984) find that when past performance was controlled, self-efficacy was a significant predictor of subsequent performance. The correlation between self-efficacy and past performance was however higher, than the correlation between self-efficacy and future performance.

Self-Efficacy of School Counsellor

Ramin and Erhan (2015) note that the school counsellors have stated that their feeling themselves to be efficient in their profession has utmost significance in terms of the people they serve. It is very imperative for psychological counsellors who are a fundamental part of modern counselling and guidance services to view themselves as professionally competent. In other words; the higher a psychological counsellor's self-efficacy is, the more effective and efficient counselling and guidance he/she carries out (Asarli, 2012). Not only do the victorious and unproductive experiences affect self-efficacy, but also self-efficacy affects victorious and unproductive experiences.

According to Ozguven (2011), counsellors' level of readiness for professional life, the tasks expected to be realized by them, skills and efficacies, the tasks which they believe that they can succeed in have the potential to help the area of psychological counselling to improve. Ozyurek (2013) makes equivalent statements with Ozguven in his work. According to Ozyurek, there are not enough studies about school counsellors' perception of their efficacy level who account for the greater scope of psychological counselling.

Self-efficacy impacts on many variables such as the quality of services that are provided, a person's motivation, one's performance, venturing into a new work, and continuity in a work s/he began, feeling of fatigue when he/she makes a mistake, his/her giving up or keeping on and job satisfaction (Bandura, 1993). Girgin (2009) examines the self-efficacy of primary school counsellors and expressed that as the age goes up, self-efficacy declines in male teachers based on the gender variable. Based on the study result, there are significant differences between the means they received from the self-efficacy scale according to the counsellors' professional seniority and this difference is between those whose length of service is six to ten years and over eleven years and 0 to five years in support of six to ten years and over eleven years. On the other hand, when the means concerning psychological capital, job satisfaction and burnout are analysed, it is seen that there is no statistically meaningful difference among the points according the professional seniority.

It is established that self-efficacy levels of the school counsellors whose length of service is up to five years are lower than those with a length of experience of six to ten years and eleven to fifteen years (Celikkaleli, 2009). Contrary to these results, there is no significant difference among the psychological consultation means of the psychological consultants in Sali-Bilgic (2011)'s study. Guven (2007) reaches some data supporting this result and determined that self-efficacy levels of school psychological consultants working at secondary level are higher. According to the results of the study, it is seen that there are significant differences according to the means they obtained from the self-efficacy, psychological capital, job satisfaction and burnout scales as to the undergraduate major they graduated from

in support of those graduating from the Guidance and Psychological Counselling department.

Karckay (2013) determines a significant difference among the self-efficacy points in support of the graduates of the Guidance and Psychological Counselling department. In the study, they analysed the self-efficacy levels of school psychological consultants graduating from different departments yet working as school psychological consultants. Nevertheless, in some of the studies carried out on counsellors graduating from different departments yet working as school psychological consultants (Ozgun, 2007), there is no significant difference in terms of the department finished from and their self-efficacy points. The results of the study indicates that there is a significant and positive correlation between self-efficacy and job satisfaction ($p < .01$); When the literature is looked through, there are some stating that there is positive correlation between psychological capital and job satisfaction (Akçay, 2012; Luthans, 2007), a positive correlation between self-efficacy and job satisfaction and a negative correlation between job satisfaction and burnout.

In the opinion of Oyewumi, Ibitoye and Sanni (2012), counsellors with high assurance in their capabilities approach difficult tasks as a challenge to be mastered rather than as threats to be avoided. Such an efficacious outlook fosters intrinsic interest and deep commitment. They heighten and sustain their efforts in the face of failure. They quickly recover from failure and setbacks. They attribute failures to insufficient effort or deficient knowledge and skills which are acquirable. They approach threatening structure with assurance that they can overcome them. Such efficacious outlook produces personal accomplishment, reduces stress and lower vulnerability to depression (Bandura, 2001). However, a counsellor with low self-efficacy avoids difficult tasks which he views as personal threats. Such counsellors usually have low aspirations and weak commitment to the goals they have set for themselves in their chosen profession. Bandura (1994) stated that there are four main sources of a person's self-efficacy: mastery experiences, vicarious experiences, social (verbal) persuasion, and somatic and emotional states in judging one capability (physiological arousal). The first and most effective source is "mastery experience" or successes at tasks.

Counsellors that are highly self-efficacious have more motivation to remain in the counselling profession than counsellors with low self-efficacy (Whittington, McConnell & Knobloch, 2003). Less efficacious counsellors are more likely to experience burnout and leave the profession (Bandura, 1993). Thus, secondary school counsellors that have low counselling self-efficacy may find it very difficult to enjoy job satisfaction. It cannot be disputed that self-efficacy has been a much more consistent predictor of behaviour and behaviour change than has any of the other closely related expectancy variables. For example, self-concept (Graham & Weiner, 2013). Collins (2012) concludes after a research, that ability was related to job satisfaction but regardless of ability level, workers with high self-efficacy tackled more problems correctly and reworked more of the ones they missed.

In the same vein, Bouffard, Parent, Lariv and Egrave (2011) find that counsellors with high self-efficacy engaged in more effective self-regulatory strategies at each level of ability. Self-efficacy regulates the way in which an individual perceives his or her competence. This perception influences an individual's

ability to complete a task and a set, attainable goal. According to Pajares (2017), research studies have demonstrated that self-efficacy affects the level of motivation, learning, and achievement. Covey (2014), after conducting a research on the importance of self-efficacy to job satisfaction, which allow individuals to fully experience themselves and their sense of self-worth, and this enables them to deal effectively with others from a position of quiet inner strength

Self-efficacy as Predictor of Job Satisfaction

Moyosola and Abel (2014) researched on Job Satisfaction among Secondary School Teachers: Emotional Intelligence, Occupational Stress and Self-Efficacy as Predictors in Ondo State Nigeria. Two research questions were answered in the study and one null hypothesis was tested at 0.05 level of significance. The correlational descriptive research design was used for the study. Four hundred teachers constituted the sample of the study. Four standardized instruments were used to measure both the independent and dependent variables. Two research questions were answered in the study. Through multiple regression analysis the researchers found that emotional intelligence, occupational stress and self-efficacy jointly predicted job satisfaction. Further analysis indicates that emotional intelligence is more important than self-efficacy while occupational stress did not predict job satisfaction among teachers. These results are discussed, and counselling and educational psychologists are challenged to assume more responsibility and active role in enhancing emotional intelligence and self-efficacy among secondary school teacher. It is further recommended that counselling, educational psychologist and school administrators should equip teachers with necessary stress management skills. This empirical study is related to the current study in terms of the two variable self-efficacy as predictors of job satisfaction. The design used for the study and the statistical tool for data analysis, differ from the current study in terms of participants used for the study and geographical location of the study.

Robert and Ming (2010) examined the relationships among teachers' years of experience, teacher characteristics (gender and teaching level), three domains of self-efficacy (instructional strategies, classroom management, and student engagement), two types of job stress (workload and classroom stress), and job satisfaction from western Canada. Three hypotheses were formulated and tested at 0.05 level of significance. The design of the study was a correlational research. Participants were attendees at one of several annual, compulsory, multidistrict teacher conferences, the total attendance of which was approximately 8,000 teachers from about 350 schools, with a sample of 1,430 practicing teachers using factor analysis, item response modeling, systems of equations, and a structural equation model. Findings from the study revealed that teachers' years of experience showed nonlinear relationships with all three self-efficacy factors, increasing from early career to mid-career and then falling afterwards. Female teachers had greater workload stress, greater classroom stress from student behaviours, and lower classroom management self-efficacy. Teachers with greater workload stress had greater classroom management self-efficacy, whereas teachers with greater classroom stress had lower self-efficacy and lower job satisfaction. This study is related to the present study in term of the design used and the variable covered in the study. It

also differs from the current study in the geographical area and participants used for the study.

Reilly, Dhingra, and Boduszek, (2014) examined the role of teaching self-efficacy, perceived stress, self-esteem, and demographic characteristics (age, gender, education, and years of teaching experience) in predicting job satisfaction within a sample of 121 Irish primary school teachers. Four hypotheses were formulated and tested at 0.05 level of significance. The design for the study was correlational and the sample size was 121. Three instruments were used for data collection and t-test was used for data analyses. Findings indicated that the predictor variables accounted for 22% of variance in teachers' job satisfaction. However, only perceived stress was found to explain unique predictive variance, with high levels of occupations stress related to low levels of job satisfaction. This study differs from the current study in terms of geographical location but related to the present study in terms of research design used for the study.

Olayiwola (2013) investigated self-efficacy, intrinsic motivation and job satisfaction as predictors of job performance of industrial workers, with the aim of improving employees' productivity in Nigerian industrial settings. Four hypotheses were formulated and tested at 0.05 level of significance. Descriptive study of *expo facto* was adopted. The population for this study was made up of employees of both Frigoglas Nigeria Plc Ijebu-Ode (500 workers) and Ayokunle Industry Ltd Ijebu-Ode (600 workers). A total of 150 workers were selected through simple random sampling technique from each organization. Four research instruments titled Intrinsic Motivation Inventory (IMT), Self-Efficacy Scale (SES) and Job Satisfaction Scale (JSS) were used to collect data for the study. Job Performance was assessed using the Annual Performance Evaluation Reports (APER). The IMT was adapted from Ryan (1982). The test retest reliability of the instrument administered within two weeks interval yielded .80. The SES was self developed and has coefficient of .82. JSS was also self developed and has coefficient of .76. It measured job satisfaction. Multiple Regression Analysis was used to analyse data collected. 0.05 level of significance was applied in the analysis. As a result of the finding, the analysis of the hypotheses are clear indication that self-efficacy, intrinsic motivation and job satisfaction will predict the job performance of industrial workers and relatively, each of these variables will predict the job performance of workers. Therefore, it is suggested that for organization to achieve their stated objectives and goals, managements of those organization must put in place policies that will encourage self-efficacy, intrinsic motivation and job satisfaction among workers. This study differ from the current study in terms of the participants used and the geographical location of the study but related to the present study in terms of how self-efficacy of workers can be a predictor of their job satisfaction.

In sum, the above studies have shown that self-efficacy is a predictor of job satisfaction of workers. Although, none of the studies indicated its predictor of counsellors' job satisfaction in Delta and Edo States, Nigeria. The study is poised towards filling this gap; hence the need to research on Self-Efficacy, Locus of Control, and Marital status as Predictors of Counsellors Job Satisfaction in Delta and Edo state, Nigeria.

Research Design

The research design of the study is correlational survey. A correlational study focused on examining the relationships among two or more variables. This information can be used either to explain a phenomenon or to make predictions (Gall, Gall, & Borg, 2017). This study used a predictive correlational research design to determine if a predictive relationship exist between self-efficacy and job satisfaction of secondary school counsellors in Delta and Edo States.

Population of the Study

The population of the study is 359 practising guidance counsellors in all public secondary schools in Edo and Delta states.

Sample and Sampling Technique

The sample of the study is made up of all practising counsellors in public secondary schools in Secondary schools in Edo and Delta States. Since the population of 359 is small the entire population was studied. In all, therefore, a total of 217 and 142 counsellors from Delta and Edo respectively responded to the questionnaire, which ultimately formed the sample. Thus, there was no sampling since all counsellors in the area of study were used.

Instrument for Data Collection

Two instruments were used to collect data for this study. These are ; General Self-Efficacy Scale (GSE) and Job Satisfaction Questionnaire (JSQ). The researcher adopted the three instruments for the study.

Reliability of the Instrument

The two instruments General Self-Efficacy Scale (GSE) and Job Satisfaction Questionnaire (JSQ) have good psychometric properties. For GSE, cronbach alpha of internal consistency reliability coefficient of .76 and .90 was reported by Schwarzer and Jerusalem in 1995 . In Nigeria, the instrument has also been used by Adeyemo and Ogunyemi in 2010 a reliability coefficient of .83 index was reported. The reliability of job satisfaction questionnaire was established through a reliability estimate test involving 40 participants (counsellors) from secondary schools in Imo State selected through accidental sampling technique. The researcher used Cronbach alpha method in determining the reliability in which case the instrument was subjected to analysis. The coefficient alpha of the instruments were then determined. The reliability levels are: $r = 0.68$ for JSQ.

Method of Data Collection

The researcher and research assistants administered the instruments through direct delivery method. The researcher with the help of 11 well-trained research assistants, distributed the questionnaire to the respondents. The researcher have a briefing meeting with the research assistants during which he intimated them on the purpose of the research, contents of the questionnaires, how to administer the instrument and also how to collect them back. The researcher and assistants collected the completed copies of the questionnaires. Out of the 359 copies of the questionnaire distributed only copies (95.5%) were retrieved from the respondents.

Method of Data Analyses

For data analyses, research question 1-2 was answered using aggregate scores while simple regression analysis was used to answer research question 3- 5. The null hypotheses were tested using simple regression analysis.

Results

Research Question 1

What are the self-efficacy scores of the secondary school counsellors in Delta and Edo States, Nigeria?

Table 1: Range of scores on self-efficacy of secondary school counsellors

| Range of scores | N | % | Remarks |
|-----------------|-----|------|--------------------|
| 10 – 24 | 131 | 38.2 | Low Self-efficacy |
| 25 – 40 | 212 | 61.8 | High Self-efficacy |

Table 1 shows that with scores ranging from 25 to 40, 212(61.8%) of the counsellors have high self-efficacy while 131(38.2%) other counsellors who scored between 10 and 24 have low self-efficacy.

Research Question 2

What are job satisfaction scores of the secondary school counsellors in Delta and Edo States, Nigeria?

Table 2: Range of scores on job satisfaction of secondary school counsellors

| Range of scores | N | % | Remarks |
|-----------------|-----|------|-----------------------|
| 30 – 48 | 200 | 58.3 | Good job satisfaction |
| 12 – 29 | 143 | 41.7 | Poor job satisfaction |

Table 2 reveals that with scores ranging from 30 to 48, 200(58.3%) of the counsellors have good job satisfaction while 143(41.7%) other counsellors who scored between 12 and 29 have poor job satisfaction.

Research Question 3

How do secondary school counsellors' self-efficacy predict their job satisfaction in Delta and Edo States, Nigeria?

Null Hypothesis 1

Secondary school counsellors' self-efficacy do not significantly predict their job satisfaction in Delta and Edo States, Nigeria.

Table 3: Regression analysis on the counsellors self-efficacy as predictors of their job satisfaction

| Variable | R | R ² | R ² change | B | BETA | % |
|---|-------|----------------|-----------------------|------|------|------|
| <u>variance added Cal. F Cal t df Pvalue Remark</u> | | | | | | |
| Components | 0.856 | 0.732 | 0.730 | | | 73.0 |
| 308.99 | 339 | 0.000 | S | | | |
| Self-efficacy | | | | .466 | | .396 |
| 7.41 | 0.000 | S | | | | |

In table 3, it was observed that self-efficacy of the secondary school counsellors had Beta of 0.396. This indicates that self-efficacy of the counsellors had contributed to 39.6 percent for their job satisfaction.

Also at 341df and 0.05 level of significant, the calculated t 7.41 with Pvalue 0.000 which is less than the 0.05, the first null hypothesis is rejected. Therefore, secondary school counsellors' self-efficacy is a significant predictor of their job satisfaction.

Research Question 4

How do secondary school male counsellors' self-efficacy predict their job satisfaction in Delta and Edo States, Nigeria?

Null Hypothesis 2

Secondary school male counsellors' self-efficacy do not significantly predict their job satisfaction in Delta and Edo States, Nigeria.

Table 4: Regression analysis on the male counsellors self-efficacy as predictors of their job satisfaction

| Variable | R | R ² | R ² change | B | BETA | % |
|---|-------|----------------|-----------------------|------|------|------|
| <u>variance added Cal. F Cal t df Pvalue Remark</u> | | | | | | |
| Components | 0.852 | 0.725 | 0.717 | | | 71.7 |
| 84.54 | 96 | 0.000 | S | | | |
| Self-efficacy | | | | .753 | | .644 |
| 5.09 | 0.000 | S | | | | |

In Table 4 also, it was observed that self-efficacy of the secondary school male counsellors had Beta of 0.644. This indicates that self-efficacy of the male counsellors had contributed to 64.4 percent for their job satisfaction.

Also at 98df and 0.05 level of significant, the calculated t 5.09 with P value 0.000 which is less than the 0.05, the second null hypothesis is rejected. Therefore, secondary school male counsellors' self-efficacy is a significant predictor of their job satisfaction.

Research Question 5

How do secondary school female counsellors' self-efficacy predict their job satisfaction in Delta and Edo States, Nigeria?

Null Hypothesis 3

Secondary school female counsellors' self-efficacy do not significantly predict their job satisfaction in Delta and Edo States, Nigeria.

Table 5: Regression analysis on the female counsellors self-efficacy as predictors of their job satisfaction

| Variable | R | R ² | R ² change | B | BETA | % |
|---|-------|----------------|-----------------------|------|------|------|
| <u>variance added Cal. F Cal t df Pvalue Remark</u> | | | | | | |
| Components | 0.866 | 0.749 | 0.746 | | | 74.6 |
| 237.97 | 239 | 0.000 | S | | | |
| Self-efficacy | | | | .377 | | .317 |
| 5.35 | 0.000 | S | | | | |

In Table 5 also, it was observed that self-efficacy of the secondary school female counsellors had Beta of 0.317. This indicates that self-efficacy of the female counsellors had contributed to 31.7 percent for their job satisfaction.

Also at 241df and 0.05 level of significant, the calculated t 5.35 with Pvalue 0.000 which is less than the 0.05, the third null hypothesis is rejected. Therefore, secondary school female

counsellors' self-efficacy is a significant predictor of their job satisfaction.

III. DISCUSSION OF RESULT

The result of this study revealed that secondary school counsellors' in Delta and Edo States self- efficacy had predictor variable that accounted for 39.6 percent of variance in counsellors job satisfaction. This indicated that self-efficacy of counsellor had contributed 39.6 percent for job satisfaction. This confirm that secondary school counsellors' self-efficacy in Delta and Edo States is a significant predictor of their job satisfaction. The finding is in consonance with the work of Olayiwola (2013) that counsellor with low self-efficacy tend to be dissatisfied with their jobs thus leaving the helping profession. Olayiwola went further to comment that the predictive impact of self- efficacy on job satisfaction must not be underestimated.

In line with the findings the study of Trentham, Silvern and Brogdon (2009) noted that there is a prediction between self-efficacy and job satisfaction of worker, they argued that people who hold a strong self-efficacy tend to be more satisfied with their jobs and demonstrate more commitment and lower absenteeism. More so, Guskey (2013) in a study observed that self-efficacy is a predictor of job satisfaction among worker. Demirdag (2015) noted that counsellors with greater self-efficacy have greater desire for counselling and are more likely to continue staying in the counselling profession. In other word the self-efficacy of worker is a strong predictor of job satisfaction. In addition to the findings the work of Seyithan (2015) supported the claims of the study that there is a prediction between self-efficacy and job satisfaction among teachers. The reason for this could be attributed to the fact that counsellors with high self- efficacy are more likely to approach difficult tasks as a challenge to be mastered rather than as threats to be avoided. Such an efficacious outlook fosters intrinsic interest and deep commitment. They attribute failures to insufficient effort or deficient knowledge and skills which are acquirable. They approach threatening structure with assurance that they can overcome them. On the contrary counsellors with low self-efficacy are also found to limit the extent to which they approach difficult task in an endeavour and are more apt to give up at the instance of any difficulty. The finding thus is an empirical evidence of the predictive ability of counsellors' self-efficacy in foretelling their job satisfaction.

From the study, it was observed that secondary school male and female counsellors' self-efficacy in Delta and Edo States have predictor variable that accounted for 64.4 and 31.7 percent of variance in counsellors' job satisfaction. This indicated that male and female self-efficacy of counsellor had contributed 64.4 and 31.7 percent for the job satisfaction, which show that male and female secondary school counsellors' self-efficacy in Delta and Edo States is a significant predictor of their job satisfaction.

The finding affirm the work of Bilali (2013) who found that female and male teachers had similar levels of self-efficacy. The study reported that there was no significant difference in the level of sense of efficacy across gender, that is, both female and male teachers had similar levels of self-efficacy. The finding of the study oppose the study of Klassen and Chiu (2010) that female teachers had lower self-efficacy than male teachers and found that male teachers had higher self-efficacy than female teachers did.

Similarly, Aktaú, Kurt, Aksu and Ekici (2013) used regression analysis to examine biology teachers' self-efficacy and gender in Turkey. The results of the regression analysis indicated that gender positively and significantly predicted education process self-efficacy perception. Gender accounted for 11.4% of the total variance in education process self-efficacy perception. The reason could be that male and female secondary school counsellors who have high levels of self-efficacy as predictors of their job satisfaction are more open to new ideas, exhibit greater levels of planning and organization, tend to experiment with new counselling strategies with their clients, and have clear goals with higher levels of aspiration. Unlike male and female secondary counsellors with low self-efficacy have lesser desires for counselling and are more likely to leave the counselling profession

IV. CONCLUSION

Based on the findings of this study, it was concluded that secondary school counsellors' in Delta and Edo States self-efficacy was a significant predictors of their job satisfaction. It was also concluded that secondary school male and female counsellors' self-efficacy is a significant predictor of job satisfaction.

V. RECOMMENDATIONS

Based on the findings of this study and their implications, the researcher has proffered the following recommendations:

1. Job satisfaction is dependent upon certain factors among which are the job itself , opportunity for advancement, recognition management of Post Primary Schools should endeavour to design the counselling job in such a way that it will be more meaningful, interesting, challenging and offers counsellors opportunity to take the responsibilities of their job outcomes. This will ensure greater job satisfaction and devotion to performing task well.
2. It is recommended that management of post primary education boards should occasionally organised programmes that will enhance school counsellors' self- efficacy and internal locus of control beliefs so that their job satisfaction could be enriched.
3. Government should make policies that would enhance the job satisfaction level of secondary school counsellors. For instance, provision of regular training on the job or in-service training for secondary school counsellors from time to time will not only make them more competent but will also enhance their job satisfaction. This could further led to an increase in their self-efficacy and internal locus of control.

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A Detailed Study on Deflection of Fixed Beams Connected to Three Different Types of Building Structures due to the Pressure Applied on the Beams

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Abstract- Nowadays there is a huge trend on using timber roof structure with traditional joineries in hotels constructions because of its advantages like flexibility, durability, beautiful appearance, strength, eco-friendly, energy efficient, and aesthetical freedom. The king post and beam joinery is one of traditional timber joinery that commonly used when designing cabanas, summer houses, greenhouses and lobby in hotels. There is a standard measurement system is used by carpenters when design a roof structure and one of the basic measurements is the distance between two king-post trusses. Generally, carpenters in Sri Lanka use 8-10 feet as the range for the distance between two king-post trusses.

In this study, an attempt will be made to investigate the deflection of a fixed ridge beam due to pressure applied on the beam and from that to detect the optimum distance between two king post trusses within the general range and also find the optimum beam size that can be used to design the king post beam joinery more effective way. The study is intended to do analysis on three different types of building structures; Cabana, Lobby, and Summer house. In this study, a new model is generated to calculate the deflection of a fixed beam by using the Euler-Bernoulli Differential equation and Fourier series. The study is used only clay tiles as the roof covering materials and Kempas wood as the material for beams, king posts and rafters.

According to results for the cabana, the optimum distance between two king post trusses among the general range is 9 feet and the optimum beam size is 2x6 inch². The optimum distance between two king-post trusses among the general range is 8.5 feet and the optimum beam size is 3x6 inch² for the lobby. When considering the results for the summer house, the optimum distance between two king-post trusses among the considered range is 6.5 feet and the optimum beam size is 2x6 inch².

Index Terms- King post, Fixed ridge beam, Euler-Bernoulli theory, Fourier series

I. INTRODUCTION

The beams are structural elements that resist loads applied laterally to their axis and they typically transfer loads imposed along their length to their endpoints where the loads are transferred to walls, columns, foundations, and so on. A joint is an area where two separate pieces connect. In timber framing, there are many different types of joints and connections. Traditional joinery is the classic way to connect timbers in post & beam and timber frame structures. The king post and beam joinery are one of traditional joinery and it is an elegant and beautiful style of construction.

For this study, the simplest structure of king-post truss used and king-post and beam joinery connected by using mortise and tenon. Since both free ends are restrained against rotation and vertical movement, the ridge beam is a fixed.

II. RESEARCH ELABORATION

Euler-Bernoulli Differential Equation

Euler-Bernoulli Beam theory was developed around 1750 by Leonhard Euler and Daniel Bernoulli. It is a simple and effective method to calculate the behavior of beams when a load is applied.

$$\frac{d^4 y(x)}{dx^4} = \frac{1}{EI} q(x)$$

where $y(x)$ - Deflection function. (m)

$q(x)$ - Deflection pressure per unit length at point $x(N)$

E - Modulus of Elasticity of the beam. (Nm⁻²)

I - Moment of inertia of the beam. (m⁴)

Modulus of Elasticity of wood

The modulus of elasticity is defined as the following equation.

$$E = \frac{\sigma}{\varepsilon}$$

where ε = Strain (no unit or %)

σ = Stress (MPa)

Its SI unit is the Pascal (Pa) or N/m² and the practical units used are Mega-Pascal (MPa or N/mm²) or Giga Pascal (GPa or kN/mm²).

Moment of inertia of the beam

For this study, the moment of inertia for a rectangular shape body is used.

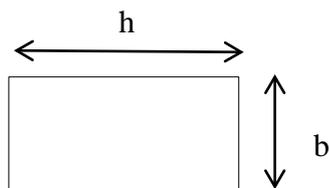


Figure 1: Rectangular shape body

Moment of inertia for rectangular shaped body,

$$I = \frac{bh^3}{12}$$

Deflection of a fixed beam under a lateral load

Consider a fixed beam is shown in the following figure 4.1. It is uniformly loaded by a load q per unit length. The deflection $y(x)$ of the beam is sought. The axis of the beam deflects from its initial position under the action of applied forces.

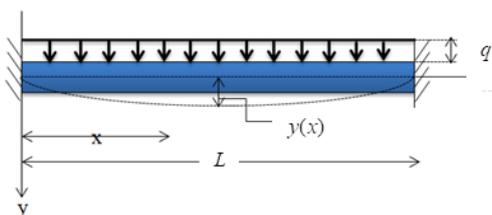


Figure 2: A fixed beam under a lateral load

The function $y(x)$ is satisfied with the differential equation

$$\frac{d^4 y(x)}{dx^4} = \frac{1}{EI} q(x) \longrightarrow (1)$$

where $1/EI$ is the rigidity of the beam.

The general expression for $y(x)$ which makes y and $\frac{dy}{dx}$ zero at both ends is

$$y(x) = \sum_{n=1}^{\infty} a_n \left\{ -\left(\frac{x^3}{L^3} - \frac{2x^2}{L^2} + \frac{x}{L} \right) - (-1)^n \left(\frac{x^3}{L^3} - \frac{x^2}{L^2} \right) + \frac{1}{n\pi} \sin\left(\frac{n\pi x}{L}\right) \right\}$$

Assuming the validity of the fourfold by term-by-term differentiation, obtain

$$\frac{d^4 y}{dx^4} = \sum_{n=1}^{\infty} a_n \left(\frac{n^3 \pi^3}{L^4} \right) \sin\left(\frac{n\pi x}{L}\right) \longrightarrow (2)$$

Then expand $q(x) = q$ into the Fourier sine series

$$q(x) = q = \sum_{n=1}^{\infty} q_n \sin\left(\frac{n\pi x}{L}\right) \longrightarrow (3)$$

where $q_n = \frac{2}{L} \int_0^L q \sin\left(\frac{n\pi x}{L}\right) dx \quad n=1, 2, 3, \dots$

$$q_n = \frac{2}{L} \int_0^L q \sin\left(\frac{n\pi x}{L}\right) dx = \frac{2q}{L} \left[\frac{\cos\left(\frac{n\pi x}{L}\right)}{\left(\frac{n\pi}{L}\right)} \right]_0^L = \frac{2q}{n\pi} [1 - \cos(n\pi)]$$

$$q_n = \begin{cases} \frac{4q}{n\pi} & \text{when } n \text{ is odd} \\ 0 & \text{when } n \text{ is even} \end{cases}$$

By (1), (2) and (3)

$$\sum_{n=1}^{\infty} a_n \left(\frac{n^3 \pi^3}{L^4} \right) \sin\left(\frac{n\pi x}{L}\right) = \frac{1}{EI} \sum_{n=1}^{\infty} q_n \sin\left(\frac{n\pi x}{L}\right)$$

When n is even, $a_n = 0$ and

when n is odd, $a_n \left(\frac{n^3 \pi^3}{L^4} \right) = \frac{1}{EI} \frac{4q}{n\pi}$

$$a_n = \frac{4qL^4}{EI n^4 \pi^4}$$

Hence

$$y(x) = \sum_{n=1}^{\infty} a_n \left\{ \left(\frac{x^3}{L^3} - \frac{2x^2}{L^2} + \frac{x}{L} \right) - (-1)^n \left(\frac{x^3}{L^3} - \frac{x^2}{L^2} \right) + \frac{1}{n\pi} \sin\left(\frac{n\pi x}{L}\right) \right\}$$

$$y(x) = \frac{4qL^4}{EI\pi^4} \sum_{\substack{n=2i+1 \\ i \in \mathbb{N}}}^{\infty} \frac{1}{n^4} \left(\frac{x^2}{L^2} - \frac{x}{L} + \frac{1}{n\pi} \sin\left(\frac{n\pi x}{L}\right) \right) \rightarrow (A)$$

Maximum Deflection Area Coefficient (MDAC)

In this study, a new coefficient named as Maximum Deflection Area Coefficient is generated to find the optimum beam sizes that suitable to build cabana, lobby and summer house. It is the multiplication of the cross-sectional surface area of the beam and maximum deflection of the beam.

A= Cross-sectional surface area

D= Maximum deflection of the beam

Maximum Deflection Area Coefficient = $A \times D$

Here optimum size beam introduced as the beam which has the lowest value for Maximum Deflection Area Coefficient.

Following reactions are considered for all building structures.

Reaction on the beam by rafter

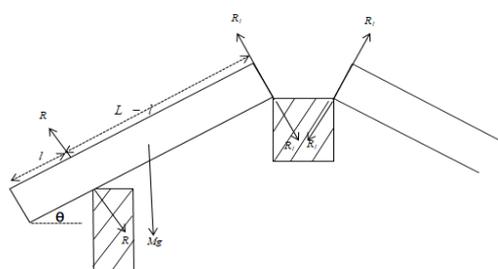


Figure 3: A roof structure

Following symbols are represented different reactions types of the roof structures.

R – The reaction on wall beam by a rafter, R_1 – The reaction on beam by rafter, l – Length of the eave, N – <http://dx.doi.org/10.29322/IJSRP.9.07.2019.p9177>

Number of rafters in one side of the beam, q_1 – The reaction on the beam per unit length by rafter, q_2 – The weight of the beam per unit length, q_3 – The reaction on the beam per unit length by support.

The moment around the wall beam

$$R_1 \times (L - l) = M \times \cos \theta \times \left(\frac{L}{2} - l \right)$$

$$R_1 = \frac{M \times \cos \theta \times \left(\frac{L}{2} - l \right)}{L - l}$$

The downward reaction on the beam by rafters=

$$R_3 = 2 \times R_1 \times \cos \theta = 2 \times (\cos \theta)^2 \times \frac{M \times \left(\frac{L}{2} - l \right)}{L - l}$$

The reaction on the beam per unit length by rafter, $q_1 =$

$$\frac{2 \times (\cos \theta)^2 \times \frac{M \times \left(\frac{L}{2} - l \right)}{L - l}}{\left(\frac{2}{39.37} \right)}$$

The weight of the beam per unit length = $q_2 = \frac{W}{D}$

Reaction on the beam by king post

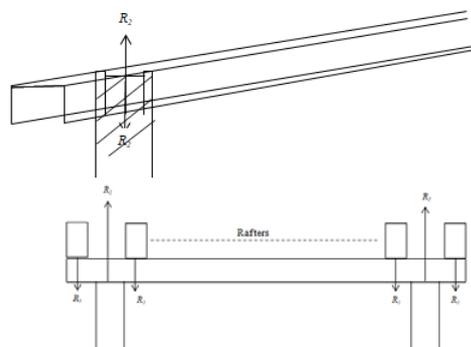


Figure 4: The king post and the beam joinery

The total reaction on the beam by both rafters and king posts=

$$R_2 = \left(\frac{N \times R_3 + W}{2} \right)$$

The reaction on the beam per unit length by support =

$$q_3 = \frac{R_2}{3} \times 39.37$$

Following measurements are used for each building structures to obtain final results.

Table I: Measurements of all building structures

| The building type | The length of the beam(m) | The number of rafters | The number of king post trusses | The angle between beam and rafter |
|-------------------|---------------------------|-----------------------|---------------------------------|-----------------------------------|
| Cabana | 5.03 | 11 | 2 | 39.81 ⁰ |
| Lobby | 10.01 | 21 | 4 | 39.81 ⁰ |
| Summer house | 2.54 | 6 | 2 | 36.87 ⁰ |

The selected region for the distance between two king post trusses of the cabana and the lobby is 7.5-10.5 feet and since the summer house is a small scale size of the building then the selected region for the distance between two king post trusses is 4.5-7 feet.

III. RESULTS

The MATLAB software is used to obtain the following results. In this study, the optimum distance between two king post trusses among the general range is obtained directly by using the minimum deflection value for each beam size. The optimum beam size is obtained by using a new coefficient named as Maximum Deflection Area Coefficient. The beam which has a minimum coefficient value is taken as the optimum beam size. All results are obtained by using Kempas wood for roof structures.

Table II, III, and IV are depicted the maximum deflection of the beam for all type of building that has different beam sizes and different distance between two king-post trusses. Table V is showed the Maximum Deflection Area Coefficient for all building structures.

Table II: The maximum deflection of the beam for the cabana

| Type of building | The Cross-sectional surface area of the beam (inch ²) | The distance between two king post trusses (feet) | The maximum deflection of the beam (meter) | |
|------------------|---|--|--|------------|
| Cabana | 2x4 | 7.5 | 0.0056 | |
| | | 8 | 0.0039 | |
| | | 8.5 | 0.0022 | |
| | | 9 | 0.000303 | |
| | | 9.5 | 0.0017 | |
| | Lobby | 2x5 | 10 | 0.0037 |
| | | | 10.5 | 0.0059 |
| | | | 7.5 | 0.0029 |
| | | | 8 | 0.002 |
| | | | 8.5 | 0.0011 |
| Summer house | | 2x6 | 9 | 0.0001619 |
| | | | 9.5 | 0.0008586 |
| | | | 10 | 0.0019 |
| | | | 10.5 | 0.0031 |
| | | | 7.5 | 0.0017 |
| | Lobby | 3x4 | 8 | 0.0012 |
| | | | 8.5 | 0.0006645 |
| | | | 9 | 0.00009824 |
| | | | 9.5 | 0.0004995 |
| | | | 10 | 0.0011 |
| Summer house | | 3x5 | 10.5 | 0.0018 |
| | | | 7.5 | 0.0038 |
| | | | 8 | 0.0027 |
| | | | 8.5 | 0.0015 |
| | | | 9 | 0.0002213 |
| | Lobby | 3x6 | 9.5 | 0.0011 |
| | | | 10 | 0.0025 |
| | | | 10.5 | 0.004 |
| | | | 7.5 | 0.002 |
| | | | 8 | 0.0014 |
| Summer house | | 3x6 | 8.5 | 0.0007872 |
| | | | 9 | 0.000121 |
| | | | 9.5 | 0.0005823 |
| | | | 10 | 0.0013 |
| | | | 10.5 | 0.0021 |
| | Lobby | 3x6 | 7.5 | 0.0012 |
| | | | 8 | 0.0008359 |
| | | | 8.5 | 0.0004661 |
| | | | 9 | 0.0000738 |
| | | | 9.5 | 0.0003403 |
| Summer house | | 3x6 | 10 | 0.0007737 |
| | | | 10.5 | 0.0012 |

Table III: The maximum deflection of the beam for the lobby

| Type of building | The Cross-sectional surface area of the beam (inch ²) | The distance between two king post trusses (feet) | The maximum deflection of the beam (meter) | |
|------------------|---|--|--|--------|
| Lobby | 2x4 | 7.5 | 0.0985 | |
| | | 8 | 0.0545 | |
| | | 8.5 | 0.0078 | |
| | | 9 | 0.0417 | |
| | | 9.5 | 0.0939 | |
| | | 10 | 0.1489 | |
| | | 10.5 | 0.2066 | |
| | | 2x5 | 7.5 | 0.0508 |
| | | | 8 | 0.0281 |
| | | | 8.5 | 0.0039 |
| 9 | 0.0217 | | | |
| 9.5 | 0.0488 | | | |
| | | 10 | 0.0772 | |
| | | 10.5 | 0.1071 | |
| | | 2x6 | 7.5 | 0.0564 |
| | | | 8 | 0.0310 |
| | | | 8.5 | 0.0041 |
| | | 9 | 0.0244 | |
| | | 9.5 | 0.0545 | |
| | | 10 | 0.0862 | |
| | | 10.5 | 0.1190 | |
| | | 3x4 | 7.5 | 0.0666 |
| 8 | 0.0367 | | | |
| 8.5 | 0.0049 | | | |
| 9 | 0.0288 | | | |
| 9.5 | 0.0644 | | | |
| | | 10 | 0.1018 | |
| | | 10.5 | 0.1410 | |
| | | 3x5 | 7.5 | 0.0345 |
| | | | 8 | 0.0189 |
| | | | 8.5 | 0.0023 |
| | | 9 | 0.0152 | |
| | | 9.5 | 0.0337 | |
| | | 10 | 0.0531 | |
| | | 10.5 | 0.0735 | |
| | | 3x6 | 7.5 | 0.0201 |
| 8 | 0.0110 | | | |
| 8.5 | 0.0013 | | | |
| 9 | 0.0090 | | | |
| 9.5 | 0.0198 | | | |
| | | 10 | 0.0312 | |
| | | 10.5 | 0.0445 | |

Table IV: The maximum deflection of the beam for the summer house

| Type of building | The Cross-sectional surface area of the beam (inch ²) | The distance between two king post trusses (feet) | The maximum deflection of the beam (meter) | |
|------------------|---|--|--|-----------|
| Summer house | 2x4 | 4.5 | 0.0047 | |
| | | 5 | 0.0036 | |
| | | 5.5 | 0.0023 | |
| | | 6 | 0.0009506 | |
| | | 6.5 | 0.0005239 | |
| | | 7 | 0.0021 | |
| | | 2x5 | 4.5 | 0.0025 |
| | | | 5 | 0.0019 |
| | | | 5.5 | 0.0012 |
| | | | 6 | 0.0004877 |
| 6.5 | 0.0002766 | | | |
| | | 7 | 0.0011 | |
| | | 2x6 | 4.5 | 0.0014 |
| | | | 5 | 0.0011 |
| | | | 5.5 | 0.0006975 |
| | | | | 6 |
| 6.5 | 0.0001646 | | | |
| 7 | 0.0006435 | | | |
| 3x4 | 4.5 | | | 0.0032 |
| | 5 | | | 0.0024 |
| | 5.5 | 0.0016 | | |
| | | 6 | 0.0006361 | |
| | | 6.5 | 0.0003706 | |
| | | 7 | 0.0014 | |
| | | 3x5 | 4.5 | 0.0017 |
| | | | 5 | 0.0013 |
| 5.5 | 0.0008142 | | | |
| | | 6 | 0.0003268 | |
| | | 6.5 | 0.0001981 | |
| | | 7 | 0.0007605 | |
| | | 3x6 | 4.5 | 0.0008807 |
| | | | 5 | 0.0006246 |
| 5.5 | 0.003554 | | | |
| | | 6 | 0.0002755 | |
| | | 6.5 | 0.0002127 | |
| | | 7 | 0.0005065 | |

Table V: Maximum Deflection area Coefficient for all building structures

| Type of the building structure | The cross-sectional surface area of the beam (inch ²) | The maximum deflection of the beam (inch) | Maximum Deflection Area Coefficient (inch ³) |
|--------------------------------|---|---|--|
| Cabana | 2x4 | 0.0012 | 0.0096 |
| | 2x5 | 0.0064 | 0.0640 |
| | 2x6 | 0.0039 | 0.0468 |
| | 3x4 | 0.0087 | 0.1044 |
| | 3x5 | 0.0048 | 0.0720 |
| Lobby | 3x6 | 0.0029 | 0.0522 |
| | 2x4 | 0.3079 | 2.4632 |
| | 2x5 | 0.1535 | 1.5350 |
| | 2x6 | 0.1614 | 1.9368 |
| | 3x4 | 0.1929 | 2.3148 |
| Summer house | 3x5 | 0.0906 | 1.3590 |
| | 3x6 | 0.0512 | 0.9216 |
| | 2x4 | 0.0109 | 0.0872 |
| | 2x5 | 0.0058 | 0.0580 |
| | 2x6 | 0.0034 | 0.0408 |
| | 3x4 | 0.0077 | 0.0924 |
| | 3x5 | 0.0041 | 0.0615 |
| | 3x6 | 0.0025 | 0.0450 |

IV. CONCLUSIONS

According to results, the optimum distance between two king post trusses among the general range is 9 feet, 8.5 feet and 6.5 feet for cabana, lobby and summer house respectively. According to Table V, the optimum size of the beam for cabana is 2x6 inch², for lobby is 3x6 inch² and for summer house is 2x6 inch².

All the results are obtained by considering the deflection values of the beam under some limitations from the practical situation. Following limitations are used for the study.: The beam is homogeneous material that has the same modulus of elasticity in tension and compression, The cross-sectional surface area of the beam is uniform, The beams are rectangular timber beams and it has a longitudinal plane of symmetry, Any section of a beam that is a flat plane before the beam deforms will remain a flat plane after the beam deforms, Any section of a beam that is perpendicular to the

neutral axis before the beam deforms will remain perpendicular to the neutral axis after the beam deforms, The roof covering material here used only clay tiles, In this study based on fixed supported beam structure that has only beams king posts and rafters, Only consider the weights of beams, rafters and clay tiles.

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Unsteady Heat Transfer to MHD Oscillatory Flow of Jeffrey fluid in a Channel Filled with Porous Material

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Abstract- The study on unsteady Heat Transfer to MHD Oscillatory flow of Jeffrey fluid through a porous medium under slip condition was investigated. The dimensionless governing equations are solved using perturbation technique. The analytical expressions for the velocity, temperature, skin friction or shear stress of the fluid have been obtained. The effects of flow parameters of Jeffrey fluid, Grashof number, Hartmann number, Slip parameter, porosity parameter, radiation parameter and frequency of the oscillation are carried out. The result obtained shows that velocity and skin friction decreases with increasing Hartmann number. It was also observed that the velocity and skin friction increases with increasing in Darcy number. The results obtained for Jeffrey fluid parameters was computed for velocity and skin friction shows that the velocity increases with increasing Jeffrey fluid parameter and skin friction decreases with increasing Jeffrey fluid parameter.

Index Terms- Jeffrey fluid, Heat transfers, MHD, Oscillatory flow, Porous medium, Slip condition,

I. INTRODUCTION

The study of non-Newtonian fluids has a variety of applications in engineering and industry especially in extraction of crude oil from petroleum products. Jeffrey fluid is a type of non-Newtonian fluid that uses a relatively simpler linear model using time derivatives instead of convected derivatives, which are used by most fluid models. Jeffrey fluid is one of the rate type materials. It shows the linear viscoelastic effect of fluid which has many applications in polymer industries.

Many researchers have carried out studies in this area. Some of these include, El-Hakiem (2000) studied the MHD oscillatory flow on free convection radiation through a porous medium with constant velocity. Sahim (2008) investigated transient three dimensional flows through a porous medium with transverse permeability oscillating with time. The effect of viscous dissipative heat on three dimensional oscillatory flows with periodic suction velocity has been studied by Sahim (2010). Makinde and Mhone (2005) examined heat transfer to MHD oscillatory flow in a channel filled with porous medium. Mehmood and Ali (2007) extended the work of Makinde and Mhone (2005) by considering the fluid slip at the lower wall. Kumar *et al.* (2010) extended the work of Mehmood and Ali

(2007) by employing perturbation technique to the problem. The effect of slip conditions on the MHD steady flow in a channel with permeable boundaries has been discussed by Makinde and Osalusi (2006). Khaled and Vafai (2004) obtained the closed form solutions for steady periodic and transient velocity field under slip condition. Mansour *et al.* (2007) studied the free convection flow of micro polar fluid in slip flow regime through porous medium with periodic temperature and concentration. Mustafa *et al.* (2008) investigated unsteady MHD memory flow with oscillatory suction, variable free stream and heat sources. In addition, Abdul-Hakeem and Sathiyathan (2009) presented analytical solution for two-dimensional oscillatory flow of an incompressible viscous fluid, through a highly porous medium bounded by an infinite vertical plate. Umavathi *et al.* (2009) studied the unsteady oscillatory flow and heat transfer in a horizontal composite channel. While Jha and Ajibade(2010) reported some interesting results on the free convective oscillatory flows induced by time dependent boundary conditions.

The effect of magnetic field on free convective flow of a viscous incompressible fluid past an infinite moving porous hot vertical plate in the presence of porous medium and radiation was analyzed by Singh *et al.* (2012). Uwanta and Hamza (2012) investigate unsteady heat transfer flow of a viscous, incompressible, electrically conductive fluid through porous medium with periodic suction and temperature oscillation. Kavita *et al.* (2012) investigate the influence of heat transfer on MHD oscillatory flow of Jeffrey fluid in a channel. In their work they observed that, the axial velocity increases with increasing of Jeffrey fluid. Also, the maximum velocity occurs at the centerline of the channel while the minimum at the channel walls. Moreover, the velocity is more of Jeffrey fluid than that of Newtonian fluid. Aruna Kumari *et al.* (2012) studied the effect of heat transfer on MHD oscillatory flow of Jeffrey fluid in a channel with slip effect at a lower wall where the expressions for the velocity and temperature are obtained analytically. Asadullah *et al.* (2013) consider the MHD flow of a Jeffrey fluid in converging and diverging channels. The flows between non parallel walls have a very significant role in physical and biological sciences. Idowa *et al.* (2013) studied the effect of heat and mass transfer on unsteady MHD Oscillatory flow of Jeffrey fluid in a horizontal channel with Chemical Reaction. Adesanya and Makinde (2014) studied MHD Oscillatory slip flow and heat transfer in a channel filled with porous medium. Al-Khafajy (2016) investigates the effect of heat

transfer on MHD Oscillatory flow of Jeffrey fluid with variable viscosity through porous medium. Ahmad and Ishak (2017) studied steady two-dimensional mixed convection boundary layer flow and heat transfer of a Jeffrey fluid over a stretched sheet immersed in a porous medium in the presence of a transverse magnetic field.

But the work of Hamza *et al.* (2011) investigate the transient heat transfer to MHD oscillatory flow through porous medium under slip condition and oscillating temperature, but the authors has not addressed the influence of a Jeffrey fluid parameters in their work.

In the present paper, we investigate the influence of Jeffrey fluid, slip conditions, magnetic field and radiative heat transfer on unsteady flow of conducting optically thin fluid through a channel filled with porous medium and surface temperature oscillating.

II. MATHEMATICAL FORMULATION

Consider the flow of a conducting optically thin fluid in a channel filled with saturated porous medium under the influence of an externally applied homogeneous magnetic field and radiative heat transfer. It is assumed that the fluid has a small electrical conductivity and the electromagnetic force produced is very small. Take a Cartesian coordinate system(x, y), where x lies along the center of the channel, y is the distance measured in the normal section. Then, assuming a Boussinesq incompressible fluid model, the equations governing the motion are given as:

$$\frac{\partial u'}{\partial t'} = -\frac{1}{\rho} \frac{\partial p'}{\partial x'} + \frac{\nu}{(1+\beta_1)} \frac{\partial^2 u'}{\partial y'^2} - \frac{\nu}{k'} u' - \frac{\sigma_e B_0^2 u'}{\rho} + \beta(T' - T'_0) \quad (1)$$

$$\frac{\partial T'}{\partial t'} = \frac{k}{\rho c_p} \frac{\partial^2 T'}{\partial y'^2} - \frac{1}{\rho c_p} \frac{\partial q'}{\partial y'} \quad (2)$$

With boundary conditions

$$\left. \begin{aligned} u' - \gamma^* \frac{\partial u'}{\partial y'} &= 0, \quad T' = T'_0, \quad \text{on } y' = 0 \\ u' = 0, T' &= T'_0 + (T'_\omega - T'_0) \cos \omega' t' \quad \text{on } y' = a \end{aligned} \right\} \quad (3)$$

Where u' is the axial velocity, t' is time, ω' is frequency of the oscillation, T' the fluid temperature, p is the pressure gravitational force, c_p is the specific heat at constant pressure, k is the thermal conductivity, q is the radiative heat flux, β is the coefficient of volume expansion, k' is the porous medium permeability coefficient, B_0 is the electromagnetic induction, σ_e is the conductivity of the fluid, ρ is the density of the fluid, ν is the kinematics viscosity coefficient. It is assumed that walls temperature T'_0, T'_ω are high enough to induce radiative heat transfer, and γ^* is the dimensionless slip parameter. Following Makindi and Mhone (2005), it is assumed that the fluid is optically thin with a relatively low density and the radiative heat flux is given by :

$$\frac{\partial q'}{\partial y'} = 4\alpha^2(T'_0 - T') \quad (4)$$

Where α is the mean radiation absorption coefficient.

The following dimensionless variables and parameters are introduced:

$$\left. \begin{aligned} x &= \frac{x'}{a} \Rightarrow x' = xa, \quad y = \frac{y'}{a} \Rightarrow y' = ya, \quad u = \frac{u'}{U} \Rightarrow u' = uU, \\ w &= \frac{w'a}{U} \Rightarrow w' = \frac{wU}{a}, \quad t = \frac{t'U}{a} \Rightarrow t' = \frac{ta}{U}, \quad \theta = \frac{T' - T'_0}{T'_\omega - T'_0} \Rightarrow T' = T'_0 + \theta(T'_\omega - T'_0), \\ p &= \frac{ap'}{\rho\nu U} \Rightarrow p' = \frac{p\rho\nu U}{a}, \quad \gamma = \frac{\gamma^*}{a} \Rightarrow \gamma^* = \gamma a, \quad S^S = \frac{1}{Da}, \quad Da = \frac{K'}{a^2} \Rightarrow k' = a^2 Da \\ N^2 &= \frac{4\alpha^2 a^2}{k}, \quad H^2 = \frac{a^2 \sigma_e B_0^2}{\rho\nu}, \quad Gr = \frac{g\beta(T'_\omega - T'_0)a^2}{\nu U}, \quad Pe = \frac{Ua\rho c_p}{k}, \quad Re = \frac{Ua}{\nu}, \end{aligned} \right\} \quad (5)$$

Where U is the flow mean velocity, the dimensionless governing equations together with appropriate boundary conditions can be written as:

$$Re \frac{\partial u}{\partial t} = -\frac{\partial p}{\partial x} + \frac{1}{(1+\beta_1)} \frac{\partial^2 u}{\partial y^2} - (H^2 + S^2)u + Gr\theta \quad (6)$$

$$Pe \frac{\partial \theta}{\partial t} = \frac{\partial^2 \theta}{\partial y^2} + N^2 \theta \quad (7)$$

Subject to the boundary condition

$$\left. \begin{aligned} u - \gamma \frac{\partial u}{\partial y} &= 0, \quad \theta = 0 \quad \text{at } y = 0 \\ u = 0, \theta &= \cos \omega t \quad \text{at } y = 1 \end{aligned} \right\} \quad (8)$$

Where β_1 is the Jeffrey fluid, Gr is the thermal Grashof number, H is the Hartmann number, N is the radiation parameter, Pe is the Peclet number, Re is the Reynolds number, Da is the

Darcy number, Pr is the Prandtl number, γ is the slip parameter and s is the porous medium shape factor.

III. METHOD OF SOLUTION

In order to solve equations (6), (7) and (8) for purely oscillatory flow, let the pressure gradient, fluid velocity and temperature be:

$$u(y, t) = u_0(y)e^{i\omega t} + u_1(y)e^{-i\omega t} \quad (9)$$

$$\theta(y, t) = \theta_0(y)e^{i\omega t} + \theta_1(y)e^{-i\omega t} \quad (10)$$

Assume that $-\frac{\partial p}{\partial x} = \lambda[e^{i\omega t} + e^{-i\omega t}]$

Where $\lambda < 0$ for favorable pressure, ω is the frequency of the oscillation. Substituting the above expressions: (9) and (10) into (6), (7) and (8), we obtained

$$\theta_0'' + N_1^2 \theta_0 = 0 \tag{11}$$

$$\theta_1'' + N_2^2 \theta_1 = 0 \tag{12}$$

$$u_0'' - M_1^2 u_0 = -\alpha\lambda - \alpha Gr \theta_0 \tag{13}$$

$$u_1'' - M_2^2 u_1 = -\alpha\lambda - \alpha Gr \theta_1 \tag{14}$$

$$\left. \begin{aligned} u_0 - \gamma u_0' = 0, u_1 - \gamma u_1' = 0, \theta_0 = 0, \theta_1 = 0, \text{ at } y = 0 \\ u_0 = 0, u_1 = 0, \theta_0 = \frac{1}{2}, \theta_1 = \frac{1}{2} \text{ at } y = 1 \end{aligned} \right\} \tag{15}$$

Where $\alpha = 1 + \beta_1$

$$N_1^2 = (N^2 - Pei\omega), N_2^2 = (N^2 + Pei\omega),$$

$$M_1^2 = (H^2 + S^2 + Rei\omega) \text{ And } M_2^2 = (H^2 + S^2 - Rei\omega)$$

Equations (11) to (15) are solved and the solution for fluid temperature and velocity are given as follows:

$$\theta(y, t) = \frac{1}{2} \left[\frac{\sin N_1 y}{2 \sin N_1} e^{i\omega t} + \frac{\sin N_2 y}{2 \sin N_2} e^{-i\omega t} \right] \tag{16}$$

$$u(y, t) = [A_5 \cosh M_1 y + A_6 \sinh M_1 y + F + G_2 \sin N_1 y] e^{i\omega t} + [A_7 \cosh M_2 y + A_8 \sinh M_2 y + K + G_4 \sin N_2 y] e^{-i\omega t} \tag{17}$$

Skin friction or shear stress

$$\tau_0 = \frac{d\theta}{dy} /_{y=0} = \frac{1}{2} \left[\frac{N_1}{\sin N_1} e^{i\omega t} + \frac{N_2}{\sin N_2} e^{-i\omega t} \right] \tag{18}$$

$$\tau_1 = \frac{d\theta}{dy} /_{y=1} = \frac{1}{2} (N_1 \cot N_1 e^{i\omega t} + N_2 \cot N_2) e^{-i\omega t} \tag{19}$$

Nusselt number or rate of heat transfer is given by;

$$Nu_0 = \frac{du}{dy} /_{y=0} = [A_6 M_1 + G_2 N_1] e^{i\omega t} + [A_8 M_2 + G_4 N_2] e^{-i\omega t} \tag{20}$$

IV. GRAPHICAL RESULTS AND DISCUSSION

To study the MHD Oscillatory flow of Jeffrey fluid in a channel filled with porous material, the velocity u , temperature θ and skin friction $(\tau_0 \text{ and } \tau_1)$ profiles are depicted graphically against y for different values of different parameters; Jeffrey fluid β_1 , thermal Grashof number Gr , Hartmann number H , radiation parameter N , Peclet number Pe , Reynolds number Re , Darcy number Da , Prandtl number Pr , slip parameter γ and porous medium shape factor s . We made use of the following parameter values except otherwise indicated, $\beta_1 = 0.01$, $Re = 1$, $S = 1$, $Ha = 1$, $Gr = 10$, $Pe = 1$, $N = 1$, $\lambda = -1$, $\gamma = 0.5$ and $\omega = 1$.

The temperature profiles for different values of the Peclet number ($Pe = 1, 2, 3, 4$) are shown in Figures 1. It is observed that the temperature increases with increasing Peclet number.

The velocity profiles have been studied and presented in Figures 2 to 5. The velocity profiles for different values of the Hartmann number ($Ha = 1, 5, 10, 15$) is shown in fig. 2. It observed that the velocity decreases with increasing Hartmann number. The velocity profiles for different values of Darcy number ($Da = 0.01, 0.03, 0.05, 0.07$), Grashof number ($Gr = 1, 2, 3, 4$) and Jeffrey fluid parameter ($\beta_1 = 0.1, 1, 5$) are shown in Figures 3, 4 and 5 respectively. It is observed that the velocity decrease with

increasing Darcy number, Grashof number and Jeffrey fluid parameter.

The variation of the skin friction $(\tau_0 \text{ and } \tau_1)$ on the porous plate with material parameters are shown in fig.6-8. The skin friction $(\tau_0 \text{ and } \tau_1)$ profiles for different values of Darcy number ($Da = 0.01, 0.02, 0.03, 0.04$) is shown in fig. 6. It is observed that skin friction increase with increasing Darcy number. The skin friction $(\tau_0 \text{ and } \tau_1)$ profiles for different values of Jeffrey fluid parameter ($\beta_1 = 0.1, 0.3, 0.5, 0.7$) and the Hartmann number ($Ha = 1, 3, 5, 7$) is shown in fig.7 and 8 respectively. It is observed that skin friction $(\tau_0 \text{ and } \tau_1)$ decreases with increasing of Jeffrey fluid parameter and Hartmann number.

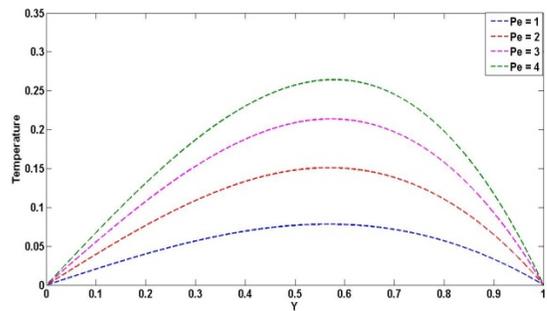


Figure 1: Temperature profiles for different values of the Peclet number

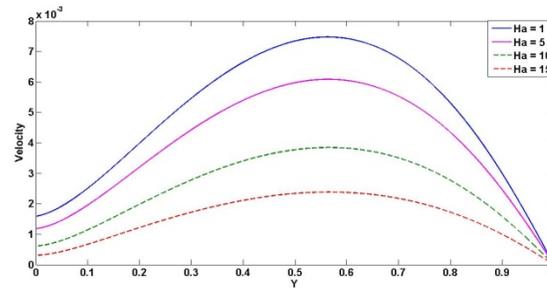


Fig. 2: Velocity profiles for different values of the Hartmann number

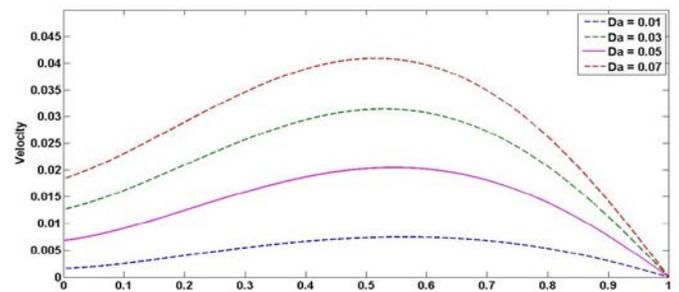


Fig. 3: Velocity profiles for different values of Darcy number

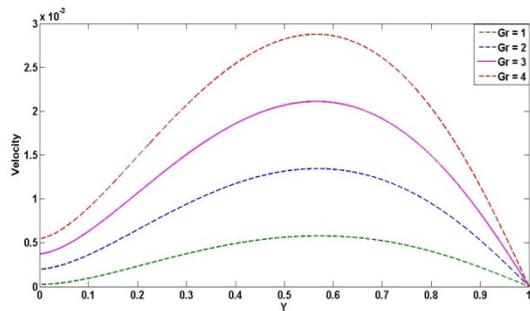


Fig. 4: Velocity profiles for different values of grashof number Gr

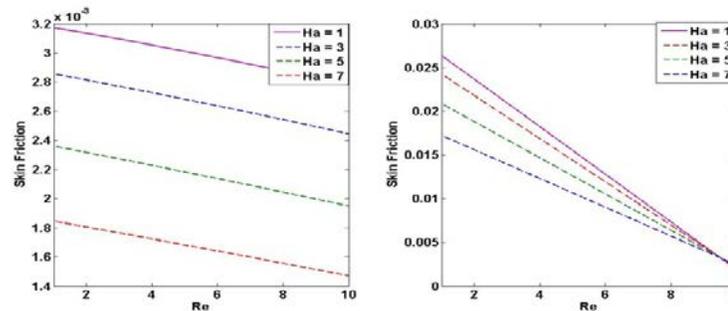


Fig. 8: Skin friction for different values of Ha

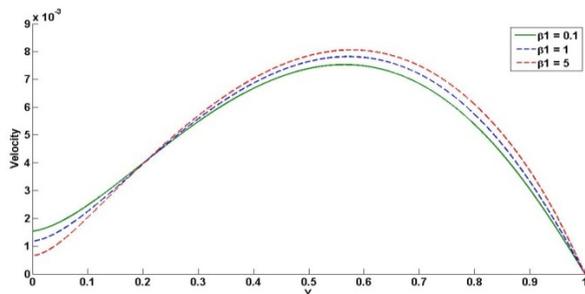


Fig. 5: Velocity profiles for different values of Jeffrey fluid parameter

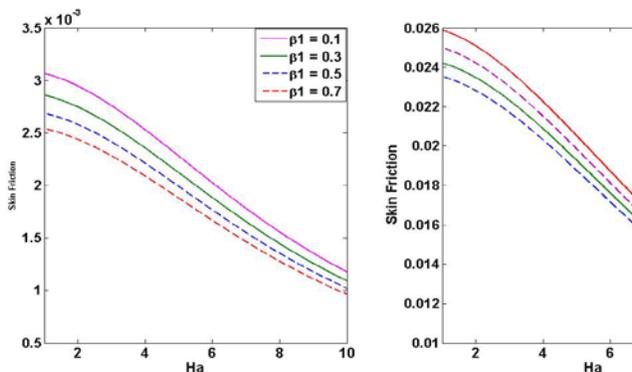


Fig. 6: Skin friction for different values β_1

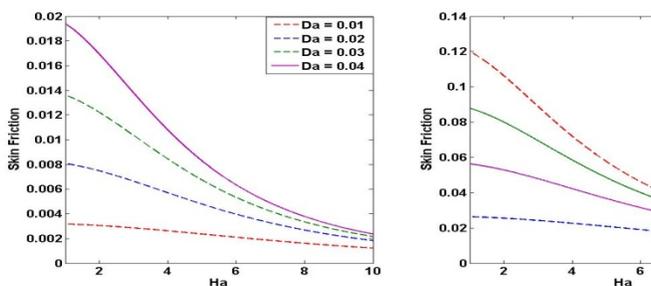


Fig. 7: Skin friction for different values of Da

V. CONCLUSIONS

This paper investigates the heat transfer to MHD Oscillatory flow of Jeffrey fluid in a channel filled with porous material. The velocity, temperature and skin friction profiles are obtained analytically. The effect of different parameters namely, the radiation parameter, Grashof number, Hartmann number, Jeffrey fluid parameter, Porosity parameter, Slip parameter, frequency of the oscillation and Peclet number are studied. The conclusions of the study are as follows;

- (i) It is observed that the temperature increases with increasing Peclet number.
- (ii) It observed that the velocity decreases with increasing Hartmann number.
- (iii) It is observed that the velocity decrease with increasing Darcy number, Grashof number and Jeffrey fluid parameter.
- (iv) It is observed that skin friction increase with increasing Darcy number.
- (v) It is observed that skin friction decreases with increasing of Jeffrey fluid parameter and Hartmann number.

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The Correlation of Tumor-Infiltrating Lymphocytes with Tumor Mass Location and Histological Grading of Cutaneous Squamous Cell Carcinoma

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Abstract- Background: Cutaneous squamous cell carcinoma (cSCC) is the malignant tumor derived from the keratinocytes of the epidermis. It is the second most common skin cancer in Indonesia. The infiltration of tumor-infiltrating lymphocytes (TILs) had been studied and related with the prognostic factor for many solid tumors. The research about TILs with Hematoxylin&Eosin staining for cSCC has not been studied until nowadays.

Objective: This study was aimed to analyze the correlation of TILs with the tumor mass location and histological grading for cSCC.

Methods: This is an analytical research with cross sectional approach using the slide and paraffine blocks from the patients diagnosed with cSCC with Hematoxylin&Eosin staining. The statistical analysis with Kruskal-Wallis method is used to analyze the correlation of intratumoral and stromal TILs with the tumor mass localation and histological grading of cSCC.

Results: Based on the statistical analysis for 48 samples of the patients with cSCC, the p-value for the correlation of intratumoral TILs with the tumor mass location, stromal TILs with tumor mass location, and intratumoral TILs with the histological grading, are 0.824, 0.124, 0.058 ($p > 0.05$). Meanwhile, the correlation of stromal TILs with the histological grading shows the p-value of 0.027 ($p < 0.05$).

Conclusion: Only the stromal TILs are closely related to the histological grading of cSCC.

Index Terms-: cutaneous squamous cell carcinoma, cSCC, TILs, grading, location, risk of metastasis.

I. INTRODUCTION

Cutaneous squamous cell carcinoma (cSCC) is the second most frequent skin cancer after basal cell carcinoma with the incidence rate is approximately 20% of all skin cancer.¹ The current estimated incidence of this tumor is 15 to 35/100,000 people per year and is expected to increase around 2% to 4% per year due to the aging population and chronic ultraviolet B exposure.² The etiology and risk factors of this skin cancer have changed from the occupational exposure of chemical carcinogen to other factors, such as HIV infection, HPV infection, therapeutic advances with immunosuppressive agent and PUVA, and also organ transplantation.³

The prognosis of cSCC is influenced by some factors. High risk factors for cSCC are tumor depth more than 2 mm, Clark level IV / V, perineural invasion, tumor location on ear or lip, and poor differentiation.⁴ Differentiation of cSCC, which are needed for histological grading evaluation, is divided into well differentiation, moderate differentiation, and poor differentiation. Histological grading for cSCC depends on the degree of anaplasia in the tumor nest, mitotic activity, and keratin formation.⁵

Tumor-infiltrating lymphocytes (TILs) as one of the immunity cells against the tumor have an important contribution for tumor invasion, growth, metastasis, and outcome.⁶ TILs infiltrate into the tumor nests (intratumoral TILs) or around the tumor nests (stromal TILs).⁷ Studies about TILs had been done for many solid tumors, such as lung carcinoma, gastric cancer, colorectal carcinoma, hepatocellular carcinoma, pancreatic adenocarcinoma, breast cancer, ovarian cancer, melanoma, and squamous cell carcinoma of head and neck. Some of these studies used the immunohistochemistry staining to evaluate the subset of TILs and only a few studies used the Hematoxylin&Eosin staining. Some results showed that TILs have an antitumorigenic role in carcinogenesis while the others showed the contrary role.^{6,8}

Although Hematoxylin&Eosin staining is the routine staining for histopathological examination, only a few studies about TILs with this staining had been done. The previous studies for TILs with Hematoxylin&Eosin staining are for epithelial ovarian carcinoma, squamous cell carcinoma of head and neck, melanoma, and breast cancer. Studies about TILs for cSCC with Hematoxylin&Eosin staining have not been done yet and this study is aimed to evaluate the correlation of TILs with histological grading and tumor mass location of cSCC. The infiltration of TILs was observed for intratumoral infiltration and stromal infiltration.

II. MATERIAL AND PRODUCT

This is an analytical study with the cross sectional approach. The study was conducted at Anatomical Pathology Laboratory of Faculty of Medicine, Universitas Sumatera Utara and also at Anatomical Pathology Unit of Haji Adam Malik Medan General Hospital. The research was held from November 2017 until May 2019, after approved by Universitas Sumatera Utara and Haji

Adam Malik General Hospital Health Research Ethics Committee.

The sample size needed for this research was calculated based on the sample formula used for testing a hypothesis in one population. Based on the sample formula, minimum samples needed for this research was 47 samples. The samples were obtained from the slide and the paraffine blocks of the patients diagnosed as cSCC.

The inclusion criteria for this study were patients' slides or paraffine blocks with a pathological diagnosis of cutaneous squamous cell carcinoma and the medical data recorded the tumor mass location. The exclusion criteria included the following: (1) Slides or paraffine blocks were lost or damaged; (2) Slides only showed the tumor cells without enough stromal area for evaluation.

All slides with the Hematoxylin&Eosin staining were observed microscopically by researcher, together with two pathologists using Olympus CX23 to determine the histological grading and the level of TILs infiltration.

Cutaneous squamous cell carcinoma is graded based on the degree of differentiation and keratinization.⁹ Histological grading was divided into: (1) Well differentiated cSCC, is characterized by squamous epithelium that is easily recognisable with abundant of keratinization. The epithelium is obviously squamous and intercellular bridges (prickles) are readily apparent. The tumors display minimal pleomorphism and mitotic figures are mainly basally located; (2) Moderately differentiated cSCC falls in between the well differentiation and poor differentiation. The epithelial structures are more disorganized in which the squamous epithelial derivation is less obvious. Nuclear and cytoplasmic pleomorphism is more pronounced. The mitotic figures, including the atypical mitosis, can be found more easily. Tumors show less keratinization, often being limited to the formation of keratin pearls; (3) Poorly differentiated cSCC, is more difficult to establish the true nature of the lesion, unless intercellular bridges or small foci of keratinization are found. Tumors showed highly atipia nuclei with lots of mitotic figures.¹⁰⁻¹¹

All fields were viewed in order to determine the level of TILs infiltration. TILs infiltration was divided into intratumoral TILs and stromal TILs. Intratumoral TILs are lymphocytes which infiltrated into the tumor nests and were in contact with the tumor cells, while stromal TILs are lymphocytes which infiltrated surrounding the tumor nests. TILs infiltration were categorized into four level: (1) Score 0 for no infiltration of lymphocytes; (2) Score 1 for minimal lymphocytes infiltration which were less than 10 cells / HPF; (3) Score 2 for moderate lymphocytes infiltration in which lymphocytes could be seen easily, but not in large aggregates; (4) Score 3 for massive infiltration in which the infiltration the lymphocytes formed large aggregates and could be found in 50% tumor area.

Tumor mass location was categorized based on the risk of local recurrence and metastatic potential in multivariate studies. Tumors were categorized into high risk location if the tumors are located on ear or lip, which had the increased risk for local recurrence and metastasis. Tumors were categorized into low to intermediate risk location if they were located on scalp, perineal region, extremity, and trunk.¹³

Data was analyzed with Kruskal-Wallis method using the statistic software program and the results were shown in the table of frequency.

III. RESULT

From 48 samples of cSCC which were evaluated in this study, 9 cases (18.8%) were located at the high risk tumor mass location and 39 cases (81.2%) were located at the low to intermediate risk tumor mass location. Histological evaluation showed that 19 cases (39.6%) were well differentiated tumors, 18 cases (37.5%) were moderately differentiated tumors, and 11 cases (22.9%) were poor differentiated tumors. Evaluation for intratumoral infiltration of TILs showed that 14 cases (29.2%) had minimal infiltration of intratumoral TILs, 27 cases (56.3%) had moderate infiltration of intratumoral TILs, and 7 cases (14.5%) had massive infiltration of intratumoral TILs. Microscopic evaluation for stromal infiltration of TILs showed that only 5 cases (10.4%) had minimal infiltration of stromal TILs, 17 cases (35.4%) had moderate infiltration of stromal TILs, and 26 cases (54.2%) had massive infiltration of stromal TILs. Detailed data are available in table 1 (see below).

Statistical analysis with Kruskal-Wallis method showed that no statistical correlation was found between the tumor mass location with intratumoral TILs infiltration (p-value = 0.824), no statistical correlation was found between the tumor mass location with stromal TILs infiltration (p-value = 0.124), and no statistical correlation between histological grading and intratumoral TILs infiltration (p-value = 0.058). Only stromal TILs infiltration had statistical correlation with histological grading (p-value = 0.027). The data are available in table 2 and table 3 (see below).

IV. DISCUSSION

As mentioned previously, many studies had been done to evaluate the prognostic role of TILs in solid tumors. Only a few studies used the hematoxylin&eosin staining as this staining is the routine staining for histopathological examination and available in every pathological laboratory.

Many authors have suggested that TILs level carries more predictive value than TNM staging for malignant tumors. Studies about TILs as the prognostic value for squamous cell carcinoma had been carried, but the authors only focused for the head and neck squamous cell carcinoma.¹⁴

As one of the prognostic factor for cSCC, tumor mass location had been statistically studied in multivariate and statistical data showed that tumors located on the lip and ears have higher risk for local recurrence and metastasis than tumors located on scalp, trunk, perineum, and extremity.¹³ TILs as predictive value of prognosis are thought to contribute for the risk of recurrence and metastasis of cSCC based on the tumor mass location because infiltration of immune cells actually affect the cancer development, progression, and metastasis. Statistical analysis of correlation between tumor mass location and infiltration of TILs, either intratumoral or stromal TILs, showed that there is no correlation at all in this study. It seems that immune cells, especially the T-lymphocyte, have a significant role in immunoediting. Tumor metastasis itself occurs because of

many factors, such as the loss of e-cadherin function for the cell adhesion, the damage of extracellular matrix due to the effect of the proteolytic enzymes, the role of hypoxia-inducible transcription factor (HIF), and the angiogenesis. Tumor metastasis also happens because of the EMT (epithelial to mesenchymal transition) program. Stroma, which is composed of a variety of fibroblast, myofibroblasts, endothelial, myeloid, and lymphoid cells, becomes reactive and releases various signals, including TGF- β , Wnts, and certain interleukins that impinge on nearby carcinoma cells, inducing the latter to activate their previously silent EMT program. Immune cells that play important role for metastasis are neutrophils and NK cells. Perhaps it can be the reason of no correlation between infiltration of lymphocytes into or surrounding the tumor nests of cSCC with the tumor mass location based on the risk of local recurrence and metastasis.¹⁵ We also consider that tumors located on the ears or lips are close to the lymphatic circulation of head and neck region which supports the metastasis process.

Besides the tumor mass location, UICC and AJCC also regard histological grading of cSCC as an important prognostic factor.¹¹ The prognostic value of TILs itself had been proven in some studies, especially the infiltration of stromal TILs. Xu, *et al*, (2017) also studied the role of stromal TILs for squamous cell carcinoma on head and neck. They stated that massive infiltration of stromal TILs were related to the better outcome with lower rate of tumor recurrence, but they did not intend on the correlation of TILs with histological grading in their study.¹⁴ In our study, there is strong correlation between stromal TILs and histological grading or tumor differentiation. We suppose that the lymphocytes which infiltrate surrounding the tumor nest have the antitumorigenic effect for cSCC which inhibit and control tumor growth. Previous studies and supporting literature stated that the subset of lymphocytes which has the antitumorigenic effect is CD8+ T lymphocytes. Further studies using the immunohistochemistry staining to evaluate the predominant subsets of lymphocytes which infiltrate into or around the tumor nests must be held.

This study was retrospective in nature with some limitations. The samples used in this study were obtained from the biopsy and also tumor excision in which the size of tumor and the depth of invasion could not be confirmed. Besides that, the clinical data, including the immunity status, comorbidity, and the previous skin lesion as the predisposing factor were not known. Analysis to the correlation between histopathological variant of cSCC and infiltration of TILs could not be conducted because not all variant were found in our samples. These limitations will be given further consideration in future studies.

V. CONCLUSION

After conducted this study, we conclude some points in the following:

1. No statistical correlation between tumor mass location of cSCC based on the risk of local recurrence and metastasis, level of intratumoral and stromal TILs infiltration.
2. No statistical correlation between histological grading of cSCC and level of intratumoral TILs infiltration
3. There are significant correlation between histological grading and level of stromal TILs infiltration.

We suggest on determining the level of stromal TILs infiltration as one of the prognostic factors which is needed to be reported in the histopathological report for cutaneous squamous cell carcinoma.

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Table 1. Distribution of cutaneous squamous cell carcinoma based on the tumor mass location, histological grading, and level of tumor-infiltrating lymphocytes.

| Variable | Total (n) | Percentage (%) |
|-----------------------------|-----------|----------------|
| Tumor mass location | | |
| • High risk | 9 | 18.8 |
| • Low to intermediate risk | 39 | 81.2 |
| Histological Grading | | |
| • Well differentiated | 19 | 39.6 |
| • Moderately differentiated | 18 | 37.5 |
| • Poorly differentiated | 11 | 22.9 |
| Level of intratumoral TILs | | |
| • None | 0 | 0 |
| • Minimal infiltration | 14 | 29.2 |
| • Moderate infiltration | 27 | 56.3 |
| • Massive infiltration | 7 | 14.5 |
| Level of stromal TILs | | |
| • None | 0 | 0 |
| • Minimal infiltration | 5 | 10.4 |
| • Moderate infiltration | 17 | 35.4 |
| • Massive infiltration | 26 | 54.2 |
| Total | 48 | |

Table 2. Correlation of level of intratumoral TILs with tumor mass location and histological grading

| Variable | Level of Intratumoral TILs | | | | | | | | Total | p-value |
|-----------------------------|----------------------------|---|---------|------|---------|------|---------|------|-------|---------|
| | Score 0 | | Score 1 | | Score 2 | | Score 3 | | | |
| | n | % | n | % | n | % | n | % | | |
| Tumor mass location | | | | | | | | | | |
| • High risk | - | - | 2 | 22.2 | 6 | 67.7 | 1 | 11.1 | 9 | 0.824 |
| • Low to intermediate risk | - | - | 12 | 30.8 | 21 | 53.9 | 6 | 15.3 | 39 | |
| Histological grading | | | | | | | | | | |
| • Well differentiated | - | - | 3 | 21.4 | 11 | 40.8 | 5 | 71.4 | 19 | 0.058 |
| • Moderately differentiated | - | - | 6 | 42.9 | 10 | 37.0 | 2 | 28.6 | 18 | |
| • Poorly differentiated | - | - | 5 | 35.7 | 6 | 22.2 | - | - | 11 | |
| Total | - | - | 14 | | 27 | | 7 | | 48 | |

Table 3. Correlation of level of stromal TILs with tumor mass location and histological grading

| Variable | Level of Intratumoral TILs | | | | | | | | Total | p-value |
|-----------------------------|----------------------------|---|---------|------|---------|------|---------|------|-------|---------|
| | Score 0 | | Score 1 | | Score 2 | | Score 3 | | | |
| | n | % | n | % | n | % | n | % | | |
| Tumor mass location | | | | | | | | | | |
| • High risk | - | - | 2 | 22.2 | 4 | 44.5 | 3 | 33.3 | 9 | 0.124 |
| • Low to intermediate risk | - | - | 3 | 7.7 | 13 | 33.3 | 23 | 59.0 | 39 | |
| Histological grading | | | | | | | | | | |
| • Well differentiated | - | - | - | - | 5 | 29.4 | 14 | 53.9 | 19 | 0.027 |
| • Moderately differentiated | - | - | 2 | 40.0 | 8 | 47.1 | 8 | 30.8 | 18 | |
| • Poorly differentiated | - | - | 3 | 60.0 | 4 | 23.5 | 4 | 15.3 | 11 | |
| Total | - | - | 5 | | 17 | | 26 | | 48 | |

Supply Chain Management Practices and Hospital Operational Efficiency: The Nigerian Example

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Abstract- This study explores public hospitals in Nigeria to investigate the relationship between supply chain management practices and operational efficiency- cost minimization, delivery quality and service availability. Survey design was adopted to delineate the study population, select participants, and design appropriate method of data collection and analysis. Out of 584 healthcare supply chain executives that constituted the study population, 293 were selected from 18 public hospitals in Southern geopolitical zone of Nigeria using the multistage sampling method. The structured questionnaire was employed to glean relevant primary data which was analyzed quantitatively. Findings shows that operational efficiency is significantly and positively influenced by three major practices: strategic supplier partnership, supplier selection decision, and integration of information communication technologies among supply chain partners. Relevant implications of the findings for managers were highlighted and discussed.

Index Terms- Supply chain management, hospital operational efficiency, collaborative inventory planning & forecasting

I. INTRODUCTION

Statistical estimates provided by the World Health Organization (WHO) revealed that about one third of people in the world do not have access to vital medicines¹. In some African and Asian nations, the proportion increases to about 40 percent. In 2011, the United Nations Conference on Trade and Development (UNCTAD) provided evidence confirming that almost two billion of the world's population, many of whom live in less developed nations, lack access to life-saving medicines. A medicine is considered essential and life-saving if it is available, affordable, assured of quality and properly used by an individual or community¹.

Furthermore, in sub-Saharan Africa, there is statistical evidence that 30-50% of the population lack access to basic medical care, and many people are still suffering from preventable and treatable diseases because of inaccessibility to essential healthcare products. Specifically, the United Nations, in its 2013 survey of healthcare indicators, ranked Nigeria 187 out of 192 participating countries. This poor human development index (HDI) showcases the dismal performance of the country's healthcare outcome. A report by the WHO predicted that by 2015, Nigeria will still struggle to meet health requirements of the immediate past millennium development goals. Thus, access to healthcare remains one of the leading causes of poor health outcomes in most African countries, including Nigeria.

As gruesome as the above statistics may appear, poor access to essential medicine is further compounded by such factors as meager funding, insufficient research and development (R&D), inadequate human capacity, and the undeveloped network of healthcare supply and distribution chain in Nigeria. In a survey carried out by the Federal Ministry of Health in 2010, the medical supply system was described as poorly coordinated and fragmented, resulting in wastage of resources, and denying the populace of access to essential drugs and medications. The provision healthcare in Nigeria is deficient of a well harmonized supply chain platform, and poor quality of healthcare is often the excuse for patient switch to private clinics either within or outside the country.

Efficient supply chain management is essential to ensure healthcare products are available for users at service delivery points. A supply chain can be understood as an integrated system composing key players such as suppliers of materials and components, product manufacturers and distributors, retailers of goods as well as customers. In a supply chain system, materials flow downstream to customers, while information flows in both directions. Supply chain management (SCM) is therefore the planning, coordinating, and

controlling of series of interconnected activities involve in moving a firm's raw materials, equipment, component parts and finished products from suppliers to end-users or customers in order to increase service level and reduce system-wide costs^{2,3}. At the minimum, efficient performance of healthcare supply chain is dependent on utilizing contemporary management practices to ensure members in the chain are effectively coordinated and add value to the medical supply chain network. Therefore, operational efficiency of healthcare supply chain must be strengthened to ensure its ability to deliver value to the end customer, the patient.

Operational efficiency explains the time, cost and flexibility needed to make quality delivery when an order is placed. Timeliness is concerned with speed and the consistency wherein the order is delivered. Apparently, customers anticipate their goods and service to be delivered on time, however, rapid delivery would make no sense if it is fraught with inconsistencies from one point to the order. In order to accomplish a secure supply and delivery operation, firms tend to put premium on service delivery consistency and afterward seeks to improve delivery speed^{4,5}.

Costs of delivering a service and producing goods are other key features of operational efficiency that needs attention. A supplier should ensure that the cost of fulfilling an order is by no means greater than the aggregate gains expected from the order delivered. Consequently, the time value of rapid order delivery must be weigh against its correspondent cost of delivering an order. Variation in customer's demand and intermittent failure in service delivery process can also pose severe operational complications and disruption⁶. These can trigger customer dissatisfaction and switching issues if not properly handled.

How agile an organization accommodates and addresses these irregularities constitutes another measure of operational efficiency. In supply chain function, process malfunction could be in terms of equipment, service failures, damaged goods, inaccurate documentation, and incorrect product assortment etc. When failure arises, the swiftness of recovery by the service operator is an important component or dimension of efficiency as well. Thus, operational efficiency explains how best an organization is able to coordinate every facets of its daily operational tasks with minimal resource utilization⁷.

From the foregoing, this study argues that as healthcare organizations implement innovative supply chain management strategies, the likelihood of making significant operational gain in logistics, procurement and storage increases. This is likely to reduce incidence of out-of stock, ensure access to essential medicine, and increase order-fill rate. In consonant with the current view, a positive association was found amongst supplier trust, integration of information technologies, knowledge exchange, and hospital supply chain performance; measured by costs, speed and flexibility of operation⁸. In a related study, inventory location and ownership, inventory costs, and information sharing was reported as relevant strategies for success in managing healthcare supply chain⁹. In a study of the Malaysian consumer goods industry aimed at investigating the relationship between supply chain responsiveness and firm's competitive advantage, it was concluded that high level of competitive edge can be achieved by managers embracing SCM particularly by practicing information sharing¹⁰. With efficient supply chain, the performance of hospital inventory and dependability of its supplies could be heightened; resulting in costs reduction, reduced cycle time, and replenishment lead time^{11,12, 13}. Thus, rather than seeing SCM as an arduous responsibility¹⁴, public hospitals in Nigeria could gain significantly by incorporating the supply chain management into their organizational strategy.

Although public hospitals recognize the potentials in effective management of medical supply chain, there still exist insufficient knowledge concerning the parameters for SCM success. This is in terms of the conditions under which SCM is likely to yield operational efficiency gains for hospitals, and the elements that should be included in the planning process.

Similarly, there are concerns that contract negotiations in many public hospitals are adversarial due to lack of trust, incongruent goals, and incompatible information communication system. This has further reduced the efficiency of healthcare supplies leading to stock outages, longer replenishment lead time for essential drugs and vaccines, increased handling costs, limited access to essential healthcare and prolonged hospital stay. Specifically, there appear to be limited studies on the mechanism through which SCM could solve poor access to healthcare and variance in inventory demand and supply- two common occurrence in Nigerian hospitals.

This study is therefore aimed at examining the mechanisms in which supply chain management practices and hospital operational efficiency are related. The outcome will enable us have a clear insight into the nature of SCM activities commonly practiced amongst Nigerian public healthcare institutions, and how they impact operational efficiency. It is expected that findings could provide managers with appropriate models for designing efficient programs for managing hospital supply chain.

II. METHODOLOGY

The study was conducted using quantitative survey design. The survey design was chosen because it is economical, ensures swift collection of primary data and its ability to give a clear insight into the population characteristics by studying its sample. The study was based on primary data derived through pre-tested and structured questionnaire, and data so gathered was analysed with descriptive and inferential statistical techniques.

The accessible population consisted of all public tertiary hospitals operating in three south-south zones of Nigeria. Three kinds of healthcare institutions merited this description, namely: Federal Medical Centers, University Teaching Hospitals, and Specialist Hospitals. The target population and unit of analysis was therefore consisted of all supply chain executive officers from the three tertiary hospitals totaling 584. In addition, key vendors of medical consumables and medical/surgical suppliers also constituted the research population. A sample size of 234 supply chain officers (i.e 78 supply chain staff \times 3 hospitals) constituted the respondents for the study.

The multistage sample method was adopted to choose participants. The first stage was to select accessible tertiary hospitals for the study. Hence, one hospital per state was purposively selected. The second stage in the sampling process involves selecting participants. Judgmental sampling approach was utilized to select the samples. Those recruited had to meet the inclusion criterion of being staff members of either procurement, central stores, or IT unit of the tertiary hospitals. This is because these departments were primarily associated with the problem this study sought to investigate. In addition, staff in the procurement, stores and IT section were assumed to have pertinent knowledge of medical supply chain management and would then be in the best position to offer valuable information for the study.

In the final sampling stage, convenience sampling technique was used to select 78 supply chain executives from each hospital comprising procurement officers, central store officers, and IT support executives. The choice of convenience sampling was purposeful to select whoever was available and willing to participate in the study because not all members of staff in the selected units indicated their willingness to complete the research instrument. Five (5) vendors of medical consumable and hospital equipment from each hospital were also selected to form part of the target respondents. Based on the list of key vendors made available to the researcher, the first five vendors on the list were contacted by phone and were requested to participate in the survey.

The structured questionnaire was developed and used for data collection. The design of questionnaire items was done taking inputs from extensive review of supply chain management literature and pre-survey discussion with healthcare supply chain practitioners. Throughout the instruments, respondents were required to rate all constructs using the five point Likert scale. Two kinds of variables were measured by the questionnaire, namely: hospital operational efficiency being the dependent variable, and SCM practices as independent variable. Supply chain management practices was operationalised by five dimensional constructs namely: strategic supplier partnership, information/knowledge sharing, information technology integration, supplier selection attributes and collaborative inventory planning. On the other hand, operational efficiency (the dependent variable) was measured by three widely used indicators: inventory costs efficiency, replenishment/delivery lead time, and revenue enhancement in terms of service level availability. These indicators were extracted from the Supply Chain Operations Reference (SCOR) model¹⁵. It is important to state that out of the 249 copies of questionnaire that were administered on participants, 105 copies were correctly filed and returned, and was therefore subjected to data analysis. In this light, a 42.2% response rate was achieved

III. RESULTS

3.1 Description of hospital supply chain management practices

To begin, we explore the data with a view to understand the nature of SCM currently practiced by surveyed hospitals. Thus, respondents were requested to state the degree to which certain practices were applied in their hospitals for managing supply chain. Though several supply chain management practices were identified, it was necessary to categorize them into five broad practices namely: strategic supplier partnership, information/knowledge sharing, supplier selection, information technology integration, and collaborative inventory planning, forecasting and replenishment practice.

Table 1 provides summary of results showing the extent to which Nigerian hospitals apply the array of practices in their supply chain management, the relative importance they attach to each SCM practice, and intercorrelation among the variables of study. The mean score of 3.00 was used as an index for decision making. This was derived by dividing the sum of the scale by 5. Accordingly, a variable with mean score less than 3.00 was considered low in terms of its application and relative importance to healthcare supply chain partners.

From Table 1, it can be seen that the mean responses of the distribution ranges between 2.73- 4.41, while the standard deviation lies between 0.69-1.22 suggesting that data are normally distributed. Data also exhibit relatively high mean score in all but one SCM practice, with information and knowledge sharing practice taking the highest mean score. That is, respondents appear to be sensitive to practices that: a) promotes the sharing of vital demand and supply information/knowledge with supply chain partners (Mean= 4.41; SD=0.69); b) encourages strategic partnership in planning and executing supply chain initiative (Mean=3.79; SD=1.22); c) emphasizes multi-criteria supplier selection attributes (Mean= 3.73; SD=1.18); and d) integrate information technology infrastructure for easy and faster flow of distribution and logistics among supply chain partners (Mean=3.29; SD=1.09). Thus, one can infer from the results, that sample were rather confident that operational efficiency of their hospital supplies could be enhanced by according prominence to the above supply chain management practices.

However, respondents appear to attach less importance to initiative that advocates collaborative demand forecasting and replenishment of medical stock (Mean= 2.73, SD=1.14). This is understood to probably be due to the perceived lack of trust amongst supply chain partners, unpredictability of patient demand, relative dearth of quantitative forecasting skills, incongruent goals and priorities, and the tendency to be opportunistic with certain proprietary planning information such as patient demand data.

3. 2: Linking supply chain management practices with hospital operational efficiency

Correlation coefficient was calculated to observe the nature of association amongst supply chain management practices and operational efficiency as shown in Table 1. The analysis in Table 1 indicates positive correlation between supply chain operational efficiency and strategic supplier partnership ($r = 0.565$, $p < 0.01$), information/knowledge sharing ($r = 0.612$, $p < 0.01$), and supplier selection ($r = 0.362$, $p < 0.01$), while the other two variables correlated negatively. In brief, these results suggest that hospitals that strategically partner with key suppliers, share quality demand information and knowledge with suppliers, and adopt multi-criteria supplier selection strategy tend to score high and perform efficiently in their supply chain operation. This is in terms of inventory costs efficiency, replenishment/delivery lead time, access to essential healthcare through service level availability, and delivery process flexibility. On the contrary, integration of information technology between hospital and key suppliers, and the use of collaborative planning and forecasting of inventory demand appear not to be significantly related to hospital operational efficiency in the context of the study.

Table 1: Mean, standard deviation (SD), Reliability Analysis, and Correlations Matrix (N=105)

| <i>Dimension</i> | | <i>Reliability coefficient (α)</i> | <i>Mean</i> | <i>SD</i> | <i>SSP</i> | <i>IFS</i> | <i>SSD</i> | <i>CIP</i> | <i>ITT</i> | <i>OE</i> |
|--|-------|--|-------------|-----------|------------|------------|------------|------------|------------|-----------|
| Strategic supplier partnership | (SSP) | 0.65 | 3.79 | 1.22 | 1.00 | | | | | |
| Information/knowledge sharing | (IFS) | 0.72 | 4.41 | 0.69 | .557** | 1.00 | | | | |
| Supplier selection decision | (SSD) | 0.82 | 3.73 | 1.18 | -.193 | .681** | 1.00 | | | |
| Collaborative inventory planning & forecasting | (CIP) | 0.77 | 2.73 | 1.14 | .740** | -.271 | .726** | 1.00 | | |
| Information technology integration | (ITT) | 0.68 | 3.29 | 1.09 | .646** | .510** | -.178 | .372** | 1.00 | |
| Operational efficiency | (OE) | 0.57 | 4.04 | 0.92 | .565** | .612** | .362** | -.165 | -.211 | 1.00 |

***Correlation is significant at the 0.01 level (2-tailed) i.e p < 0.01*
Reliability score

in

parenthesis

3.3 Effects of SCM practices on hospital operational efficiency

In order to evaluate the effect of supply chain practices on measures of hospital operational efficiency, multiple regression analysis was performed. We employed the least square regression technique. This was used to study and explain the extent to which each of the dimensional construct of operational efficiency are affected or can be predicted by series of SCM practices identified by respondents. In summary, results in Table 2 depicts hierarchical multiple regression analysis.

Table 2: Multiple regression analysis

| SCM practices | | Dependent variable | | | | Remark |
|--|------------|-------------------------------|---------------------------------|-------------------------------|--------------------------------|--------------|
| | | Costs efficiency | Delivery efficiency | Service level efficiency | Overall operational efficiency | |
| Strategic partnership | supplier | 0.452** (3.771) [0.063] | 0.302** (2.492) [0.062] | 0.213** (5.317) [0.045] | 0.203** (4.217) [0.024] | H1 Supported |
| Information/knowledge sharing | | 0.456** (6.100) [0.056] | -0.181** (-2.681) [0.046] | 0.410** (6.918) [0.040] | 0.315** (6.715) [0.038] | H2 Supported |
| Supplier decision | selection | 0.539** (7.907) [0.045] | 0.930** (11.958) [0.052] | 0.466** (5.002) [0.056] | 0.241** (4.138) [0.041] | H3 Supported |
| Collaborative planning and forecasting | inventory | 0.107 (1.679) [0.016] | 0.209 (1.008) [0.011] | 0.380** (3.064) [0.014] | -0.106 (0.008) [0.024] | H4 Rejected |
| Information integration | technology | 0.410** (6.918) [0.040] | 0.102 (1.492) [0.062] | 0.156** (1.100) [0.056] | -0.122 (0.041) [0.033] | H5 Rejected |
| F-value | | 84.948** | 74.681** | 82.747** | 180.22** | |
| R ² | | 0.743 | 0.790 | 0.839 | 0.828 | |
| Adjusted R ² | | 0.735 | 0.783 | 0.833 | 0.823 | |
| N | | 105 | 105 | 105 | 105 | |

Note: ** $p < 0.01$, numbers in the first parenthesis are t-scores; standard errors are in the second parenthesis.

The standardised beta estimates (β) and t-scores are used in order to compare and determine the impact of SCM approaches on the three measures of hospital supply operational efficiency. Results on Table 2 indicate the coefficient of determination (adjusted R²) for model IV as 0.823. This implies that the fitted model explains about 82.3% of variance in overall operational efficiency. The balance of 17.7% could be attributed to chance error or exogenous variables not considered by the study. As indicated, the overall fit of the regression model is good with a significant ANOVA (F-value) of 180.22.

Table 2 also provides summary of data for the three regression model. Note that three of the five SCM constructs (strategic supplier partnership, information/knowledge sharing, and supplier selection decision) contribute in a significant positive manner toward predicting individual and overall measures of operational efficiency for surveyed sample. For instance, information /knowledge sharing (Beta= 0.315; t=6.715; $p < 0.01$) had the highest significant influence on operational efficiency. This is followed by supplier selection decision (Beta=0.241; t=4.138; $p < 0.01$), and strategic supplier partnership (Beta=0.203; t=4.217; $p < 0.01$). What this results attempt to explain is that varying any of the SCM practices in the model is likely to stimulate a proportional variation in operational efficiency. For instance, by increasing the

accuracy and timeliness wherein customer orders are fulfilled, inventory level is maintained, and market information are shared amongst supply partners say by one percent, the organizations under survey could derive 31.5% improvement in hospital supply efficiency. By implication, hospital supply chain managers could reach and possibly exceed desired level of operational proficiency by executing SCM policies along three important dimensions, namely: information/knowledge sharing, supplier selection, and strategic supplier partnership.

IV. DISCUSSION OF FINDINGS

This study focused on supply chain functions in Nigerian public hospitals with the view to improving its efficiency through a gamut of SCM practices. The study reveals the following findings:

First, respondents were sensitive to most SCM practices under investigation, and were equally confident that a range of SCM practices can significantly lead to efficient hospital supply. Operation. This finding appear consistent with the views that in an effort towards sustaining effective and efficient treatment of patient, managers of public hospitals are beginning to embrace the essentials of effective supply chain management¹⁶.

Second, efficiency of hospital supply operations was found to correlate positively with three SCM practices, namely: a) The need to share proprietary information/knowledge, b) engage in strategic partnership with vendors, and c) adopt multi-dimensional attributes for suppliers' selection. The findings, again appear to corroborate empirical evidences which espouse the need for sharing undistorted information along all supply chain echelons as a means of achieving competitive edge^{17,18,19,20}. In like manner, exchange of SC information fosters team spirit and cohesion amongst supply chain partners. It assists in producing better appreciation of the needs of the end customer, and lead to quick responds to market changes²⁰.

Third, three SCM practices including information/knowledge sharing, supplier selection, and strategic supplier partnership had positive influence on hospital operational efficiency. This finding also substantiate previous research result which highlighted the existence of significant relationship between knowledge exchange, hospital-supplier integration and supply chain performance in US hospitals²⁰.

Finally, the study however found no significant effect of information technology integration, and collaborative inventory planning and forecasting on supply chain efficiency. What managers are saying here is that the IT infrastructural requirements and capacity to facilitate supply chain integration in Nigerian hospitals are still under developed for an uncoordinated and fragmented health sector to operate. Three kinds of information technologies are required for successful SCM integration namely: electronic data interchange (EDI), enterprise resource planning system (ERP), an uninterrupted internet, intranet, and extranet facilities^{21, 22}. However, these capabilities are still at embryonic developmental stage in most Nigerian public hospitals.

V. CONCLUSION

Seeking to gain operational efficiency through SCM has been recognized as strategic path that should be taken by all firms. Healthcare supply chain must be efficient and integrated to remain competitive and live up to its social obligation. An important means of achieving access and dependable healthcare delivery is supply chain management. This study has provided evidence necessary to ensure that Nigerian hospitals achieve supply efficiency and therefore improve on access to essential healthcare delivery.

From the findings, it is meaningful to conclude that exchange of accurate and timely inventory and demand data along the supply chain network is capable of enhancing efficient supply operations. It is also concluded that the sharing of relevant information would be facilitated by robust integration of information technologies, entering into strategic (long term) partnership arrangement with suppliers (like public private partnership, outsourcing etc), and ensuring the use of the right criteria for selecting vendors.

Given the conclusion, it is suggested that public hospitals in Nigeria embrace the practices of supply chain management, particularly by increasing it information sharing capabilities. Equally, important is the need for hospitals to look beyond quotation price and financial capabilities in selecting medical material vendors. Prominence should be given to attributes such as quality of delivery, delivery lead time, flexibility of product delivery, order fill rate etc. Moreover, supply chain efficiencies could bse gain for hospital that

improve its capacity to forecast demand, generate purchase orders, and manage inventory through automation such as electronic data interchange, automatic replenishment tools etc. Hospital should encourage long term collaboration on public private partnership involving supplier and manufacturers of medical and surgical materials.

As hospital embraces supply chain management and implement the practices highlighted in this study, access to healthcare delivery in Nigeria is likely to substantially improve.

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An Empirical Study on the Structure Optimization of Teachers in Guizhou University, China

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Abstract- Establishing a well-structured faculty is not only the focus of the construction of college faculty, but also the only way for the survival and development of universities. The core of the construction of faculty is the professional qualification structure and academic structure. This paper makes a statistical analysis of the changes in the professional qualification structure and academic structure of teachers in Guizhou University in the past three years, and finds out some problems in the construction of the school's teaching staff, and puts forward corresponding countermeasures. The research in this paper was developed based on quantitative research methods, through a measurement model, and tried to gain further understanding. Thereafter, the main data required is collected according to the survey strategy by providing self-administered questionnaires and interviews. Full-time teachers who teach at Guizhou University in China were selected as the sampling framework for this study. The survey results show a positive correlation between the professional qualification structure and the team structure. In addition, there is a significant relationship between the academic structure and the team structure; and the positive relationship between the team structure and the optimization of the faculty. The study shows that the policy has a positive impact on optimizing the teaching staff. The research results analyze the current situation of the construction of the teaching staff, policy optimization, and the average score of the sustainable development of the teaching staff with different professional qualification structures and different academic qualifications. This study is limited to Guizhou University. It can bring some enlightenment to other universities in Guizhou Province when choosing the structure adjustment mechanism of teachers. It provides countermeasures for the adjustment of the teaching staff structure in other universities in Guizhou Province, and provides relevant higher education for the Chinese Ministry of Education and the government. Educational policy provides a theoretical reference. This research can serve as a guide for other factors in future research that will influence the development of the university's faculty.

Key words: Guizhou University; teacher team; optimization; empirical research

I. INTRODUCTION

Founded in 1902, Guizhou University is located in Guiyang, Guizhou Province, China. First-class discipline The construction of colleges and universities is a national key university jointly established by the Ministry of Education of China and the Guizhou Provincial People's Government, and the best key comprehensive university in Guizhou Province. It is a high-level university with key construction in the western region. In October 1950, it was named Guizhou University. In August 1997, it merged with Guizhou Agricultural College and other institutions. In August 2004, it merged with Guizhou University of Technology. In December 2012, the Ministry of Education and the People's Government of Guizhou Province jointly established universities. In April 2016, it was listed as a national "one province, one school" to support the construction of universities. In November 2017, it was awarded the title of the first Chinese Civilization Campus.

The university has a wide range of subjects, including literature, history, philosophy, science, engineering, agronomy, medicine, economics, management, law, education, and art. There are 40 colleges and 33,064 full-time undergraduate students.

Teachers are the main body of the university. Whether the professional qualification structure and academic structure of the teaching staff are reasonable, directly affects the overall quality of the teaching staff, affects the development of the university, and how to establish a well-structured teaching staff, which is the reform and development of higher education institutions. Fundamental plan. This paper analyzes and analyzes the professional qualification structure and academic structure of the three-year faculty of Guizhou University, finds out some problems existing in the construction of the faculty of the school, and proposes corresponding optimization measures, which is extremely high for the future construction of the university faculty. The reference value will lead the construction of the optimization faculty of other universities in Guizhou, which has important reference significance for other universities in China and abroad.

II. STATISTICAL ANALYSIS OF TEACHER TEAM STRUCTURE

Establishing a well-structured faculty is not only the focus of the construction of university faculty, but also the only way for the survival and development of the university. And the core of the faculty construction is the professional qualification structure and academic structure. Table 1 shows the statistical results of the professional qualification structure and academic structure of teachers in Guizhou University in the past three years. The statistical analysis of the structure of teachers and the changing trends can provide a scientific basis for the development of other universities in Guizhou Province and the future development of the university and the construction of the teaching staff.

Table 1 Statistical Table of Faculty Structure (Guizhou University, 2011.6)

| Category item | 2016.6-2017.6 | | 2017.6-2018.6 | | 2018.6-2019.6 | |
|-----------------|------------------|----------------|------------------|---------------|------------------|----------------|
| | Number of people | Proportion (%) | Number of people | proportion(%) | Number of people | Proportion (%) |
| Total number of | 2513 | | 2842 | | 2523 | |

| teachers | | | | | | | |
|---|---------------------------|------|-------|------|-------|------|-------|
| Professional qualificatio n structure | advanced | 1198 | 47.67 | 1611 | 63.38 | 1593 | 63.14 |
| | Intermediate and below | 1315 | 52.33 | 1231 | 36.62 | 930 | 36.86 |
| Academic structure | Doctor | 286 | 11.38 | 902 | 31.74 | 1006 | 39.88 |
| | master's degree | 1230 | 48.95 | 876 | 30.82 | 1284 | 50.89 |
| | Bachelor | 997 | 39.67 | 1064 | 37.44 | 233 | 9.23 |

As can be seen from Table 1, there are 2,523 full-time teachers in the school. Among them, 1593 teachers with advanced vocational qualifications accounted for 63.14% of the total number of teachers; 930 teachers with intermediate and lower vocational qualifications, accounting for 36.86%. From 2016 to 2019, the absolute number of teachers with intermediate professional qualifications in the faculty increased in 2017, but the proportion of teachers with advanced professional qualifications declined in 2018. Teachers with intermediate and lower vocational qualifications The ratio is rising. This is mainly due to the employment of a large number of young teachers. This trend of change may continue to develop in the next few years and should be given sufficient attention.

Among the full-time teachers of the school, there are 1006 doctoral students, accounting for 39.88% of the total number of teachers; 1284 with master's degrees, accounting for 50.89% of the total number of teachers. There are 233 bachelor's degrees, accounting for 9.23% of the total number of teachers. Relatively speaking, the proportion of teachers with master's degrees is large. From 2016 to 2019, the academic level of the faculty is gradually increasing. The number of teachers with master's degree or above is increasing year by year, and the proportion of teachers with bachelor's degrees is gradually narrowing. The Ministry of Education of the People's Republic of China clearly stipulates that the proportion of doctors in key universities should be greater than or equal to 50% in the evaluation index system of the new national undergraduate colleges. The school should increase the proportion of doctors in full-time teachers from 39.88% in a short period of time. One percentage point, to meet the evaluation criteria of the Ministry of Education of the People's Republic of China, on the one hand, to train young teachers with master's degrees, and to ensure that the proportion of teachers with doctoral degrees in new teachers every year is more than 50%.

The academic structure mainly determines the academic foundation of the teaching staff. The professional qualification structure mainly determines the academic strength of the team. This paper mainly studies how to optimize the teacher's professional qualification structure and how to optimize the teacher's academic degree structure. At present, China's higher education is in the stage of major reform, great development, and great improvement. It is in the key link from scale expansion to quality improvement. Structural adjustment will inevitably become the core of higher education reform, and the best Guizhou University teacher team structure will be developed in Guizhou Province. Research is of great significance. Through the research of this

thesis, it can bring some enlightenment to other universities in Guizhou Province when choosing the structure adjustment measures of teachers. It provides countermeasures for the adjustment of the structure of teachers in other universities in Guizhou Province, and formulates relevant higher education policies for the Chinese Ministry of Education and the government. Provide a theoretical reference.

III. LITERATURE REVIEW

The main theoretical basis of this thesis includes structural function theory, system optimization theory and mutual benefit symbiosis theory.

A. *Structural Function Theory (American sociologist T. Parsons, R. Merton, 1950)*

It is mainly about the relationship between the constitutional state of things and the overall functional state of things. Later, scholars extended and supplemented the theories of T. Parsons and R. Merton. The main points are as follows.

Structure is the basic way of existence of things. The history of human science has been proven that everything has a certain structure, certain things and certain structures coexist, and everything is formed, expressed and integrated as a whole by a given structure. There are no unstructured things, no structure without things. Whether it is a macroscopic cosmic star, a mesoscopically visible object, or a microscopic science, the smallest particle ever discovered - quark, whether it is the universe in the natural world, the human organization of the social world, or the language and thinking of the spiritual world, One is not the existence of structure. The structure is omnipresent and inseparable from things. From a dynamic perspective, structural changes will inevitably lead to changes in things, and the development of things depends on structural optimization.

Structural analysis is the fundamental way to understand things. Structural analysis is the basic method for human beings to understand the world. It is inherently consistent with analytical synthesis. To obtain a comprehensive understanding of things, human beings cannot only examine the superficial phenomena of things and must go deep inside the things. The most common way to analyze things inside is to split the things into multiple parts, and then carefully examine the characteristics of each part, the relationship between each part, and the way each part constitutes the whole thing. Finally, based on the comprehensive understanding of these parts, An intrinsic, essential understanding of the whole thing.

There is a high degree of correlation between structure and function. The theory of structural function considers that the structure and function of things are closely related. A certain structure corresponds to a certain function. Under the same conditions, the structure determines the function. At the same time, there are four relationships between structure and function: one-to-one, one-to-many, many-to-many, and many-to-one. The connection between structure and function is complex, and often has many forms such as isomorphism, heterogeneous isomorphism, and isomorphism. First of all, the university teacher team is a structured system. The structure of teachers in different universities (or university systems) or the same university (or university system) in different periods is often different, even huge. Secondly, structural analysis is the most fundamental way to understand things. We know the team of college teachers and cannot do without the in-depth analysis of their structure. Thirdly, the structure and function of college teachers are highly correlated, the structure determines the function, the different combinations and different connections of the members of the university teachers, the members will have different characteristics of mutual birth, mutual gram, phase checks, phase transformation, and phase neutrality. Therefore, the university teachers team has the functions and functions of different natures and sizes. It can be seen that the theory of structural function not only lays down and enhances the significance of this research in theory, but also provides methodological guidance for the study, especially the discussion of structural optimization standards.

B. System Optimization Theory (Wei Hongsen, Zeng Guoping, 1995)

It is mainly an important branch of general system science. It is the crystallization of system theory and evolutionary cross-infiltration. It focuses on exploring and revealing the general laws of system change and development. The main points are as follows:

Any system is a system that continues to evolve. The system is composed of elements, the constant changes in the nature of the elements themselves, and the constant changes in the relationship between the elements, causing constant changes in the structure, functions, and features of the system. According to the dialectical materialism, any system has an objective existence. Things are in constant change, movement is eternal and absolute, and rest is temporary and relative, and everything must go through the process of creation, development, and extinction. Therefore, any system is a constantly changing system that may be positive, may be negative, or may behave in another form of stagnation. Among them, the forward evolution system is what we call the optimized system.

System optimization is a performance state in system evolution. The system will show different states in the long-term evolution, with optimization and non-optimization. The optimized system is in the positive evolution, the interaction between the elements is good, the part and the whole are coordinated, the energy and potential are huge, the function and The system in the extended state.

System structure optimization is the basis and performance of system optimization. The realization of system optimization is reflected by the improvement of system organization, structure and function. The optimization of structure is the important aspect and key link, that is, system optimization must include the structural optimization of the system. At the same time, system structure optimization is the overall optimization of the system. condition. A distinctive feature of the system is its constitutiveness, that is, any system is composed of elements, and a certain structure is formed between the elements. Therefore, system optimization is inseparable from the optimization of the structure. It is precisely because of the continuous positive adjustment of the structure that the system is continuously optimized. It is unthinkable that a structural imbalance is the overall optimization system. At the same time, structural optimization is the specific performance of system optimization. In a big sense, system optimization refers to the optimization of system structure.

C. Mutual Benefit Symbiosis Theory (Dale. S. Weis, 1879)

First appeared in the field of biology, proposed by the protozoologist Dale. S. Weis. Later, scholars extended and supplemented the theory of Dale. S. Weis. The main points are as follows.

Mutually beneficial symbiosis is the basic way of individual existence. Mutually beneficial symbiosis is a common phenomenon in the biological world and human society, and is the basic way for individual survival and development. Such mutually beneficial commensal individuals can be similar, categorical, or heterogeneous. In social organizations, only individuals can coordinate, help each other, and benefit each other, and individuals can be fully developed, and the functional role of the organization can be expanded and enhanced. In a real market economy society, everyone can only make a profit by contributing to others, and only through mutual benefit can promote market prosperity, wealth growth, and social progress. The market mechanism is a typical mutual benefit. Symbiotic mechanism.

Mutual benefit and symbiosis are important rules for group survival. Individuals in a group do not mutually benefit each other, and the individual will continue to decline into a mutation, and the group will become degenerate, deformed and even die. Therefore,

mutual benefit and symbiosis is the individual's life from the individual point of view. It is the whole life from the group or the system. Because the individual and the group are interdependent, the individual's life supports the group or system, and the group or system is the individual. Students provide space and opportunities.

Mutually beneficial symbiosis is the exchange of information, complementing each other's strengths, complementing each other's strengths, and achieving win-win development. The premise of mutual benefit is that you have nothing to do with me, you are open, connected, and interact with each other. The key is to exchange with each other. The purpose is to be symbiotic, that is, to develop together. Therefore, mutual benefit and symbiosis is the exchange of information or energy, complementing each other's strengths, complementing each other's strengths, and achieving win-win development.

Mutually beneficial symbiosis and structural optimization are inherently consistent. The theory of mutual benefit and symbiosis focuses on the basic characteristics of structural optimization from the interconnection and complementary relationship between elements. The mutual symbiosis between individuals within the system is conditional, and the effect of mutual benefit and symbiosis is limited by the relationship between system elements and system elements, that is, the overall structure of the system. If the individual functions of the system are similar, then only the functions will be accumulated and the mutual symbiosis will not be generated. If there is too much or too much between the individuals in the system, there will be too little or too much and too little. Then, there will be no mutually beneficial symbiosis or mutual benefit symbiosis effect; if the individuals in the system are loosely isolated, mutually closed, the connection mode is single or the connection relationship is broken, then the mutual symbiosis effect is also difficult to produce. The above series of "if" are related to the structural problems of the system itself. Therefore, there is internal consistency between mutual benefit and structural optimization, structural optimization promotes mutual benefit and symbiosis, and mutual benefit and symbiosis reflect structural optimization. From the mutual benefit symbiosis between the individual systems, the optimization of the system structure can be judged to some extent.

D. Theoretical review

Improve the proportion of high-level talents. Chen Yongmei (2018) believes that teachers' academic qualifications and professional qualifications are important indicators of teachers' quality. The degree of education reflects the extent to which teachers receive formal education. Professional qualifications reflect the academic and working abilities of teachers. Therefore, in line with the principle of "based on training and active introduction", we should introduce young and highly educated talents in various preferential conditions, and actively introduce high-quality and highly qualified professionals with high academic qualifications. Improve the professional qualification structure and academic structure of the faculty. Zhang Xiaoxu (2014) believes that the implementation of young and middle-aged teacher training programs, strengthen continuing education, improve the academic level, form a complete talent training chain, optimize the teacher's knowledge structure, improve the overall quality of the teaching staff, and enable a group of young and promising rising stars to grow rapidly. Get up and gradually take up the heavy responsibility of discipline construction. Zhang Yingqiang & Jiang Hualin. (2014) believes that the construction of the echelon of disciplines will enable the formation of a reasonable echelon in all disciplines of the school, and improve the imbalance between the academic qualifications, professional qualifications, age, and academic boundaries of echelon members in different disciplines. The overall structure of the school's faculty has become more rational and strives for all-round development.

Improve and perfect the professional training system with advanced professional qualifications and high education. Yao Xu (2016) believes that the overall professional qualification level of university teachers is low. The construction of teachers in provincial universities needs to develop a long-term teacher construction plan and broaden the channels for introducing high vocational qualifications to adapt to the development of transformation. It is necessary to establish and improve the advanced professional

qualification training mechanism and establish a practical evaluation system; Liu Jun (2014), to study the construction of provincial-level university teachers, to run schools for colleges, rationally plan and train senior professionals, people-oriented, and respect teachers. Strengthen the centripetal force, train teachers, increase training, expand training channels, deepen the reform of personnel distribution system, establish an effective performance management mechanism for teachers, and rely on the government's public resources to ensure the development and construction of teaching staff; Gao Jiaqi (2013) believes that it should be from the government, universities Starting from the three middle aspects of teachers, we are looking for effective ways to improve the level of college lecturers. It is pointed out that the government should lead talent training with the scientific development concept. With the direction of the construction of teachers, universities should give full play to the construction of teachers. The role of teachers should start from their own, improve the quality of teaching and research, and cooperate with the construction of teachers.

The policy affects the structure of the faculty. Han Fubin (2016) proposed that China's provincial universities should establish a policy system for teacher recruitment, talent introduction and senior professional qualifications, formulate or revise relevant policies, and optimize the structure of the teaching staff; Wang Yiding & Wang Weiying (2015) believe that the university's faculty construction It has a great relationship with the transformation and development of local undergraduate colleges. It not only requires the efforts of the university itself, but also the support of the government and the society. The university needs to reform its personnel management system and teacher training system. The government must be qualified for talents and schools. Cooperate and other aspects to give strong support to jointly create a faculty with new characteristics in line with the requirements of the university, in order to cultivate high-level professional and technical personnel; Jin Quan (2009) believes that policy is the primary factor affecting the construction of university faculty, and promotes the development of higher education The foundation and long-term impact. To improve the existing university teacher policy work, we should start from four aspects: accurately constructing policy issues, improving the policy-making participant mechanism, coordinating the relationship between policies, and improving the importance of policy implementation.

Optimize the research of the faculty team. Yan Xiaolei & Wang Zhifei (2017) analyzed the dilemma and connotation of the construction of the teaching staff of provincial universities, and proposed to optimize the teaching staff through innovative methods based on criteria such as thinking renewal, connotation construction, collaborative cooperation, and teacher performance appraisal. The demand for rapid development; Zhong Binglin & Wang Xinfeng (2016) believe that science draws on international experience, localization practice, teacher selection, hiring and dismissal related systems, etc., and puts forward suggestions for Chinese university optimizable faculty; Liu Xiaoge (2013) Considering the new situation of China's higher education transition from elite to mass, it is proposed to ensure the stable and sustainable development of higher education. The key is the performance appraisal and promotion mechanism of the teaching staff of colleges and universities.

IV. RESEARCH METHOD

This study believes that the structure of the teaching staff of Guizhou University has achieved initial results after many years of adjustment, but there are still many problems. This paper proposes the following three research hypotheses. Figure 1 shows the conceptual framework presented in this study.

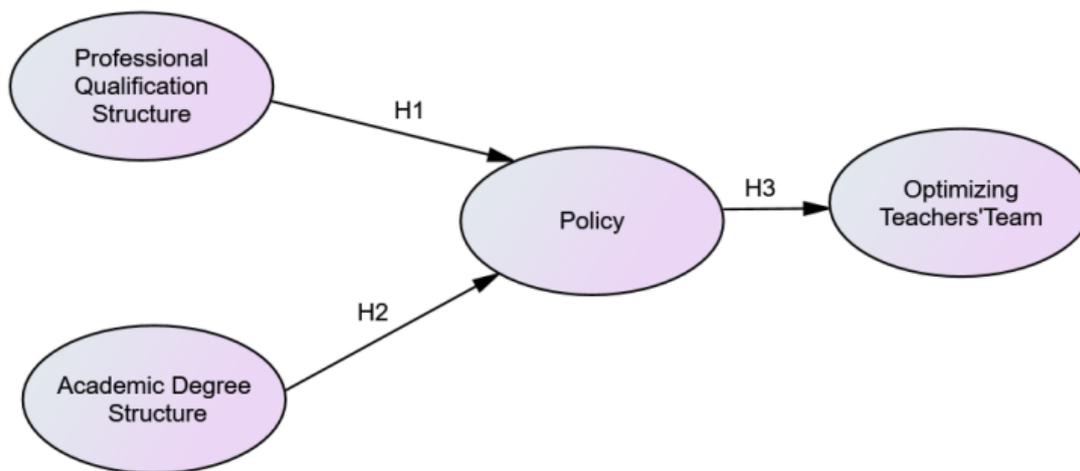


Figure 1: Conceptual framework

Hypothesis 1 (H1): The professional qualification structure has a significant positive impact on the policies of Guizhou University.

Hypothesis 2 (H2): The degree structure has a significant positive impact on the policies of Guizhou University.

Hypothesis 3 (H3): The policy has a significant positive effect on optimizing the faculty.

This thesis takes the teachers of Guizhou University as a sample. This study uses a combination of questionnaires and interviews to investigate the professional qualification structure and academic degree structure of the teachers in Guizhou University. 254 individual questionnaires were distributed, 250 valid questionnaires were returned, and the effective questionnaire recovery rate was 98.4%. The demographic characteristics of the respondents were descriptively analyzed using spss 21.0 and the reliability of the study variables was analyzed. Use amos version 21.0 to test the hypothesis of this research development.

Data analysis and discovery

Based on the respondents' responses to the items in the questionnaire, Table 1 provides an average score for four areas: professional qualification structure, degree structure, policy optimization, and optimization of the faculty. The scores in the intervals [0-4], [4-4.5] and [4.5-5] indicate that the degree of recognition has low, medium and high levels, respectively. The current situation of the construction of the faculty team is mainly reflected in two aspects: the professional qualification structure and the degree structure. The higher the score, the more stringent the conditions for building a faculty team.

Table 1: Levels of Instructor Team Indicators

| | Mean | standard deviation | Level |
|--------------------------------------|----------|--------------------|--------|
| Professional qualification structure | 4.549982 | 0.262639 | high |
| Degree structure | 4.387926 | 0.256662 | medium |
| policy | 4.587976 | 0.137224 | high |
| Optimize the faculty | 4.560306 | 0.471331 | high |

Table 2 shows the survey status of the faculty team, policy optimization, and the average score of the faculty team structure optimization with different professional qualifications and different levels of education.

Table 2: Average scores of respondents with different professional qualifications and different levels of education

| | N | Status of the lecturer team | Policy optimization | Optimize the faculty |
|--|-----|-----------------------------|---------------------|----------------------|
| Lecturer and below | 110 | 4.71 | 4.72 | 4.68 |
| Deputy senior professional qualification | 85 | 4.41 | 4.56 | 4.47 |
| Positive professional qualification | 59 | 4.52 | 4.57 | 4.61 |
| Bachelor | 90 | 4.51 | 4.63 | 4.58 |
| master's degree | 134 | 4.48 | 4.62 | 4.49 |
| Doctor | 30 | 4.52 | 4.64 | 4.59 |

the information gathered from a particular set of data. However, before proceeding with EFA, two tests, namely, Kaiser-Meyer-Olkin (KMO) and Bartlett’s Test of Sphericity, should be verified for checking the factorability of data (Pallant, 2007). Tabachnick et al. (2001) have indicated that the value of the first test (KMO) ranges from 0 to 1, and for an appropriate analysis it is essential to have at least a value of 0.6, and for the latter (Bartlett’s Test of Sphericity) it is essential to attain a significant p-value ($p < .05$). After running both of these several tests through SPSS, it was observed that the results of both fell within the acceptable range, indicating that the researcher can run EFA. The outcomes of the tests are shown below in Table 4. From EFA, certain items have been derived, and all the items are considered to be significant as they managed to load with a value higher than 0.50, and any loading above this value is considered to be practically significant by Hair et al. (2009). It shows that the total variance accounted for approximately 72.824% per cent, which is highly adequate. A higher variance is explained when eight components are retained. Cronbach’s alpha has also been calculated for all the items of the four variables. It can be seen in Table 4, all items under each of the variables are reliable as they all have surpassed the minimum value of .60 suggested by Hair, Black, Babin, and Anderson (2010).

Table 3: Kaiser-Meyer-Olkin (KMO) & Bartlett’s test

| | | |
|--|--------------------|----------|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .797 |
| | Approx. Chi-Square | 5391.860 |
| Bartlett’s Test of Sphericity | Df | |
| | Sig. | .000 |

Descriptive statistics help to interpret data consequentially by summarizing the data set of the population or sample (Malhotra, 2011). To achieve the basic features of the data set, the following methods of descriptive statistics have been applied to the data of this study.

Table 4: Descriptive Statistics and Reliability Measures

| Variables | Mean (Item) | SD (Item) | Cronbach Alpha |
|-----------|-------------|-----------|----------------|
|-----------|-------------|-----------|----------------|

| | | | |
|--------------------------------------|--------|--------|------|
| Professional qualification structure | 3.8368 | .68905 | .889 |
| Degree structure | 3.7167 | .71288 | |
| Team Structure | 3.81 | 1.103 | |
| Optimize the faculty | 3.65 | 1.132 | |

As can be seen from Table 4 above, the occupational structure, degree structure, team structure, optimization of the faculty, Team Structure and norms and values have mean scores 3.84, 3.72, 3.81 and 3.65. As respective of the values drops below 4.0, a corresponding value equivalent to agree on the five-point Likert scale, the concluding remark is that there is a need for some consideration to increase satisfaction on these cultural factors. The standard deviation of the first six constructs indicates that the responses on average were the same deviation of the first six constructs indicating that the responses on average were a small below 1 point away from the mean. It reflects the fact that the mean of the sample more accurately portrays the mean of the actual population. All of the constructs used in the study are reflective.

In an attempt to calculate measurement errors, each of the latent constructs was measured by multiple observed items (See Table 5).

Table 5: Results of Reliability and Validity

| Key Factors (Constructs) | Sub-Factors (Item) | Communalities | Factor Loadings | Mean | S.D | Cronbach's α |
|--------------------------------------|--------------------|---------------|-----------------|------|-------|---------------------|
| Professional qualification structure | PQS1 | .723 | .779 | 3.39 | 1.059 | 0.903 |
| | PQS2 | .739 | .763 | 3.56 | 1.270 | |
| | PQS3 | .687 | .767 | 3.67 | 1.180 | |
| | PQS4 | .623 | .514 | 3.93 | .984 | |

| | | | | | |
|----------------------|-------|------|------|------|-------|
| Degree structure | AS 1 | .714 | .555 | 3.65 | 1.051 |
| | AS 2 | .666 | .656 | 3.72 | 1.053 |
| | AS 3 | .739 | .793 | 3.73 | 1.165 |
| | AS 4 | .620 | .515 | 3.64 | 1.039 |
| | AS 5 | .677 | .537 | 3.73 | 1.078 |
| | AS 6 | .800 | .748 | 3.50 | 1.168 |
| | AS 7 | .603 | .680 | 3.70 | 1.092 |
| Team Structure | TS 1 | .563 | .718 | 3.71 | .951 |
| | TS 2 | .674 | .563 | 3.94 | .996 |
| | TS 3 | .757 | .798 | 3.67 | 1.104 |
| Optimize the faculty | OTT 1 | .769 | .755 | 3.50 | 1.103 |
| | OTT 2 | .831 | .688 | 3.23 | 1.339 |
| | OTT 3 | .765 | .671 | 3.52 | 1.168 |

This study adopted a two-step technique of model through SME analysis recommended by Anderson and Gerbing, (1988). In this technique, data was analyzed initially through factor analysis, which provides an assessment of measurement reliability, convergent and discriminant validity. Then, the structural equation model was conducted to test the model fit and to understand the hypothesized relationships. Before the model test, the correlation matrix for all constructs of the proposed model was examined. The results of and correlations among the variables are shown in Table 6.

Table 6: Summary of Correlations among Constructs

| Constructs | Correlations |
|------------|--------------|
|------------|--------------|

| | Professional qualification structure | Academic structure | Team Structure | Optimize the faculty |
|--------------------------------------|--------------------------------------|--------------------|----------------|----------------------|
| Professional qualification structure | 1 | | | |
| Academic structure | .692** | 1 | | |
| Team structure | .680** | .626** | 1 | |
| Optimize the faculty | .474** | .577** | .305** | 1 |
| | .621** | .735** | .525** | .664** |

** Correlation is significant at the 0.01 level (2-tailed)

The correlations indicate indicated that the scales are empirically distinct from each other. The correlation matrix indicates that are positive correlations among all of the study variables. Pearson Correlations co-efficient is 0.689 between professional qualification structure and academic structure, which indicates a positive moderately high linear relationship and this relationship exists at the significant level of 0.01. The correlations co-efficient between professional qualification structure and team structure, , team Structural and academic structure, as well as team structure, are 0.790, 0.636 and 0.745 respectively which indicate there is that moderate relationship among them. These relationships are also significant at 0.01 level. Relationships between other constructs are also significant at 0.01 level.

Assessing Reliability and Validity

The estimates of structural relationships can be biased unless the measurement instrument is reliable and valid. Therefore, reliability and validity should be measured to make this study authentic. Reliability of each construct has been assessed through a degree of internal consistency. This analysis was conducted before other analyses. For data to be considered reliable, the value of its Cronbach’s alpha should be >0.7 (Nunnally, 1978). The reliability analysis of this paper sample produced a Cronbach’s alpha of 0.903 (Table 5), meaning that all items used in the questionnaire were reliable.

Next, the construct validity was calculated by the factor analysis. Where the Principle Component Analysis with Varimax rotation has been applied to minimizes the number of variables with extreme loadings on a factor. After the rotated component matrix, it

is assumed that variables are loaded onto factors. Convergent validity means that the variables within a single factor are highly correlated. This is evident by the factor loadings in Table 5.

Communality means the extent to which an item correlates with all other items that indicate higher communalities are better. If communalities for a particular variable is low (between 0 - .4), then that variable may struggle to load significantly on any factor. So, the values of communalities are more than 0.5 estimates that all items have a pretty good quality of influence in all.

Discriminant validity refers to the extent to which factors are distinct and uncorrelated. To meet the discriminant validity, the variable should relate more strongly to their factor than to another factor. Two primary methods help to determine discriminant validity. The first method is to examine the rotated component matrix. Variables should load significantly only on one factor. The rest of the items were, and the discriminant validity is assumed.

Another method for validity testing is to examine the factor correlation matrix and correlations between the key strategic factors which should not exceed 0.8 (Kenneth, 1988). Thus, in this method, Table 6 presented that all of the correlation values between factors are below 0.8, which provide support to the discriminant validity. Overall, according to the evidence of reliability, convergent validity and discriminant validity, the measurement model was believed to be appropriate.

Hypothesis Testing

After the model was found to be acceptable by examining the model fit indices, the proposed hypotheses were tested using Structural Equation Modeling (SEM) technique with Maximum Likelihood Estimation. Within the overall model, the estimates of the structural coefficients provide the basis for testing the proposed hypotheses. Hypotheses are tested by examining the significance level, direction and magnitude of the standardized estimates of paths that link independent variables with the dependent variable. The summarized results are presented in Table 7.

Table 7: Results of Path Analysis

| Hypothesis | | | | Estimates | P value | Result |
|------------|--------------------------------------|---|----------------|-----------|---------|----------|
| H1 | Professional qualification structure | → | Team Structure | 0.777 | *** | Accepted |
| H2 | Academic structure | → | Team Structure | 0.898 | *** | Accepted |

| | | | | | | |
|----|----------------|---|----------------------|-------|-----|----------|
| H3 | Team Structure | → | Optimize the faculty | 0.714 | *** | Accepted |
|----|----------------|---|----------------------|-------|-----|----------|

Source: AMOS output by analyzing primary data

The result shows that the estimated value for the qualification structure in the prediction of Team Structure is 0.777 and p-value is less than 0.01. This indicates a positive relationship found between the professional qualification structure and Team Structure. The p-value is .000, Which means this relationship is significant at a level of .01 (Table 7). The result presents that, the estimated value for one of cultural factor which is educational structure and Team Structure is 0.898 and p-value is less than 0.01. There is a significant relationship found between the structure and the Team Structure. The p-value is .000, which means this relationship is significant at a level of .01 (Table 7). The result shows that the estimated value for Team Structure in the The meaning of the optimization faculty is .714 and p-value is less than .01. This means there is a positive relationship found between Team Structure and optimization faculty. The p-value is .000, which means this relationship is significant at a Level of .01 (Table 7). TheThe hypothesized relationships between exogenous and endogenous variables are significant at .01 level. The directional relationships between them are statistically established (Table 7). So, H1, H2, and H3 hypotheses are accepted at .01 levels. All hypotheses are established through this study .

Therefore, H1, H2, H3 are accepted at a significance level of $p > 0.000$ of 0.5. The study shows that this policy (POL) has a positive impact on the optimization of the faculty (OTT).

V. DISCUSSION AND CONCLUSION

By referring to the professional qualification structure, degree structure and policy optimization revealed in the current research, and optimizing the relationship between the faculty, it can be concluded that the faculty structure of Guizhou University needs to be further optimized. To optimize the structure of the teaching staff of Guizhou University, it is necessary to prescribe the right medicine and choose effective measures. The level of faculty construction not only requires Guizhou University to introduce policies that are conducive to the construction of faculty, but also requires the government to give policy support to the faculty of the university.

Improve the professional qualification review system and optimize the professional qualification structure. There are many factors that affect the irrational structure of the professional qualifications of college teachers. The unreasonable vocational qualification review system is an important aspect, so this situation should be changed as soon as possible. First of all, to change the previous professional qualification assessment system, that is, to change the standard system of professional qualifications. Secondly, it will <http://dx.doi.org/10.29322/IJSRP.9.07.2019.p9181>

change the method of assessing the professional qualifications of the scientific research and the scientific research. Therefore, in the process of teacher professional qualification assessment, the ability and contribution of teachers should be evaluated mainly from the aspect of teaching, that is, the standard of vocational qualifications should be based on teaching, taking into account scientific research and social services. Again, emphasis on teacher business training, skills training and business assistance. The promotion of professional qualifications is based on ability. Without the promotion of ability, there is no promotion of professional qualifications.

Improve academic standards, strengthen academic qualifications, and optimize academic structure. First of all, moderately improve the academic qualifications for the qualifications of college teachers. By adjusting or formulating relevant policies, it is stipulated that in the future, hiring teachers must first have a master's degree or above, and gradually improve the overall level of the teaching staff by improving the qualifications of professional qualifications. Secondly, university administrators should vigorously tap potential resources, scientifically allocate existing resources, and should be inclined to the construction of teachers in the use of funds. Attract and recruit more doctoral students by improving the treatment of teachers, changing management methods, and creating a good atmosphere. Health. Once again, increase the academic qualifications of in-service teachers. At present, the proportion of teachers with only master's degree or below is still relatively large. To optimize the academic qualification structure of the teaching staff, in addition to vigorously recruiting highly educated teachers, another way out is to select or encourage teachers to pursue doctoral degrees and gradually increase teachers. The proportion of highly educated teachers in the team.

The government has appropriately raised the relevant policies for professional qualifications and higher education standards, and strictly established the minimum academic qualifications for the promotion of professional qualifications for professors and deputy teachers. The government adjusts the administrative orientation of over-administration, transforms micro-management into macro-management, actively guides and urges colleges and universities to adjust the structure of teachers' teams independently from the macro level; the university adjusts the administrative orientation of over-administration, respects the academic development rules and academic professional characteristics, and adopts science. Reasonable measures to optimize the structure of the teaching staff. Second, the government and universities should adjust the development orientation of higher education with emphasis on scale expansion and light structure adjustment. The government scientifically formulates macroeconomic policies to guide colleges and universities to attach importance to and adjust the structure of the teaching staff. By tapping potential resources and integrating existing forces, universities adjust the matching relationship of elements, promote academic exchanges among teachers, and optimize the structure of teachers. Strengthen the rational regulation and control of the government, and guide the university to adjust and optimize the structure of the teaching staff through scientifically formulating and strictly implementing various relevant academic professional policies. The government increased funding, expanded opportunities for teachers to

exchange and cooperate, and provided more opportunities for teachers to study abroad, visits, and academic cooperation. The university itself increased special funds and vigorously introduced various high-level talents that are conducive to adjusting the structure of the original teachers. In short, sufficient school funding is an important basis for optimizing the structure of local undergraduate college teachers.

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Antimicrobial activities and Characterization of Isolated Compound from the Stem Bark of *Couroupita Guianensis* Aubl. (Amyauk-San-Bin)

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Abstract: In this paper, the Myanmar indigenous medicinal plant, *Couroupita Guianensis* Aubl. (Amyauk-San-Bin), was studied. The phytochemical constituents of *C. Guianensis* was investigated and the antimicrobial activities of n-hexane, dichloromethane, ethyl acetate, ethanol and methanol extracts of *C. Guianensis* was tested by Agar-well diffusion method on six selected organisms *Bacillus subtilis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus pumilus*, *Candida albican* and *E-coli*. The isolation and characterization of organic compounds from the extracts of *C. Guianensis* bark was carried by Thin Layer Chromatography (TLC) and FT IR. The isolated compounds (I, II and III) from ethyl acetate extract of the bark of *C. Guianensis* were studied by Thin Layer and Column Chromatography (TLC). The yield percent of compound I was found to be 1.92% (0.05 g) base upon the ethyl acetate crude extract, that of compound II was found to be 0.38% (20 mg) and that of compound III was found to be 0.76 % (20 mg) respectively.

Key words: *Couroupita Guianensis* Aubl., antimicrobial activities, Thin Layer Chromatography, FT IR, dichloromethane.

Introduction

Medicinal plants have been in use for treatment of various diseases all over the world. Medicinal plants are used as traditional form of providing relief to several diseases. Presently, millions of adults are depending on medicinal plants for their primary health care needs. Medicinal plants have been a major source in the maintenance of health, as well as in the prevention, improvement or treatment of physical and mental illness.

Herbal medicines certainly have over a millenary history, especially through the Orient. Although, the use of these medicines in the western world is decidedly amplifying, most of them are not yet acceptable scientific evidences to support this conviction. Various medicinal plants have been identified and modern scientific approaches have been used to study their authenticity, safety and efficacy of their therapeutic uses.

Couroupita guianensis Aubl. (Myanmar name Amyauk-San-Bin) is also called as “Cannonball tree” or “Sal tree”. The effects of the Cannon ball tree in medical use are strong. As when using any natural medicine, the correct dosage is vital. In medicinal use, the flowers, leaves, bark and fruit flesh are used. The bark of Cannon ball tree malaria, antibiotic, antifungal, antiseptic and analgesic qualities. The trees are used to cure colds and stomach aches.

Botanical Description

| | |
|-----------------|--|
| Scientific name | - <i>Couroupita Guianensis</i> Aubl. |
| Family name | - Lecythidaceae |
| Local name | - Amyauk-San-Bin |
| Distribution | - Amazonian Colombia, Northern Venezuela, Guyana, Surinam, French Guiana, Amazonian Ecuador, Amazonian Peru, eastern and southwestern Amazonian Brazil and Myanmar |
| Part of Use | - Bark |
| Medicinal Use | - malaria, antibiotic, antifungal, antiseptic and analgesic qualities |

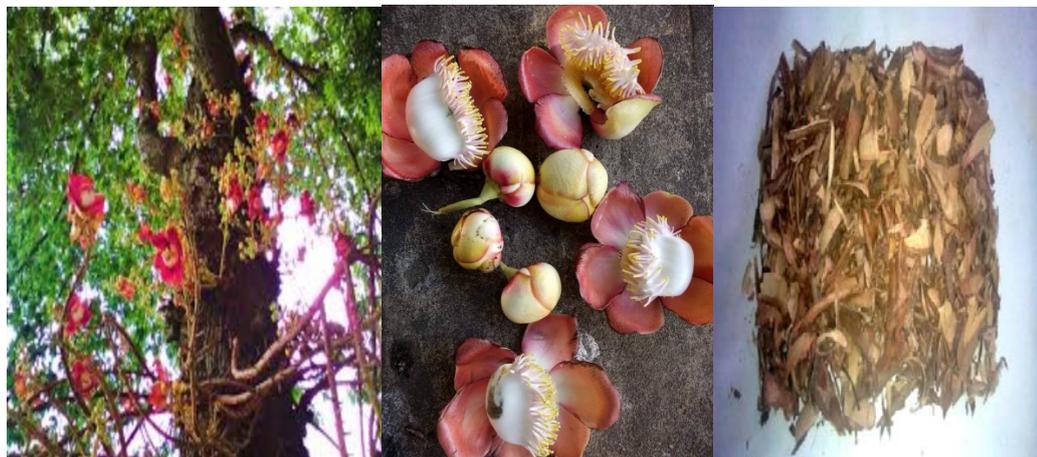


Figure1. Plant, flower and bark of *Couroupita Guianensis* Aubl.

Experimental

Instrumentation and Materials

Instrumentation

The occurrence of UV absorption on TLC plate was checked by UV detector and iodine vapor. The apparatus for extraction and chromatography were used with common laboratory equipments.

Materials

Before the research work was taken all the commercially available reagent and solvent were distilled. Analytical and preparative thin-layer chromatography was performed by using precoated silica gel plates. Silica gel (Merck-Co., Inc., Kieselgel 60, 70-230 Mesh ACTM) was used for column chromatography.

Sample Collection and Preparation

Myanmar medicinal plant Amyauk-San-Bin was collected from Magway Township, Myanmar.

Phytochemical screening

The air-dried powdered sample was subjected to preliminary phytochemical test in order to find out the types of phytochemical constituents such as alkaloid, flavonoid, glycoside, phenolic compound, reducing sugar, saponin, steroid, polyphenol and terpene present in sample according to appropriate reported methods.

Test for Alkaloid

Dried powdered sample (2 g) was boiled with 1% HCl for about 10 minutes, allowed to cool and then filtered. The filtrate was divided into two portions in test tubes. The first portion was then tested with Dragendorff's reagent and the second with Wagner reagent respectively. The yellow precipitates indicates the presence of alkaloids

Test for Flavonoid

Dried powdered sample (2 g) was extracted with 95% ethanol (25 cm³) and concentrated alcoholic HCl solution (4 cm³) was treated with a few pieces of magnesium turning and a few drops of concentrated sulphuric acid. The appearance of pink colour solution indicates the presence of flavonoids.

Test for Steroid

Dried powdered sample (2 g) was introduced into a round-bottomed flask followed by the addition of petroleum ether. The mixture was kept on water-bath under reflux for 15 minutes and filtered. The filtrate was treated with acetic anhydride (3 drops) and a few drops of concentrated sulphuric acid were carefully added and shaken. The mixture was left in a dark place for a few minutes. The appearance of greenish blue colour solution indicates the presence of steroids.

Test for Terpene

Dried powdered sample (2g) was boiled with ethanol 25 cm³ for about 10 minutes and filtered, 3 drops of acetic anhydride, 1 cm³ of chloroform and one drop of concentrated sulphuric acid were added to ethanol extract and recorded the observed colour. Reddish brown coloration indicates the presence of terpene.

Test for Glycoside

Dried powdered sample (2 g) was boiled with distilled water (100 cm³) for about 10 minutes, allowed to cool and filtered. The filtrate was treated with a few drops of 10% lead acetate solution. The formation of white precipitates indicates the presence of glycosides.

Test for Reducing Sugar

Dried powdered sample (2g) was boiled with distilled water for about 10 minutes and then filtered. The filtrate was boiled a few drops of Benedict's solution for about 2 minutes. The formation of brick red precipitate indicates the presence of reducing sugars.

Test for Polyphenol

Dried powdered sample (2 g) was extracted with ethanol for 10 minutes. It was allowed to cool and filtered. The filtrate was added to the mixture of 1% FeCl₃ (1 mL) and 1% K₃Fe(CN)₆ (1 mL). The appearance of greenish blue colour solution indicates the presence of polyphenol.

Test for Saponin

Dried powdered sample (2 g) was put into the test tube followed by the addition of distilled water. The mixture was vigorously shaken for a few minutes, allowed to settle for 10 minutes. Formation of stable foams indicates the presence of saponin.

Test for Phenolic Compound

Dried powdered sample (2 g) was boiled with distilled water and filtered. The filtrate was treated with a few drops of 10% ferric chloride solution. The brown colour solution indicates the presence of phenolic groups.

Determination of Antimicrobial Activity by Agar Well Diffusion Method

Antimicrobial activities of different crude extracts of Amyauk-San-Bin was screened in vitro by agar well diffusion method on nutrient agar medium. The studies were performed at CRDT (Central Research Development and Technology), Insein, Yangon as shown in Figure (2).

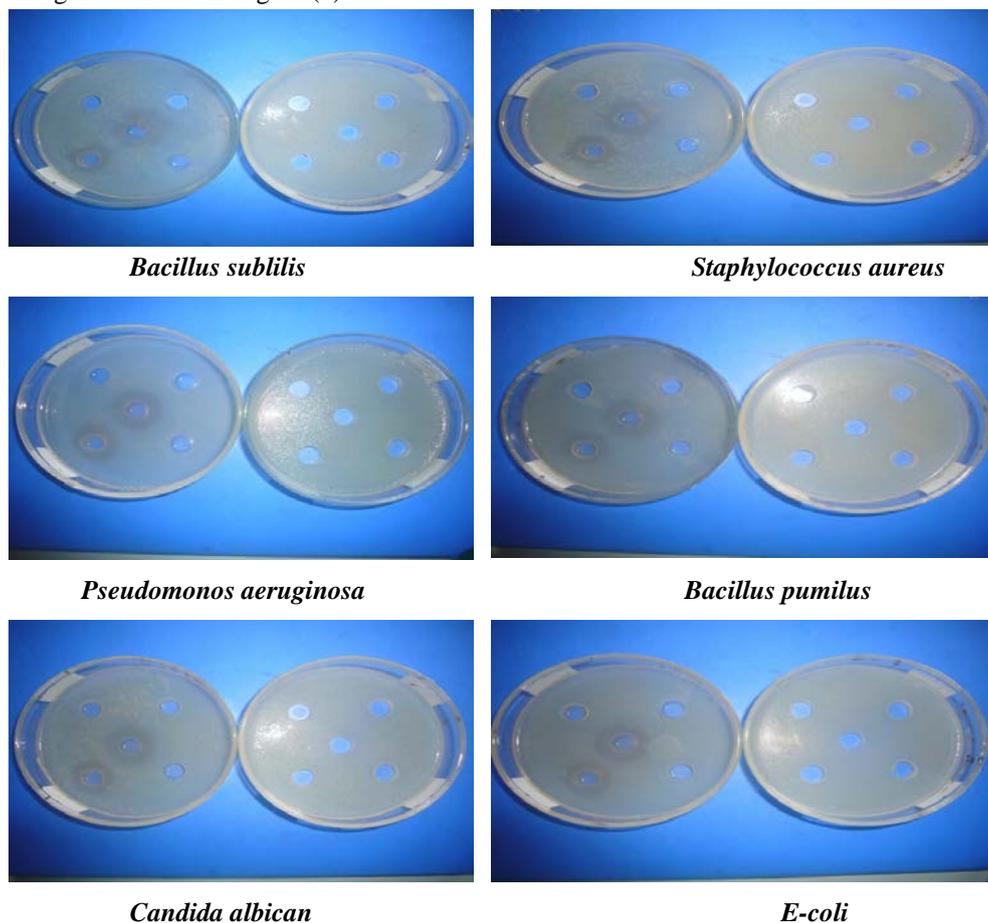


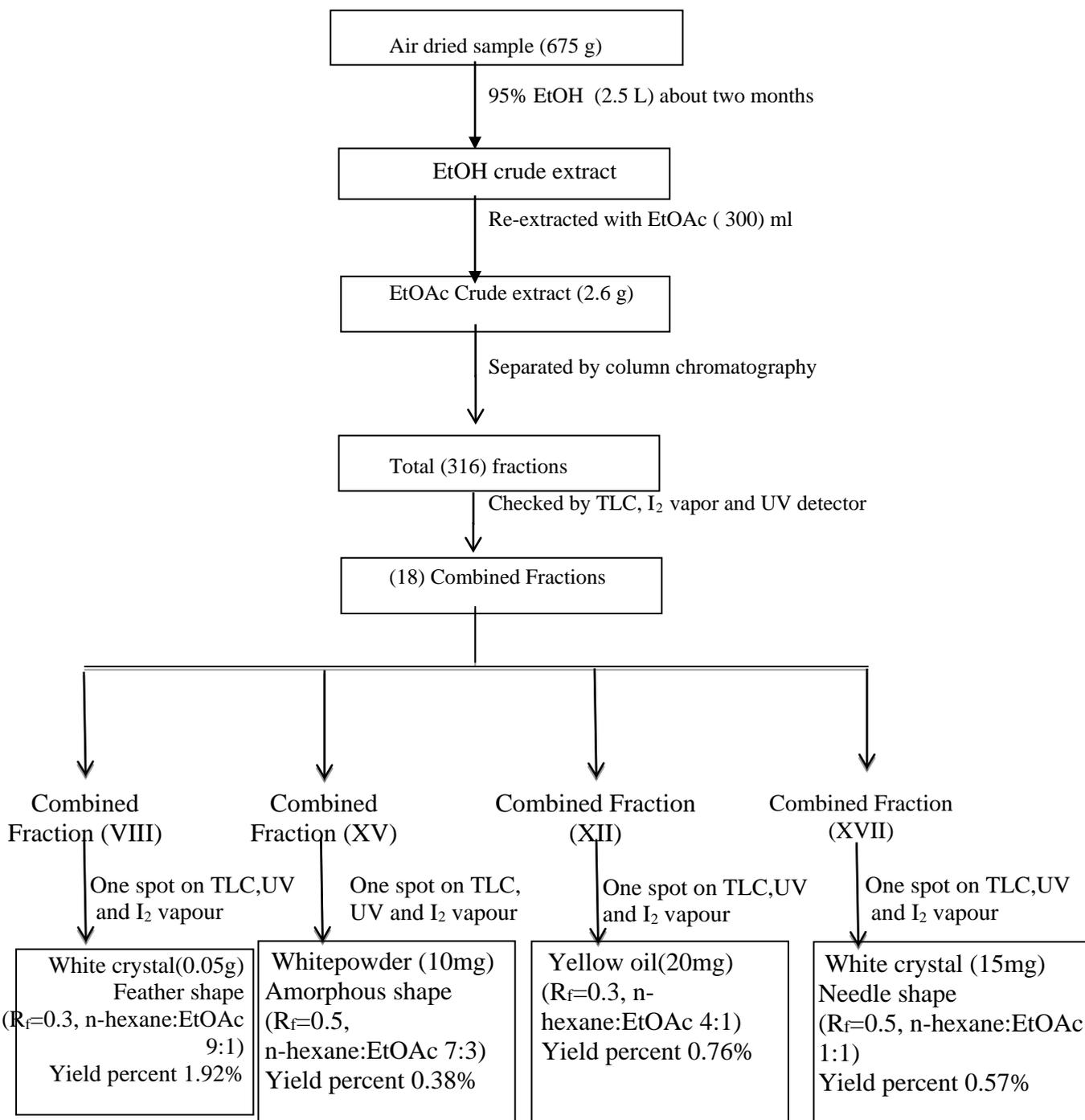
Figure 2. Antimicrobial Activities of *Couroupita Guianensis* Aubl. (Amyauk-San-Bin)

Column Chromatography Separation

The bark of *Couroupita Guianensis* Aubl. (Lecythidaceae) Myanmar named Amyauk-San-Bin collected from Magway Township, Myanmar.

The air dried bark of *Couroupita Guianensis* Aubl. (675 g) were extracted with 95% EtOH (2.5 L) at room temperature about two months. Ethanol extract was re-extracted with EtOAc (300 ml) and then filtered and evaporated. Ethyl acetate crude extract (2.6 g) was separated by column chromatography with adsorbent (silica gel 70-230 mesh) and eluent (n-hexane: EtOAc

various ratio). Total (316) fractions were obtained. Each fractions were checked by TLC, I₂ vapor and UV detector. The same R_f value fractions were combined. And then 18 combined fractions were obtained. Among them combined VIII gave white powder 0.5 g. This shape is feather shape with R_f value 0.3. n-hexane and EtOAc ratio is 9:1, yield percent 1.92%. White crystal 10 mg was obtained from combined XV, this shape is amorphous with R_f value 0.5. n-hexane and EtOAc ratio is 7:3, yield percent 0.38% . Combined fraction XII gave yellow oil 20 mg. R_f value 0.3. n-hexane and EtOAc ratio is 4:1, yield percent 0.76%. White crystal 15 mg was obtained from combined XVII, this shape is needle shape with R_f value 0.5. n-hexane and EtOAc ratio is 1:1, yield percent 0.57% .



Results and Discussion

Preliminary Phytochemical Test for the bark of *Couroupita guianensis* Aubl.

Table 1. Phytochemical Test for the bark of *Couroupita guianensis* Aubl.

| No. | Constituents | Reagent used | Observation | Results |
|-----|----------------|--|----------------------|---------|
| 1. | Alkaloid | Dragendroff's reagent | Yellow ppt | + |
| | | Wagner reagent | Orange ppt | + |
| 2. | Flavonoid | EtOH, Mg ribbon, Conc: HCl | Pink colour | + |
| 3. | Steroid | EtOH, acetic anhydride, CHCl ₃ Conc: H ₂ SO ₄ | Greenish blue colour | + |
| 4. | Terpene | Petether, acetic anhydride, CHCl ₃ , Conc; H ₂ SO ₄ | Reddish brown colour | + |
| 5. | Glycoside | 10% lead acetate solution | White ppt | + |
| 6. | Reducing Sugar | Benedict's solution | Brick red ppt | + |
| 7. | Polyphenol | 1% FeCl ₃ , 1% [K ₃ Fe(CN) ₆] solution | Greenish blue colour | + |
| 8. | Saponin | H ₂ O, shaking | Frothing | + |
| 9. | Phenolic | H ₂ O, Δ, 10 min, 10% FeCl ₃ solution | Brown colour | + |

Results of Antimicrobial Activities of *Couroupita guianensis* Aubl.

Table 2. Antimicrobial Activities of *Couroupita Guianensis* Aubl.

| No | Type of Solvent | Inhibition Zone | | | | | |
|----|-------------------|-----------------|----------|------------|-----------|-----------|-----------|
| | | I | II | III | IV | V | Vi |
| 1 | n-hexane | 12mm (+) | 12mm (+) | 13mm (+) | 13mm (+) | 12mm (+) | 12mm (+) |
| 2 | Di-chloro methane | 11mm (+) | 13mm (+) | 13mm (+) | 12mm (+) | 13mm (+) | 12mm (+) |
| 3 | EtOAC | 14mm (+) | 14mm (+) | 14mm (+) | 14mm (+) | 14mm (+) | 14mm (+) |
| 4 | EtOH | 14mm (+) | 13mm (+) | 20mm (+++) | 15mm (++) | 15mm (++) | 15mm (++) |
| 5 | MeOH | 13mm (+) | 13mm (+) | 12mm (+) | 13mm (+) | 13mm (+) | 13mm (+) |

Agar well-10mm (+)

15mm~19mm (++)

20mm above (+++)

10mm~14mm

I - *Bacillus subtilis*

II - *Staphylococcus aureus*

III - *Pseudomonos aeruginosa*

IV - *Bacillus pumilus*

V - *Candida albican*

VI - *E-coli*

According to this table, n-hexane, dichloromethane, ethyl acetate, ethanol and methanol extracts of three selected samples were tested by Agar-well diffusion method on six selected organisms. In this study, it can be observed that n-hexane, dichloromethane, ethyl acetate and methanol extracts of *Couroupita Guianensis* Aubl. gave low activities on six selected organisms. Ethanol extract of this sample gave medium activities on *Bacillus pumilus*, *Candida albican* and *E-coli* and high activity on *Pseudomonos aeruginosa*.

Table 3. FT-IR Spectral Data of Compound -1

| No. | Wave number of absorption band (cm ⁻¹) | Assignment of functional group |
|-----|--|---|
| 1. | 3303.21 | O – H stretching vibration of alcohol group |
| 2. | 3098.5 | C-H stretching vibration of sp ² hydrocarbon |
| 3. | 2926.11,2852.81 | Assymmetric and symmetric C-H stretching vibration of sp ³ hydrocarbon |
| 4. | 1710.92 | C = O stretching vibration of carbonyl group |
| 5. | 1640.51 | C=C stretching vibration of alkenic group |
| 6. | 1459.20 | C-H stretching vibration of allylic hydrocarbon |
| 7. | 1382.04, 1361.79 | C – H bending vibration of sp ³ hydrocarbon |
| 8. | 1261.49 | C – C –O stretching vibration of ether group |
| 9. | 1095.60,1033.88 | C – O – C stretching vibration of ether group |
| 10. | 804.34 | C-H out of plane bending vibration |

Table 4. FT-IR Spectral Data of Compound -2

| No. | Wave number of absorption band (cm ⁻¹) | Assignment of functional group |
|-----|--|--|
| 1. | 3080.42 | – CH stretching vibration of sp ² hydrocarbon alkene |
| 2. | 2932.86,2868.24 | Asymmetric and symmetric C-H stretching vibration of sp ³ hydrocarbon |
| 3. | 1735.99 | C = O stretching vibration of carbonyl group |
| 4. | 1680.05 | C=C stretching vibration of alkenic group |
| 5. | 1456.30 | C-H stretching vibration of allylic hydrocarbon group |
| 6. | 1371.43 | C – H bending vibration of CH ₃ group |
| 7. | 1041.60 | C – O– C stretching vibration of ether group |
| 8. | 968.30 | C – H out of plane bending vibration of trans or E and cis or Z alkenic group |
| 9. | 883.43 | C – H out of plane bending vibration of cis or Z alkenic group |

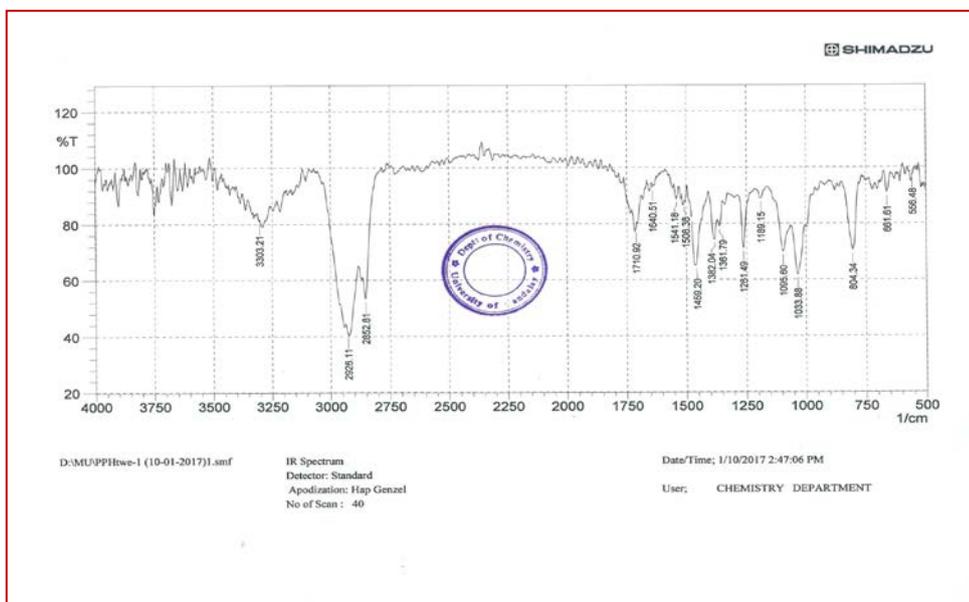


Figure3. FT IR Spectrum of pure compound -1

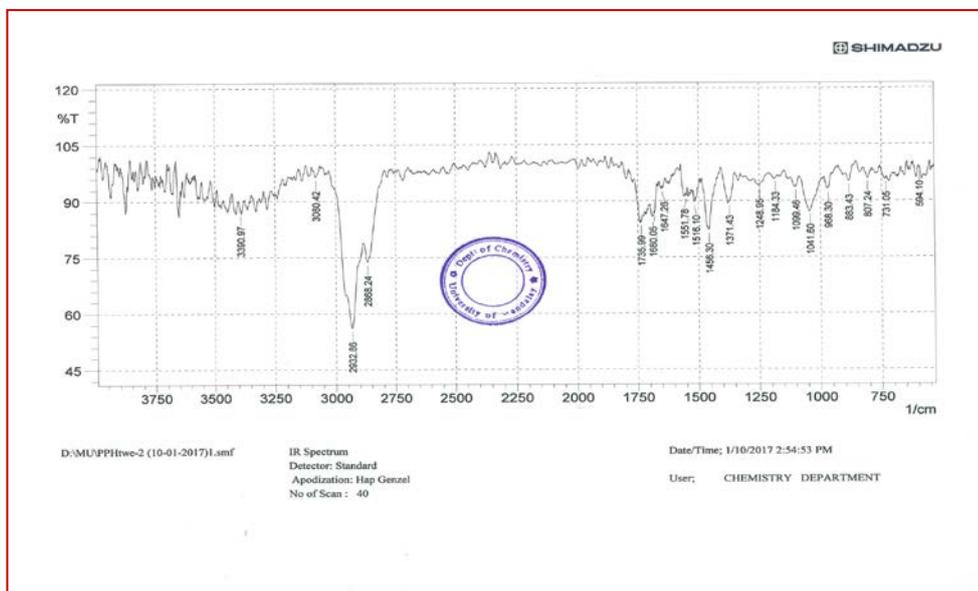


Figure 4. FT-IR Spectrum of pure compound -2

Table 5. FT-IR Spectral Data of Compound -3

| No. | Wave number of absorption band (cm ⁻¹) | Assignment of functional group |
|-----|--|--|
| 1. | 3004.23 | – CH stretching vibration of sp ² hydrocarbon |
| 2. | 2926.11,2854.74 | Asymmetric and symmetric C-H stretching vibration of sp ³ hydrocarbon |
| 3. | 1743.71 | C = O stretching vibration of carbonyl group |
| 4. | 1608.5 | C=C stretching vibration of alkenic group |
| 5. | 1456.30 | C-H stretching vibration of allylic hydrocarbon |
| 6. | 1376.26 | C – H stretching vibration of CH ₃ group |
| 7. | 1169.87 | C – O– C stretching vibration of ether group |
| 8. | 971.19 | C – H out of plane bending vibration of trans or E and cis or Z alkenic group |
| 9. | 811.09 | C – H out of plane bending vibration of cis or Z alkenic group |

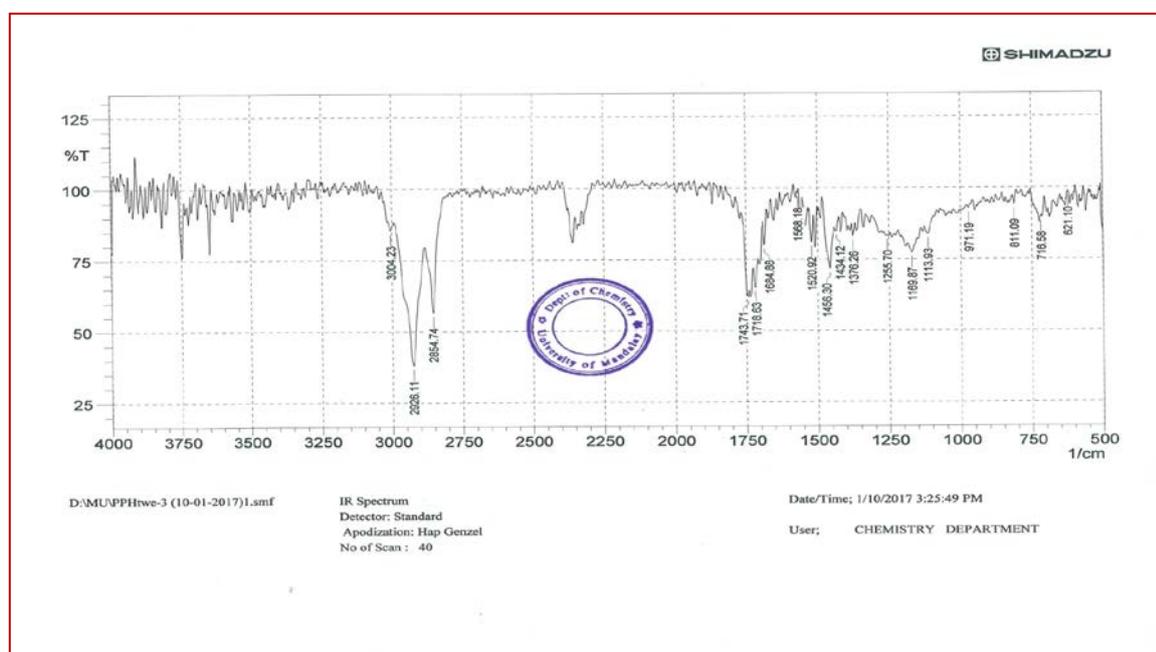


Figure 5. FT-IR Spectrum of pure compound -3

Conclusion

In this paper, Myanmar indigenous medicinal plant was collected from Magway township, Magway Region. In the phytochemical screening, the bark of *Couroupita Guianensis* Aubl. (Amyauk-San-Bin) contains alkaloid, flavonoid, steroid, terpene, glycoside, reducing sugar, polyphenol, saponin, and phenolic compound respectively. The antimicrobial activities of n-hexane, dichloromethane, ethyl acetate, ethanol and methanol extracts of *Couroupita Guianensis* Aubl. (Amyauk-San-Bin) was tested by Agar-well diffusion method on six selected organisms. In this study, it can be observed that n-hexane, dichloromethane, ethyl acetate and methanol extracts of Lumbini Ingyin gave low activities on six selected organisms. Ethanol extract of this sample gave medium activities on *Bacillus pumilus*, *Candida albican* and *E-coli* and high activity on *Pseudomonas aeruginosa*.

Furthermore, pure organic compounds 1, 2 and 3 were isolated from ethyl acetate extract of the bark of *Couroupita Guianensis* Aubl. (Amyauk-San-Bin) by applying advanced separation techniques such as Thin Layer and Column Chromatography. The yield percent of compound -1 was found to be 1.92% (0.05g) base upon the ethyl acetate crude extract, compound-2 was found to be 0.38% (20mg) and compound -3 was found to be 0.76% (20mg) base upon the ethyl acetate crude extract.

The FT-IR spectrum of compounds -1, 2 and 3 were measured at the Department of Chemistry, University of Mandalay and the functional groups containing in this pure compounds could be determined by the FT-IR assignments.

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Simulation of Ziegler-Nichols PID Tuning for Position Control of DC Servo Motor

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Abstract- This paper presents the implementation of PID controller in position control of dc servo motor. Due to its simplicity, robustness and successful practical application, PID (Proportional-Integral-Derivative) controllers have become most widely used controller in the industry. There are several different methods through which the PID controller can generate automatic control efficiently. In this paper, the tuning method used for the proposed position control model of dc servo motor is Ziegler-Nichols (ZN) tuning algorithm. Here, a computer based model (using MATLAB SIMULINK) is furnished for obtaining the output during the position control of dc servo motor. Nowadays, dc servo motors have become the workhorse of the industrial sector due to their easy means of construction and maintenance. Therefore, the performance of the machine needs to be specified using computer aided programs and the control strategy best suited here is PID.

Index Terms- DC servo motor, Position control, PID tuning, Ziegler-Nichols method, MATLAB-Simulink

I. INTRODUCTION

The heart of many automatic control systems are servo motor drive. The dc servo motor has applications in automatic control systems, either speed or position control of the dc servo motor. The dc servo motor is basically like a transducer that converts electric energy into mechanical energy. The torque developed on the motor shaft is directly proportional to the field flux and the armature current. The dc servo motors are more expensive in comparison to ac servo motors because of brushes and commutators [1]. These motors have relatively low torque to volume and torque to inertia ratio, however the characteristic of dc servo motors are quite linear and are easy to control. Servos are commonly electrical or partially electronic in nature, using an electric motor as the primary means of creating mechanical force. Other types of servos use hydraulics, pneumatics, or magnetic principles. Usually, servos operate on the principle of negative feedback, where the control input is compared to the actual position of the mechanical system as measured by some sort of transducer at the output. Any difference between the actual and wanted values (error signal) is amplified and used to drive the system in the direction necessary to reduce or eliminate the error. Nowadays, servo motors are used in automatic machine tools, satellite tracking antennas, remote control airplanes, automatic navigation systems on boats and planes, and anti-aircraft gun control systems. In the past decades, control theory has found several developments. Different intelligent control algorithms

have been developed so far. However, the PID type controller is still the most widely used control strategy in industries [2]. Studies even indicate that approximately 90% of all industrial controllers are of the PID (Proportional-Integral-Derivative) type. The Ziegler-Nichols tuning method is a means of relating the process parameters- delay time, process gain and time constant to the controller parameters, controller gain and reset time. It has been developed for use on delay-followed-by-first-order-lag processes but can also adapt to real processes. Ziegler and Nichols presented two standard methods to tune a PID controller. These methods, due to their simplicity, are still widely used in different industrial and other tuning process. This paper is organized as follows. Section (II) describes about servo motor mathematical model. Section (III) addresses servo motor SIMULINK model. Section (IV) illustrates two kinds of Ziegler-Nichols. And section (V) concludes the whole results.

II. SERVO MOTOR MATHEMATICAL MODEL

The equivalent circuit diagram of servo motor is presented in Figure (1). The armature is modeled as a circuit with resistance, R_a connected in series with an inductance, L_a and a voltage source, $V_b(t)$ representing the back emf in the armature when the rotor rotates .

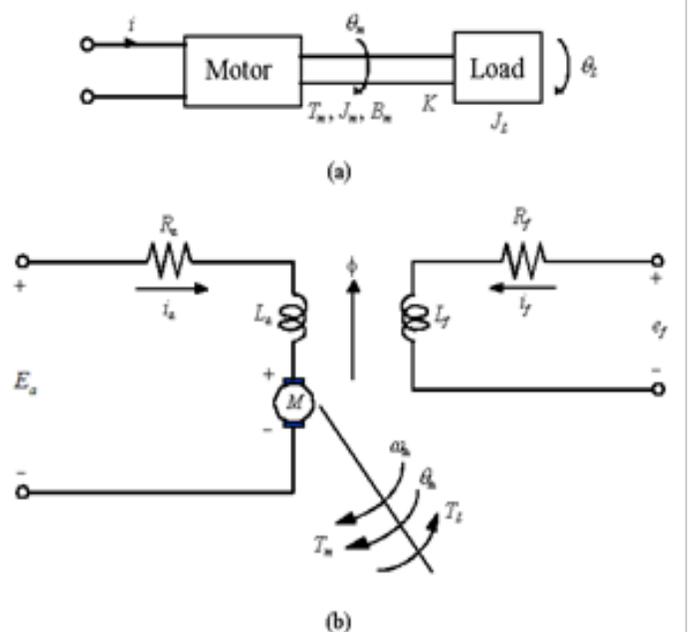


Figure1. (a) A dc servo motor drives an inertia load

(b) The equivalent circuit diagram of the dc servo motor
Mathematical modelling of dc Servo motor system:

$E_a(t)$ =Input Voltage

$i_a(t)$ =Armature current

R_a =Armature resistance (1 ohm)

L_a =Armature inductance (29.79×10^{-3} Henry)

$E_b(t)$ =Back e.m.f

T_m =Developed Torque

ω_m =Motor Angular Velocity

J =Motor moment of Inertia (0.01Kg.m²)

B =Viscous friction coefficient (0.004N.m/rad/s)

K_b =Back e.m.f constant (0.1V/rad/s)

K_T =Torque constant (0.1 N.m/A)

The differential equation of armature circuit is

$$E_a(t) = R_a i_a(t) + L_a \frac{di_a(t)}{dt} + E_b(t) \quad (1)$$

The Torque equation is

$$T_m(t) = J \frac{d\omega_m(t)}{dt} + B \cdot \omega_m(t) \quad (2)$$

In order to create the block diagram of system; initial conditions are acquiescence zero and laplace transform is implemented to the equations.

$$I_a(s) = \frac{E_a(s) - K_b \cdot \omega_m(s)}{R_a + L_a s} \quad (3)$$

$$\frac{\omega_m(s)}{E_a(s)} = \frac{K_i}{s^2 J_m L_a + s J_m R_a + K_i K_b} \quad (4)$$

$$\frac{\theta_m(s)}{E_a(s)} = \frac{K_i}{s^3 J_m L_a + s^2 J_m R_a + K_i K_b s} \quad (5)$$

The overall transfer function of the servomotor is represented as

$$G_p = \frac{0.1}{0.0002979s^3 + 0.01012s^2 + 0.014s + 0.1} \quad (6)$$

III. SERVO MOTOR SIMULINK MODEL

In this paper, the software used for constructing the simulation model is MATLAB [3]. Firstly, we investigated to know the response of the dc servomotor. The output result is as shown in figure (2). The settling time came out to be 6.34 seconds with a maximum overshoot of 56.4 %.

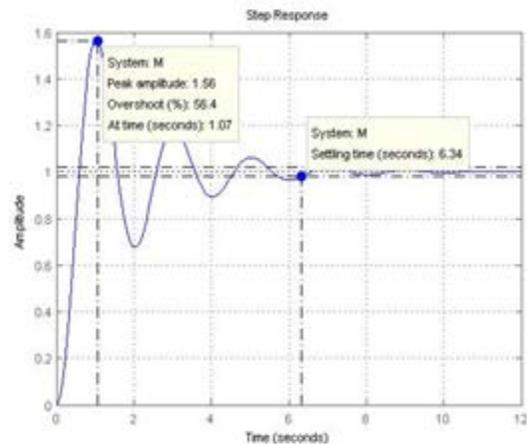


Figure (2).The response of the dc servo motor (without PID controller)

IV. ZIEGLER-NICHOLS PID TUNING METHOD

Tuning methods of controller describe the controller parameters in the form of formulae or algorithms. They ensure that the resultant process control system would be stable and would achieve the desired objectives. In literature, a wide variety of PID controller tuning methods are proposed [4]. These are broadly classified into three categories and these are

- Closed loop methods
 - Ziegler-Nichols method
 - Modified Ziegler-Nichols method
 - Tyres-Luyben method
 - Damped oscillation method
- Open loop methods
 - Cohen-Coon method
 - Fertik method
 - IMC method
 - Minimum error criteria (IA)

In closed loop tuning methods the plant is operating in closed loop and controller tuning is performed during automatic state. In contrast the open loop techniques operate the plant in open loop and the controller tuning is done in manual state. In this paper, the tuning methods considered for simulation is Ziegler-Nichols method.

A proportional-integral-derivative controller (PID) is a generic control loop feedback mechanism widely used in industrial control systems [6]. A PID controller will correct the error between the output and the desired input or set point by calculating and give an output of correction that will adjust the process accordingly.

$$u(t) = K_p e(t) + K_i \int_0^t e(\tau) d\tau + K_d \frac{de}{dt} \quad (7)$$

Where K_p is proportional gain, K_i is the integral gain, and K_d is the derivative gain. The Proportional value determines the reaction to the current error, the Integral determines the reaction based on the sum of recent errors and the Derivative determines the reaction to the rate at which the error has been changing.

The PID controller has the transfer function:

$$G_c(s) = K_p + \frac{K_I}{s} + K_D s \quad (8)$$

$$G_c(s) = K_p \left(1 + \frac{1}{T_I s} + T_D s \right) \quad (9)$$

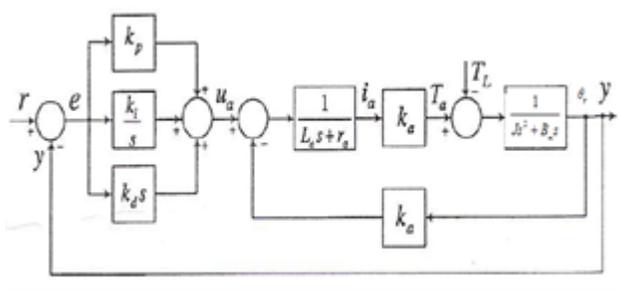


Figure (3) Block Diagram of the Closed-Loop Servo motor with PID Controller

The value of K_p that makes the system marginally stable so that sustained oscillation occurs can be obtained by use of Routh's stability criterion [5].

Ziegler-Nichols method: The Ziegler-Nichols method is common used in tuning of PID controllers. The proposed ruled of Ziegler-Nichols method is for determining values of the proportional K_p , integral time T_i , and derivative time T_d based on the transient response characteristics of the plant. Such as the determination of the parameters of PID controllers or tuning of PID controller can be made on site by experiment on plant. In this method, it described simple mathematical procedures, the first and second methods respectively for tuning PID controllers. These procedures are accepted as standard in control system practices.

A. Ziegler-Nichols (first method)

If the plant involves neither integrator nor dominant complex-conjugate poles, then that step response exhibits as S-shape curve, the first method can be applied. Such step-response curves may be generated experimentally or from a dynamic simulation of the plant.

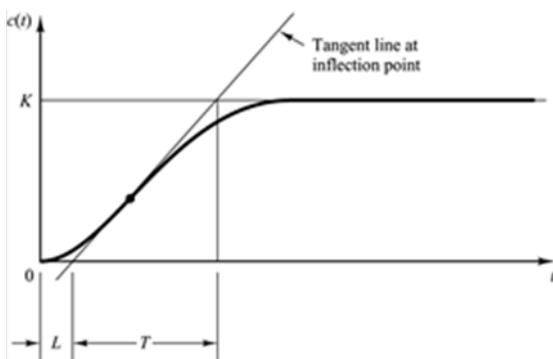


Figure (4) S-shaped response curve

Table I
Ziegler-Nichols (first method) Tuning Rule Based on L and T

| Type controller of | K_P | T_i | T_d |
|--------------------|-------------------|-----------------|--------|
| P | $\frac{T}{L}$ | ∞ | 0 |
| PI | $0.9 \frac{T}{L}$ | $\frac{L}{0.3}$ | 0 |
| PID | $1.2 \frac{T}{L}$ | $2L$ | $0.5L$ |

B. Ziegler-Nichols (second method)

We first set $T_i = \infty$ and $T_d = 0$, use the proportional control action only. And increase K_p from 0 to a critical value K_{cr} at which the output first exhibits sustained oscillations. And then consider the T_i and T_d according to table II.

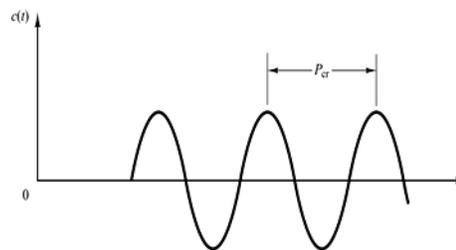


Figure (5) sustained oscillation with period P_{cr}

Table II
Ziegler-Nichols (second method) Tuning Rule Based on Critical Gain K_{cr} and Critical Period P_{cr} (Second Method)

| Type controller of | K_P | T_i | T_d |
|--------------------|--------------|------------------------|---------------|
| P | $0.5K_{cr}$ | ∞ | 0 |
| PI | $0.45K_{cr}$ | $\frac{1}{1.2} P_{cr}$ | 0 |
| PID | $0.6K_{cr}$ | $0.5P_{cr}$ | $0.125P_{cr}$ |

We determine the parameters of the PID controller by second method as follows:

$$K_p = 2.253575025$$

$$T_i = 0.458269661$$

$$T_d = 0.114567415$$

The transfer function of the PID controller is thus

$$G_c(s) = 2.253575025 \left(1 + \frac{1}{0.458269661s} + 0.114567415s \right)$$

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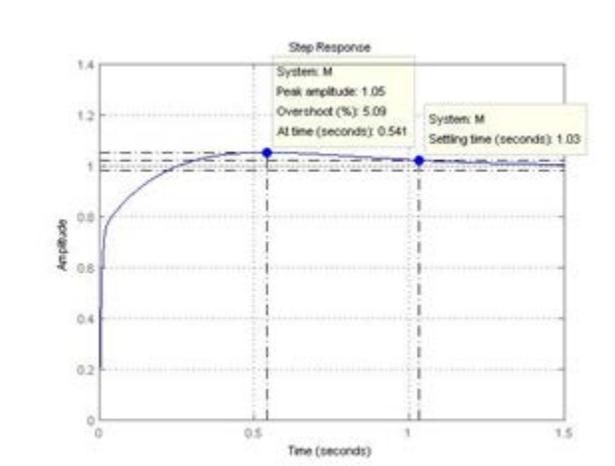


Figure (6) Response of the system with ZN algorithm

In the second model, with Ziegler-Nichols tuning method was used, the response is shown in the figure (6). Here, the value of settling time came out to be 1.03 seconds and a maximum overshoot of 5.09 %.

V. CONCLUSION

In this paper, we investigated about mathematic model and SIMULINK model of a dc servo motor. And Ziegler-Nichols tuning method is utilized for PID control of a dc servo motor. First analyzed Ziegler-Nichols tuning gain by second method and then continued in MATLAB SIMULINK. Initial settle time of dc servo motor is around 6.34 seconds. After used PID with Ziegler-Nichols closed-loop tuning algorithm, the overshoot of the system gets reduced drastically. The settling time of the second simulation was also very less as compared to first one that is the conventional method, that didn't meet the design requirement.

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Single Performance And Cluster Evaluator (space) for clustering algorithms comparison

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Abstract- Clustering is renowned data mining technique used in exploratory Data Analysis which is based on unsupervised learning. Many clustering algorithms have been developed so far, and are applied in variety of disciplines based on nature of problem. The selection of suitable algorithm is necessary for accuracy, nature and complexity of data and practical representation of results. In this paper, we present SPACE algorithm which stands for “Single Performance And Cluster Evaluator”. This paper also reviews the clustering algorithms and provides foundation to the data analyst to further explore the power of clustering. SPACE algorithm is novel technique which provides solid analysis and visualizes the results efficiently.

Index Terms- space, cluster, kmeans, hierarchical, algorithm, Density-based.

I. INTRODUCTION

Clustering is unsupervised learning technique which partition the data in unknown groups based on similarity of instances. The data instances with maximum similar features are placed in the same cluster and similarity must be practically meaningful. The basic steps in clustering are selection of representative features, selection of appropriate algorithms, evaluation of results and explanation and representation of results. Clustering helps to detect outliers and manage the data in groups which can be analyzed from different perspectives and help in decision making in different aspects of life. For example clustering helps to know:

- I. Group the customers with similar buying habits?
- II. Show the documents with relevant contents?
- III. Show the customers with extra-large transactions (help in fraud detection).outlier detection.
- IV. Identify the users with similar browsing history.(help in personalized services in www.)
- V. Lot of more examples.

Clustering is unsupervised classification, we can't say that particular object will go into a particular group (cluster) rather the attributes are used to check the similarity of objects.

1.1. Things Before Clustering.

There are important points which must be in mind before stepping into clustering. Few of them are as follows:

1.1.1. Data Preprocessing

Although different clustering algorithms can cope with curse of dimensionality and other starting drawbacks but the quality of clustering results widely effected by the pre-preprocessing techniques. Therefore, the data analyst must be familiar with data preprocessing techniques like, scaling, handling missing values, dimensionality reduction ,normalization and handling categorical data. Different data preprocessing for clustering are given in (1)(2).

1.1.2. Similarity measure

The composition of data helps to understand its nature. All the attributes of objects may not be relevant for proper clustering results. Therefore, select relevant features. For Quantitative data features we use different distance functions to measure the similarity among object. The common distance functions are Minkowsky, Euclidean and Pearson correlation distance functions(3). For Qualitative data attributes we use different similarity functions instead of distance functions(4). Therefore, the data analyst must be familiar with distance functions and similarity function. These functions are summarized in(5).

1.1.3. Handling parameters.

Most of the clustering algorithms need some parameters to set while working with them. therefore, data analyst should adjust them frequently to get appropriate results. Although many algorithms exist which are parameterless like APSCAN. a new trend for parameter less clustering is given in (6).

1.1.4. Evaluation indicators.

The evaluation of clustering algorithms is very important for effective results. There are two main approaches which are internal evaluation and external evaluation. Both of these can not completely judge the quality of clustering and are only informative to identify bad clusters(7). the common internal evaluation indicators are, Davies-Bouldin index, Dunn index and Silhouette coefficient. whereas external evaluation indicators are purity, random-measure, F-measure and confusion-matrix. the comprehensive discussion of these can be found in (8).

1.1.5. Clustering software (Tool)

The selection of data clustering software plays a vital role to succeed in clustering analysis because the user has to ultimately run the clustering algorithm in any software. There are lot of open source and premium data analysis tools which apply clustering algorithms. They are based on different underlying platforms

(OS, languages, libraries, etc) and interface (command-line, GUI). The Tools with command-line interface like R, scikit-learn etc. provide more power and flexibility to the Data Analyst as compared to the GUI Tools like Weka, SPSS etc. The use of any clustering software should not affect the quality of clustering results. Almost all data analysis tools are backed by large community of developers, data analysts, framework supporters

, tutorials and forums. They are updating, resolving issues, developing and refining algorithms and interfaces. Therefore, the user must join the relevant community of that software to keep up with updates. Table [2] presents famous tools with download links. The large scale overview of data analysis tools can be found in (9)

| Clustering Tools with download links. | | |
|---------------------------------------|---|--|
| Data Analysis Tool | Download page | Features |
| Weka | https://www.cs.waikato.ac.nz/ml/weka/downloading.html | <ul style="list-style-type: none"> • By University of Waikato For Machine Learning and knowledge analysis under GNU under general purpose Licence. • Require Java runtime environment. • Documentation-url: https://www.cs.waikato.ac.nz/ml/weka/documentation.html • dataset from UCI repository are included in download package. • GUI interface. |
| R | https://www.r-project.org/ | <ul style="list-style-type: none"> • R is language and integrated suite of software for data manipulation, data handling and graphic display. • Under GNU general Public License. • Complete and flexible environment to apply statistical techniques. • Few R packages are available with R distribution and rest of the package are available through CRAN family of internet sites. • Command-Line as well as GUI interfaces. • The best Feature is R help. |
| CLUTO | http://glaros.dtc.umn.edu/gkhome/cluto/cluto/download | CLUTO is copyright by university of Minnesota and can be used for educational and research purpose. The documents need to be converted in cluto format by using perl script given on the site. |
| SPSS | https://www.ibm.com/analytics/data-science/predictive-analytics/spss-trials | Proprietary software by IBM. Trial version is available. GUI interface and easy to use. |
| Scikit learn | http://scikit-learn.org/stable/install.html | Open source under BSD License. Built on Python, numpy, scipy and matplotlib. Simple and powerful machine learning tool. |

II. LITERATURE REVIEW

Clustering algorithms can be divided into two broad categories which are classic (traditional) and Modern ones. Traditional algorithms are further divided based on the techniques used to create cluster such as partition-based, Hierarchical, Grid-Based, Density-Based, Model-Based and fuzzy-theory based. Modern clustering algorithms use novel techniques and mix of the traditional algorithms to achieve better results. In this paper we briefly review the traditional clustering algorithms.

2.1. Partition-Based Algorithms

Partition-Based Algorithms partition the dataset into k clusters by using the mean, median or Mode as centroid. They randomly select some objects (call them centroid) and then compute the distance of other objects from these objects. Then again select new centroid and compute distance of other objects to

form k clusters. In each iteration we try to optimize some objective function by iterative minimizing the distance of points from centroid.

K-means is the famous partitioning algorithm it works in very simple way. It requires k as input parameter. The algorithm is:

K-Means: For input k and D where k is number of clusters and D is data set.

- I. At random select k points as cluster centers call them centroids.
- II. compute distance of all points from these centroids.
- III. Assign each point to that centroid which is at minimum distance. Each point will be the part of one of k clusters.
- IV. Compute the mean of each cluster and this mean will be the new centroid.
- V. Repeat the step 2-4.
- VI. Stop until no change in mean values.

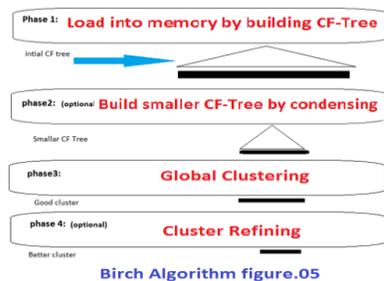
Output: k clusters.

Different variations of k-means were developed and they differ in their distance function or the centroid selection as given in(10).Simple k-means minimize the error-function.In(11)Author present the different variations of k-means from its origin to date.

PAM uses Mode instead of mean to reduce the effect of noise (mean is more effected by the biased data), and replace the cluster center(medoid) with non-selected object and try to decrease the objective function as given in(4).PAM has drawback of computational complexity due to selecting of the entire data set. CLARA is another algorithm which, unlike PAM, select a random sample for clustering and has improved performance than PAM. CLARANS is improved version of CLARA which is based on randomized search. If you compare PAM, CLARA and CLARANS on some dataset it will be clear that the later will outperform the other twoas compared in(12).

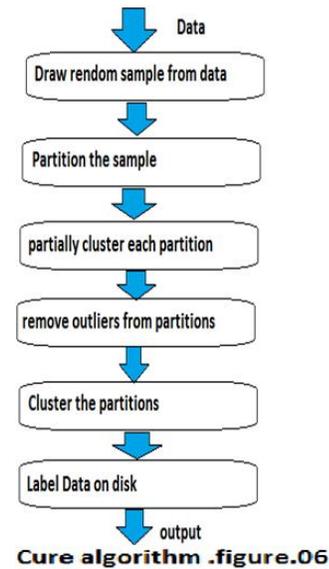
2.2. Hierarchical-Clustering

These methods decompose the dataset hierarchically and form a tree like structure called dendrogram. Tree (dendrogram) is built either from bottom up (agglomerative) fashion or from top to bottom (divisive) manner. There are different measures to split or merge two clusters. The famous criteria is to compare distance between cluster means. Termination condition of merging or splitting, updating the distance matrix and failing to detect arbitrary shaped clusters are the main issues of hierarchical methods.Birch is example of hierarchical clustering.An other algorithm called chameleon is given in(13).BIRCH stands for **B**alance **I**terative **R**educing and **C**lustering using **H**ierarchies'.BIRCH. Uses the CF-Tree data structure for clustering the large data set as given in(14).figure-05



Birch Algorithm figure.05

CURE stands for **C**lustering **U**sing **R**epresentative .Ituses few representative points instead of a single centroid for clusters .This algorithm can handle outliers very efficiently and can detect clusters with different shapes (Non-Convex) and sizes .If you carefully look at the algorithm and its working you will agree that it can be describe as given in (15).figure.06.



Cure algorithm .figure.06

2.3. Grid-Based Clustering

Grid-base algorithms form Grid of input for clustering .For example CLIQUE and STING form grid and rectangular boxes (cell) of input and merge the adjacent high density cells. STING stands for StatisticalInformation Grid-base clustering (16). STING algorithms works as :

STING Algorithm:

- I. Pick a layer to start .
- II. Find confidence for each cell of layer for query relevance.
- III. If this is bottom layer go to 5 otherwise 4.
- IV. Go to next level of hierarchy and repeat step 2 for the relevant cell of higher level.
- V. If query is satisfied go to 7 else 6.
- VI. Retrieve data from relevant cells for further processing and return result. Go to step 8.
- VII. Return the regions of relevant cells.
- VIII. Stop.

2.4 Density-Based-Clustering:

These algorithms separate dense regions of objects from low density regions and form cluster of arbitrary shapes depending upon the density distribution of data objects(17).Example is DBSCAN.Density based algorithm to handle noise is given in (18).

According to (17) DBSCAN(**DB** for Density-Based **S** For Spatial **C** for Clustering **A** for Applications **N** For Noise) is Density-Based and can construct cluster with any shape depending upon data and this algorithm requires less parameters .The Parameters required for DBSCAN are Eps and Minpts. These are the terms which can be described as:

Eps can be called as radius of the cluster. The points inside this distance are called Eps-neighborhood (**Eps short for epsilon**) of a point.Minpts stands for Minimum points with in Eps-Range (neighborhood).Formal definitions can be found in (19).

DBSCAN Algorithm:

Step1. Select P point arbitrarily.

Step2. Get all Density-Reachable points from p within Eps and Minpts range.
 Step.3 Cluster will be formed if p is the Core-Point otherwise visit the next point.
 Step.4. continue until all the points have been processed.

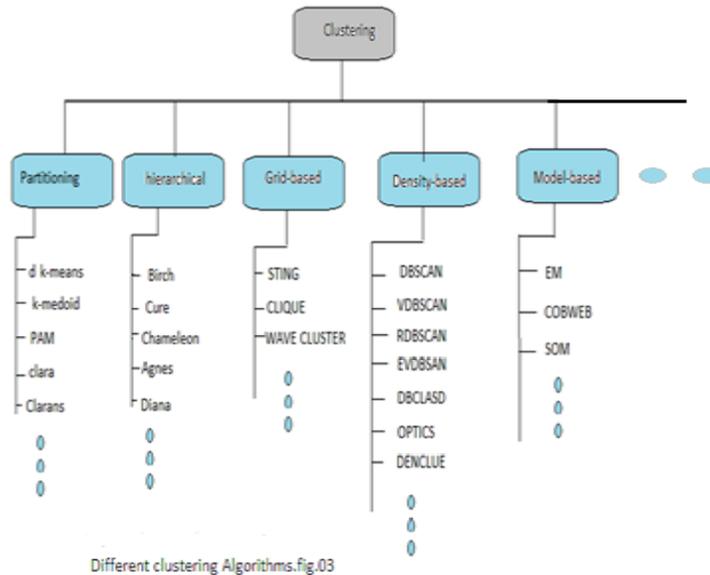
RDBC-Algorithm:

RDBC-Algorithm (R For Recursive D for Density B for Based C for Clustering) .it is also called Recursive-DBSCAN .It is improvement to the original DBSCAN. It separates the core points from the data set and apply DBSCAN on core points. Than

it assigns the remaining points to the clusters formed from core points .

2.5. Model-Based-Clustering.

These algorithms use hypothetical Models and try to adjust the data so that it can fit to some model. The model-based clustering algorithms assume that the data were generated from a model and try to discover original model from data .the common model-based clustering algorithm is Expectation-maximization (EM). The detail comparison of model-based clustering algorithm can be found in (20). Summary of classic clustering algorithms.



Different clustering Algorithms.fig.03

2.6. Modern Algorithms:

Modern clustering algorithms use more sophisticated approaches to form clusters .they mostly use mix of traditional algorithms with new techniques .we can divide the modern algorithms based on approach use as we did in classic one. Kernel-based, swarm intelligence-based, quantum Theory-based, ensemble-based, Graph theory-based are major categories to consider.They also use optimization techniques which individually or in combination with other algorithms are used.Ant-Colony-Optimization(ACO) and Particle-Swarm-Optimization (PSO)are very famous techniques which have been applied in recent years in different areas of computer science.

III. SINGLE PERFORMANCE AND CLUSTER EVALUATOR (SPACE)

As discussed in literature review section of this paper clustering algorithms are different in terms of input parameters, size of input ,way of working and presentation of results. SPACE algorithm provides the data analyst a single platform to apply and test the result of famous clustering algorithms .it takes the dataset and clustering algorithms along with parameters as input ,and show the results on graph with different colors, for visual evidence . It also append the result as new column with original data set. The algorithm is quite flexible and efficient for measuring the

performance of each algorithms. It also keeps record of all the cluster centers and can print them, if needed.

3.1. SPACE Algorithm Formal Definition

Input:

- I. clustering algorithm # like kmean, dbscan etc.
- II. Dataset # the actual dataset X to apply clustering.
- III. Arguments # parameters like k, eps etc.
- IV. Keywords # additional arguments

Start :

On input: space(X,algorithm,args,kwds)

- 1. Variable declaration:
- 2. Apply clustering algorithm
- 3. Print results
- 4. Plot results on graph with time consumed
- 5. append the results with original dataset and save in global result
- 6. return global result

End

IV. Methodology and workplan

As discussed in introduction section of the paper ,that preprocessing and selection of clustering tool is necessary part of clustering. We preferred to use sickit learn in python language due to its flexibility and open source availability.we used jupyter notebook environment to code and test in python language.

3.2. Sample code in python

here is the sample code of space algorithm please proper indent the code .this can be #found on my github account or email to get notebook.

```
def space(X, algorithm, args,kwds):
# start time stamps
start_time = time.time()
algo=algorithm(*args,**kwds)
algo.fit_predict(X)
labels=algo.labels_          # show the labels of cluster
results=pd.Series(labels)    # save results to global variable
global result
    # print parameters          print(algo)
clusters=labels.max()+1      # total clusters ,labels start from 0
cluster_values=Counter(labels) # instances assigned
end_time = time.time()

#####
# show number of clusters and elements of each cluster
print("Total cluster are",clusters)
print("cluster wise instance are : \n (0 for c1 ,1 for c2 and so on):",cluster_values)
#####
# this portion is to show cluster centers (centroids) and to skip for spectral and #agglomerative algorithms
if(algorithm==cluster.SpectralClustering)or (algorithm==cluster.AgglomerativeClustering)or
(algorithm==cluster.Birch)or (algorithm==cluster.DBSCAN):
    pass # do not have clusters hence pass.
else:    # as spectral and agglomerative dont have centers
centers=algo.cluster_centers_ # centeroids
#print("clusters centers are ",centers) uncomment if we needed
#####
# plotting portion to show clusters with different colors on scatter plot
# assign different colors to clusters
palette=sns.color_palette('deep', np.unique(algo.labels_).max()+1)
colors = [palette[x] if x >= 0 else (0.0, 0.0, 0.0) for x in algo.labels_]
# 4rth and 5th columns of X for clustering
plt.scatter(X.iloc[:,4],X.iloc[:,5],c=colors,cmap='rainbow')
plt.title('Clustersfoundby{}'.format(str(algorithm.__name__)),fontsize=24)
# print the total time taken by the algorithm to form clusters
plt.text(0.5, 0.9, 'Clustering took: {0:6.3f} s'.format(end_time - start_time), fontsize=14)
# prints total cluster count on graph
plt.text(0.1,0.1,"totalclustersFoundby{clust}are:{num}".format(clust=str(algorithm.__name__)
,num=clusters,fontsize=14))
plt.show()
##### add new column with algorithm name to see the results
result =pd.concat([X,results.rename(str(algorithm.__name__))],axis=1)
return result
#here is one way how to call and save result manually
space(X, cluster.KMeans(), {'n_clusters':6})
result.to_csv("D:/Data/Results/2017_results.csv")
```

3.3.. Datasets

The data used for clustering was taken from kaggle ,sickit learn datasets and UCI Repository (21).The dataset can be downloaded from the link given in (11)(22).

| Table -1 Data sets | | | | | |
|--------------------|--------|---------|------------|-----------|----------------|
| The dataset | Source | Type | Attributes | Instances | Missing values |
| Word happiness | kaggle | numeric | 10 | 155 | none |

| | | | | | |
|-----------------------------|--------------|----------------------|----|--------|------|
| Survey_result stackoverflow | kaggle | Numeric, categorical | 38 | 98855 | yes |
| xclara | Sickit learn | numeric | 2 | 3000 | none |
| Wholesale customers data | UCI | numeric | 8 | 440 | none |
| The iris | UCI | numeric | 5 | 150 | none |
| Diabetic | UCI | Numeric | 50 | 101766 | none |
| Weather | UCI | Numeric | 5 | 14 | none |
| CPU-vendor | UCI | Nominal | 8 | 209 | 1 |
| Online retail | UCI | numeric | 8 | 541909 | none |

3.4. Clustering algorithms Tested.

The following algorithms were applied and used in testing.

1. KMeans
2. MeanShift.
3. MiniBatchKMeans
4. AffinityPropagation
5. SpectralClustering
6. AgglomerativeClustering

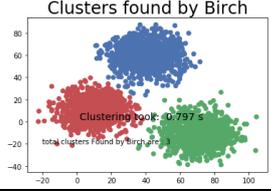
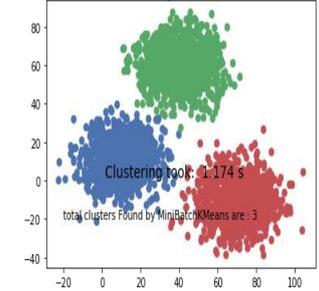
7. DBSCAN

8. Birch

3.5. Results.

The following table shows the results of clustering algorithms applied on xclara data set with known 3 clusters the dataset have two columns with names V1 and V2 .the parameters were adjusted to bring the cluster count to 3 (if possible for comparison purpose).

| Table -2 Results | | | | | |
|------------------|-------------------------|------------------------|----------------------|-----------------------|--|
| Sr.no | Algorithm Name | Parameter set | Clusters | Performance (seconds) | Plot image |
| 1 | kmeans | n_cluster=3 | 3 | 0.062 | |
| 2 | Affinity propogation | Pref=-80, damping=0.95 | 4 (failed to form=3) | 14.842 | |
| 3 | Mean Shift | Cluster all=true | 3 | 7.633 | |
| 4 | Spectral clustering | n_cluster=3 | N/A | N/A | Took too long to return ,tried different parameters {As TMs is undecidable} |
| 5 | Aglomerative clustering | n_cluster=3 | 3 | 1.453 | |
| 6 | DBSCAN | Eps=5.2 | 3 (outlier =35) | 0.094 | |

| | | | | | |
|---|------------------|-------------|---|-------|---|
| 7 | Birch | n_cluster=3 | 3 | 1.703 |  |
| 8 | MiniBatch Kmeans | n_cluster=3 | 3 | 1.174 |  |

3.6. Discussion.

The total eight algorithms with different parameters were given as input to the SPACE algorithm as input alongwith dataset. From Table 2 and figure 4 below it is clear that affinity propagation is not suitable for this dataset.

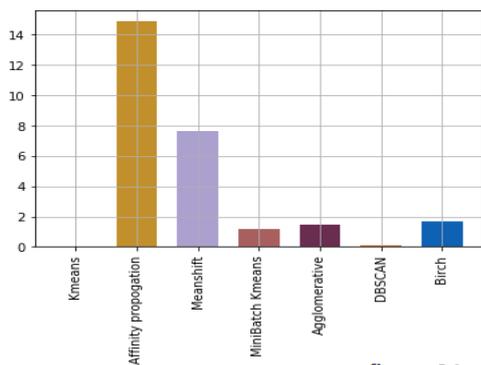


figure:04

running time on xclara dataset

Out of eight algorithms, six algorithms successfully presented the actual 3 big clusters in dataset. This does not mean that we cannot find more clusters with in

these three rather we can do, and we actually found 6 or more but these does not have much dissimilarity. The same algorithms were tested on remaining datasets and the presentation of all the results can be found on my official GitHub page or can be requested by email. The performance of algorithms becomes very important when the dataset is very large. As the resource requirement and efficiency varies from application to application therefore, you should carefully select clustering algorithm which best suit your needs.

3.7. Further Explore

As discussed in “Sample code in Python “section of this paper the SPACE algorithm form a new column with algorithm name and append with actual dataset and this dataset can be saved in file on disk. This helps to explore and elaborate the results in more details as given in top 10 rows of appended results table.

| | Channel | Region | Fresh | Milk | Grocery | Frozen | Detergents_Paper | Delicassen | KMeans |
|----|---------|--------|-------|-------|---------|--------|------------------|------------|--------|
| 0 | 2 | 3 | 12669 | 9656 | 7561 | 214 | 2674 | 1338 | 0 |
| 1 | 2 | 3 | 7057 | 9810 | 9568 | 1762 | 3293 | 1776 | 0 |
| 2 | 2 | 3 | 6353 | 8808 | 7684 | 2405 | 3516 | 7844 | 0 |
| 3 | 1 | 3 | 13265 | 1196 | 4221 | 6404 | 507 | 1788 | 0 |
| 4 | 2 | 3 | 22615 | 5410 | 7198 | 3915 | 1777 | 5185 | 1 |
| 5 | 2 | 3 | 9413 | 8259 | 5126 | 666 | 1795 | 1451 | 0 |
| 6 | 2 | 3 | 12126 | 3199 | 6975 | 480 | 3140 | 545 | 0 |
| 7 | 2 | 3 | 7579 | 4956 | 9426 | 1669 | 3321 | 2566 | 0 |
| 8 | 1 | 3 | 5963 | 3648 | 6192 | 425 | 1716 | 750 | 0 |
| 9 | 2 | 3 | 6006 | 11093 | 18881 | 1159 | 7425 | 2098 | 0 |
| 10 | 2 | 3 | 3366 | 5403 | 12974 | 4400 | 5977 | 1744 | 0 |

For any dataset, when I changed the distance function the running time was also changed. The running time increases with the increase in instances. When I applied the same algorithm on different datasets with the same number of instances the number of clusters were different in case of density based algorithms. Partitioning algorithms like k-mean are efficient for fast clustering applications.

V. CONCLUSION

With our experimental results and discussions it is obvious that the choice of appropriate algorithm is very important before applying clustering to any problem domain. The choice of clustering algorithm also depends on data.

We also should keep in mind that:

1. There is no Universal clustering algorithm which can solve all problems.
2. The time taken to form clusters, the number of clusters, the shape and size of cluster, ability to handle large dataset, robustness, the input parameters, use of distance or partitioning function, handling the type of data and number of dimensions are the major characteristics which decide the success of an algorithm.
3. Due to the advancement in technologies and use of computing in all aspects of life, there is always room to improve the clustering algorithms and find new ones.
4. There is overlap of categories of algorithms and novel algorithms are hybrid of the present algorithms.

Compliance with Ethical Standard:

Conflict of Interest:

1. Author 1(fiaz ahmed) declares that he has no conflict of interest.
2. Author 1(fiaz ahmed) declares that he has no conflict of interest.

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

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Development of Problem-Based Learning Devices to Improve Elementary School Students Ability on problem solving in Fraction Topics

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Abstract- The low level of problem solving abilities of students and the lack of learning activities that hone problem solving skills are one of education problems that must be overcome. This study aims to develop and examine the feasibility, practicality, and effectiveness of problem-based learning devices to improve problem solving skills of fifth grade students of elementary school. This study used the Thiagarajan research and development (R & D) model known as 4D (define, design, develop, & disseminate). The feasibility of learning devices based on the results of expert validation. The practicality of learning devices based on the results of observations of the implementation of learning and student activities. While the effectiveness of learning device based on the results of the student questionnaire response and the problem solving ability test used One Group Pretest-Posttest Design. The results of the study showed that problem-based learning devices are feasible, practical, and effective to improve students' problem solving abilities. So that the problem-based learning device is recommended to be used as a learning tool for improving problem solving skills of fifth grade students of elementary school.

Index Terms- Problem based-learning, problem solving ability, Fraction, Elementary school

I. INTRODUCTION

On 2013 Curriculum, the general meaning of mathematics learning has an aim to the students competencies on mathematics skills, especially in fraction material, one of them is the ability to solve problems in daily life problems. In addition, one of the objectives of mathematics learning is students are able to solve the problem, that is the ability for understanding some problems, designing mathematics learning models, completing the models and drawing solutions [1]. This aim of this study is to replace problem solving material as a part of the crucial mathematic curriculum. In the process of learning and problem solving, students get an experience from his/her knowledge and skills which are they already have. Mathematics was developed as one of its objectives to the needs of humankind in problems solving for their lives [2].

Based on the description above, it can be said that one of the abilities that students must develop and possess is problem solving ability. By solving a problem, students will get new experiences in implementing the basic knowledge and skills they already have [3]. In the 2013 curriculum, problem solving learning skills at school became an important thing for students because problem solving were often used by students in daily life. Therefore, students must be equipped with problem solving by solving their own problems in their daily lives.

Based on the observations on several teachers when teaching mathematics showed that explanation is the most method that is used by the teachers when they are teaching in the class, teachers speak more than students, almost all teachers give unchallenging task and almost teachers only used textbooks. In addition, for knowing the facts about this case, researchers also conducted interviews with teacher at Sukomanunggal Elementary School I / 105 Surabaya, whose results showed that teachers preferred to use conventional learning models in teaching mathematics. They gave some assignment based on the textbook and is similar to the assignment quite similar with the tasks given by the teacher when explaining the material.

Based on the facts above, it can also be said that in the school, teachers have not taught optimally about the way of solving problem so the students are still having difficulty in giving some tasks on solving problems. Students are still not able to solve non-routine questions which is given by the teacher. This is also indicated by the score of the most students on the topic of fraction is still very low. Students' ability to solve mathematics problems is in low level. The cause of the low ability of the students because the students are not familiar with problem solving material, teachers have not often drilled their students by using problem solving questions (*LKPD*) and dominant evaluation exercise in the form of daily question. In addition, the teacher still used a conventional learning model. The teacher preferred

using explanation model and has not used a learning model that can improve problem solving skills. Teachers also focused on achieving students' numeric skills by using mathematics formulas.

Based on these problems, the teacher must be able to choose the appropriate learning model. The choice of learning model must be accordance with the material and students' conditions, so that it is expected that learning can improve student activity in solving mathematical problems skills and also create a competitive atmosphere. In this learning process, it is expected that there will be interaction between students and other students in the form of group discussions, so that students can be active.

One learning model that can be offered to improve problem solving skills is a problem-based learning model. Problem-based learning model is an innovative learning model that requires students to learn and work actively, either in pairs or in groups to develop high thinking order by finding the problems, building an understanding, and finding alternative solutions to gain a knowledge and skills. Based on the analysis of several journals, one of them states that the learning model of problem-based learning can improve students' problem solving abilities [4]. The type of research is conducted as classroom action research in two cycles. The implementation of the PBL model can improve students' problem solving skills where in cycle 1, which is 69%, in the second cycle, is 73%.

The problem-based learning model has three main characteristics [5]. First, problem-based learning is a series of learning activities, it means that there are a number of activities must be done by students. Problem-based learning does not only listen something, but memorizing subject matter, and students actively think, communicate, search and process the data, and finally conclude. Second, learning activities are directed at solving the problems, knowing the problems as the keywords of the learning process. Third, problem solving is done by using a natural thinking approach.

This model also has the characteristic of using real life problems, students must learn to train and improve problem solving skills and gain knowledge of important concepts. The application of problem-based learning model is one of the efforts and students can solve every problem related to mathematics. Every student has different abilities in solving each problem. The steps of problem-based learning are orientation to students about a problem, organizing students to study, providing personal guidance and guidance to small groups when conducting investigations, developing and presenting works that have been made, and making analysis and evaluation of how to solve problem [6].

Learning strategies based models have several advantages, such as problem solving is a good technique to better understanding of the lesson. It can improve student learning activities, problem solving is more fun and students will like this method [5]. Problem solving can give some opportunities for students to apply the knowledge which they have in the real life. Other advantages are: (1) students can find their own concepts through a series of learning activities, so that students are able to understand the concept; (2) students are active in learning that is conducting an investigation, while the teacher is as a guide; (3) learning is more meaningful because problems solved are related to students' real life so students are motivated to learn; and (4) students are controlled in group learning process which interact with each other so they can complete the learning achievement.

This study aims to (1) describe the process of developing problem-based learning devices on fraction topics; (2) describe the quality (validity, practicality, and effectiveness) of problem-based learning devices on fraction topics; and (3) describe the students' problem solving abilities with problem-based learning on fractional topics.

II. IDENTIFY, RESEARCH AND COLLECT IDEA

This research is developmental research. The study produced learning devices with problem-based learning models to improve the problem solving abilities of elementary students in the form of lesson plan (RPP), Student Worksheets (LKPD) and Problem Solving Ability Tests. The development model used 4D model which is developed by Thiagarajan [7]. It consists of define, design, develop, and disseminate stages. The subject of this study was the fifth grade students of SDN Sukomanunggal I / 105 Surabaya in academic year 2018/2019 with 20 students. The experimental research was conducted on several students using *One Group Pretest-Posttest* Design [8]

Data collection techniques used in this study were questionnaires, observations, and tests of problem solving abilities. While the feasibility analysis technique for problem-based learning is done by converting the average observation results into validation criteria. Analysis of the practicality of learning devices is obtained from the results of the average implementation of learning, activities, and student responses, henceforth converted into predetermined criteria. While the effectiveness of problem-based learning devices can be measured based on the results of student problem solving ability tests

III. RESULTS AND DISCUSSION

The results of validity test of problem-based learning devices were obtained from the validation sheet from two validators. Based on the results of the validation sheet, it showed that the problem-based learning device which is developed is valid (feasible to be applied with

little improvement). Some suggestions given by the validator are on the learning objectives in lesson plans, it should be more detailed, writing on teaching materials should use contrasting colors, and tests of problem solving skills should be tested first to find out whether the problem is a problem solving problem. The results of the validation sheet can be seen in the following table.

Table 1. The Result of Validator

| Devices | Score | | Average | Category |
|--------------------|-------|------|---------|--------------------------------|
| | V1 | V2 | | |
| Syllabus | 3,82 | 3,00 | 3,41 | Valid (usable, minor revision) |
| Lesson plan | 3,79 | 3,14 | 3,46 | Valid (usable, minor revision) |
| Material | 3,47 | 3,00 | 3,23 | Valid (usable, minor revision) |
| Students worksheet | 3,67 | 3 | 3,33 | Valid (usable, minor revision) |
| Test | 3,75 | 3 | 3,37 | Valid (usable, minor revision) |

The practicality of problem-based learning devices can be seen from the results of the observation sheet of the students' implementation learning and activities. The results of the learning implementation obtained from the observation sheet which is conducted by two teachers and showed good implementation. While the students' activities during the implementation of learning by using a problem-based learning model based on observations obtained in good interpretation results. In more detail the results of the observation sheet of the implementation learning and student activities can be explained in the following table.

Table 2. Practicality of Learning Devices

| Validity | Observation result | | Average | Category |
|----------------------|--------------------|------------|---------|-----------|
| | Observer 1 | Observer 2 | | |
| Teaching learning | 3,60 | 3,66 | 3,63 | Very good |
| Students' activities | 3,35 | 3,40 | 3,37 | Good |

The effectiveness of problem-based learning devices to improve students' problem-solving abilities was obtained from the results of questionnaires and the results of problem-solving ability tests. Student responses are presented in the form of questionnaires and given after learning is completed. The results of the student questionnaire showed that 76% -100% of children were happy and interested in participating in learning with the development of problem-based learning devices. The problem solving ability test is in the form of a description problem as many as six questions. This test is given to 20 students before being given treatment (pre-test) and after being given treatment (post-test). The test results of students' problem solving skills will be described in the following table 3.

Table 3. The result of Problem Solving Ability/ skills

| No. | Name | Score | | Achievement | | N-Gain | Criteria |
|-----|---------|----------|-----------|-------------|-----------|--------|----------|
| | | Pre-test | Post-test | Pre-test | Post-test | | |
| 1 | ABD | 67 | 97 | TT | T | 0.91 | High |
| 2 | ADN | 73 | 100 | T | T | 1 | High |
| 3 | ANN | 43 | 77 | TT | T | 0.60 | Medium |
| 4 | APR | 40 | 77 | TT | T | 0.62 | Medium |
| 5 | CHT | 67 | 93 | TT | T | 0.79 | High |
| 6 | DEN | 23 | 57 | TT | TT | 0.44 | Medium |
| 7 | FRH | 67 | 93 | TT | T | 0.79 | High |
| 8 | FRS | 53 | 83 | TT | T | 0.64 | Medium |
| 9 | FAR | 43 | 70 | TT | T | 0.47 | Medium |
| 10 | FIK | 50 | 73 | TT | T | 0.46 | Medium |
| 11 | FIY | 53 | 80 | TT | T | 0.57 | Medium |
| 12 | HAW | 73 | 90 | T | T | 0.63 | Medium |
| 13 | MAG | 40 | 70 | TT | T | 0.50 | Medium |
| 14 | MWA | 47 | 67 | TT | TT | 0.38 | Medium |
| 15 | NOO | 63 | 83 | TT | T | 0.54 | Medium |
| 16 | NOV | 60 | 93 | TT | T | 0.82 | High |
| 17 | QUR | 43 | 77 | TT | T | 0.60 | Medium |
| 18 | SAI | 47 | 70 | TT | T | 0.43 | Medium |
| 19 | SIN | 57 | 70 | TT | T | 0.30 | Medium |
| 20 | YAS | 40 | 80 | TT | T | 0.67 | Medium |
| | Average | 52 | 80 | TT | T | 0.58 | Medium |

Based on table 3, it is known that at the pretest, the problem solving abilities were 5% of students completed. Whereas in the posttest the problem solving skills is from 100% of students completed. The table also showed the N-Gain score which showed an increasing of students' problem solving abilities that ranged from 0.30 to 1 with a moderate to minimum category.

The implementation of problem-based learning devices in learning proved an effectiveness of improving problem solving skills of elementary school students on fractions topic. This is in accordance with research by Rokhmawati, et al. [4] which states that the learning model of problem-based learning can improve students' problem solving abilities. Based on the validation results, the development of problem-based learning devices is included in the valid category. The validity of the learning device developed based on the results of validation expert in the syllabus, lesson plan, student worksheet, teaching materials and problem-solving ability tests. The Valid devices can be seen from the suitability of the device with the learning model and material, and all components of the learning device are related consistently between one another [9]. After the validation stage, the problem-based learning device can be continued at the small group on experiment stage. Based on the results of the feasibility analysis, a feasible problem-based learning device is used to improve the problem solving skills of students in grade V of elementary school with fraction material.

The practicality of problem-based learning devices is known from the results of observations implementation learning and student activities. Based on the results of observations, it was found that a problem-based learning device was developed practically and it was used to improve problem-solving skills of students in grade V of elementary school with fractions. While the effectiveness of the problem-based learning device based on the results of the student response questionnaire and the results of the student's problem solving ability test. Questionnaire for student responses is given at the end of the lesson, that was in the second meeting The results of student responses are positive because the average student answers was "yes" statement around 76% -100%. They were interested in problem-based learning because the students solve problems in groups and then discussed to be agreed. This can motivate students to increase attention and make them visible in fun and meaningful learning [10]. While the results of the problem solving ability test showed an increasing in the pretest and posttest score. Increasing students' problem solving skills can be known by using N-Gain. The results of the student's problem-solving ability test presented in table 3 showed students have problem-solving abilities with an average n-gain of 0.58 which is included in the medium category. At the pretest of 20 students there were only 2 students or about 5% of students completed. While at the posttest there was an increase in test results, that is 90% of students completed the test. The test uses problem solving questions consisting of six questions. Increasing the results of this problem solving ability test shows that the learning tools developed by researchers can improve students' problem solving skills on the topic of fractions.

IV. CONCLUSION AND SUGGESTION

Based on the results of research and discussion, the results of the study can be concluded such as: (1) Problem-based learning devices to improve the ability of problem solving is valid based on the score of the validator and can be used in the learning process. (2) The practicality of the problem-based learning device is seen from the implementation of the lesson plan that takes place well and the activities of the students are in a good category which means that students carry out all activities needed in learning process. (3) The effectiveness of learning devices can be seen from the increasing problem-solving abilities which is indicated by n-gain scores in the medium category and the most students response expressed interest in problem-based learning.

Based on these conclusions, it can be suggested that problem-based learning devices can be used and disseminated in the learning of fraction subject in the fifth grade of elementary school, especially in examining and improving students' problem solving abilities.

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Effectiveness of Self Instructional Module on Knowledge Regarding Anticipated Risk of Ischemic Heart Diseases Among Clients with Hyperlipidemia at Selected Hospital

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Abstract- Ischemic heart disease (IHD) is commonly known as coronary artery disease. Blood supply to the heart is reduced due to narrowing of blood vessels. It is mainly caused by blockage of the arteries as well as deposition of cholesterol. It can lead to reduced blood, oxygen supply and functional impairment of the heart tissue. The preventive measure of coronary artery disease such as healthy lifestyle to do regular screening test for cholesterol levels and other parameters related to the disease. The self instructional module is one of the teaching strategies which can be used for teaching the clients regarding anticipated risk of ischemic heart diseases with hyperlipidemia.

Materials and Methods: pre experimental one group pre test post test design used for the study. Non probability purposive sampling technique was adopted to select 60 hyperlipidemic clients

Settings and population: out patient department of St. Philomenas hospital Bengaluru, 60 hyperlipidemic clients who fulfill the inclusion criteria.

Findings: The findings revealed that the calculated paired t test value is 21.256 greater than table value 1.98 at $p < 0.05$ found to be a statistically significant. Thus accepting hypothesis H_1 stating that there is a significant difference between pre & post test knowledge scores.

Conclusion: The study findings proved that self instructional module were effective in increasing the knowledge of hyperlipidemic clients regarding anticipated risk of ischemic heart diseases.

Index Terms- Self instructional module, anticipated risk of ischemic heart diseases with hyperlipidemia

I. INTRODUCTION

Coronary heart diseases is a major cause of mortality and morbidity all over the world. Coronary artery diseases are one or more arteries become narrowed or totally blocked by a gradual build-up of fat (cholesterol) within the artery wall, which reduces blood flow to the heart muscle. As a result, the heart muscle does not get oxygen rich blood that it needs and begins to die.¹ With dramatic changes in life style of people, hyperlipidemia incidences are increasing in our country especially among adults because of

addiction to fast food, lack of physical activity at an earlier stage.² High blood cholesterol levels are consistently associated with higher risk of coronary artery diseases, and other life-threatening cardiovascular and cerebrovascular damage, including fatal strokes.³ The burgeoning burden of coronary heart disease in India is due to alarming rise in the prevalence of coronary risk factors such as diabetes, smoking, obesity and physical inactivity. Rapid urbanization and changing lifestyle have led to the growing burden of coronary risk factors in India WHO(2009).⁴ Currently, hyperlipidemia is the major risk factor for coronary heart disease among men and women, affecting more than 12 million people. Death rate from hyperlipidemia appears to be higher in US, than in under developed countries and there is also evidence that atherosclerotic lesions leading to this problem, are developing at an early stage.⁵ Heart diseases are considered to be silent disease whose symptoms are not evident in patients suffering from them till the disease is in an advanced state.⁶

Despite of alarming statistics and literature reviews the researcher felt the need to develop Self Instructional Module to facilitate education regarding anticipated risk of ischemic Heart diseases among hyperlipidemic clients on life style modification. This will be helping them to have better quality of life.

The conceptual frame work adopted for this study was based on Imogene King's goal attainment theory. This theory was chosen as it highlighted the interaction between nurse and the clients where by each perceives the other as well as the situation and through communication they set goal, explore means and agree to achieve goals.

The objectives of study were :

- ✓ To assess the level of knowledge regarding anticipated risk of ischemic heart diseases among clients with hyperlipidemia.
- ✓ To evaluate the effectiveness of self instructional module on knowledge regarding anticipated risk of ischemic heart diseases among clients with hyperlipidemia.
- ✓ To determine the association between pre and post test knowledge scores on anticipated risk of ischemic heart diseases among clients with hyperlipidemia with selected baseline variables. At 0.05 level of significance

II. RESEARCH HYPOTHESES

At 0.05 level of significance

H₁: There will be a statistically significant increase in the level of knowledge regarding anticipated risk of Ischemic heart diseases among clients with hyperlipidemia following administration of self instructional module as measured by structured knowledge questionnaire.

H₂: There will be a statistically significant association between pre and post test knowledge scores on anticipated risk of Ischemic heart diseases among clients with hyperlipidemia with selected base line variables.

sampling technique was adopted to select 60 hyperlipidemic clients . The subjects were selected based on inclusion criteria. Tools were used Structured Knowledge questionnaire to assess the level of knowledge of hyperlipidemic clients regarding anticipated risk of ischemic heart diseases. Data collection was done after Obtaining from Administrator of St.Philomenas hospital. Informed consent was taken from clients. Pre test was conducted by Structured knowledge questionnaire .Administered SIM .Post test was conducted by structured knowledge questionnaire . Descriptive and inferential statistics were used for the analysis and interpretation of data . The conceptual framework used in the study was based on Imogene King’s goal attainment theory.

III. MATERIALS AND METHODS

To accomplish the task Quantitative Evaluative research approach was used for this study. pre experimental one group pre test post test design used for the study . Non probability purposive

IV. RESULTS

Frequency and Percentage distribution of pre & post test knowledge scores among clients with hyperlipidemia n=60

| Knowledge Scores | Pre Test | | Post Test | |
|--------------------|-----------|-------------|-----------|-------------|
| | Frequency | Percentage | Frequency | Percentage |
| Inadequate (<50%) | 44 | 73% | 0 | 0% |
| Moderate (50-75%) | 16 | 27% | 54 | 90% |
| Adequate (>75%) | 0 | 0% | 6 | 10% |
| Total | 60 | 100% | 60 | 100% |

Majority of clients during pre test 44(73%) most of them had inadequate knowledge ,16(27%)had moderate knowledge ,none of them had adequate knowledge. Where as in post test majority 54(90%)had moderate knowledge,6(10%)adequate

knowledge ,none of them had inadequate knowledge regarding anticipated risk of ischemic heart diseases .

ASPECT WISE COMPARISON OF PRETEST AND POST-TEST LEVEL OF KNOWLEDGE n=60

| Aspect-wise (Pre vs Post Knowledge) | Type | Mean | Std. dev | Paired t-test value | Df | Sig. (p-value) testing |
|-------------------------------------|-----------|------|----------|---------------------|----|------------------------|
| General information of Heart | Pre-test | 1.58 | 0.74 | 6.948 | 59 | 0.003 s* |
| | Post-test | 2.18 | 0.73 | | | |
| Ischemic heart diseases | Pre-test | 4.60 | 1.08 | 14.219 | 59 | 0.001 s* |
| | Post-test | 6.30 | 1.14 | | | |
| Hyperlipidemia | Pre-test | 4.15 | 0.97 | 13.527 | 59 | 0.001 s* |
| | Post-test | 5.90 | 1.29 | | | |
| Prevention | Pre-test | 3.15 | 1.06 | 14.212 | 59 | 0.001 s* |
| | Post-test | 4.60 | 1.11 | | | |

*Significant at 5%level t (0.05,59df)=1.98

The mean pre test knowledge scores on general information of heart was 1.58 with S.D 0.74 and mean Post test knowledge score 2.18 with S.D 0.73. The computed paired 't' value 6.948 is greater than the table value 1.98. The mean pre test knowledge scores on Ischemic heart diseases was 4.60 with S.D 1.08 mean Post test knowledge score 6.30 with S.D 1.14. The computed paired 't' value 14.219 is greater than the table value 1.98. The mean pre test knowledge scores on Hyperlipidemia was 4.15 with S.D 0.97 mean Post test knowledge score 5.90 with

S.D 1.29. The computed paired 't' value 13.527 is greater than the table value 1.98. The mean pre test knowledge scores on Prevention was 3.15 with S.D 1.06 mean Post test knowledge score 4.60 with S.D 1.11. The computed paired 't' value 14.212 is greater than the table value 1.98 shows a statistical significant difference between pre test and post test knowledge scores on hyperlipidemia at $p < 0.05$ level.

overall pretest and post-test knowledge scores of hyperlipidemic clients regarding anticipated risk of ischemic heart diseases
n=60

| Overall Knowledge | Max Score | Mean | Mean Difference | SD | Paired t-test value | Df | Sig. Testing (p-value) |
|-------------------|-----------|------|-----------------|------|---------------------|----|------------------------|
| Pre test | 60 | 13.5 | 5.5 | 2.14 | 21.256 | 59 | 0.0001 |
| Post test | 60 | 19.0 | | 2.45 | | | |

TABLE VALUE= 1.98

The computed t value (21.256) is greater than the table value (1.98) at $p < 0.05$ level found to be statistically significant. There was a statistically difference between pre-test and post knowledge scores of clients regarding ischemic heart diseases.

The study revealed that there was an increase in the level of knowledge regarding ischemic heart diseases, indicating the effectiveness of self instructional module. Hence research hypothesis H_1 is accepted.

Association between pretest knowledge scores of hyperlipidemic clients regarding anticipated risk of ischemic heart diseases with selected base line variables n=60

| Knowledge regarding hyperlipidemia – Pre test with baseline variables | Category | Respondents knowledge | | | | χ^2 value | P & t' Value |
|---|-------------------------|-----------------------|----|----------|----|----------------|--|
| | | Inadequate | | Moderate | | | |
| | | N | % | n | % | | |
| Age in years | 35-45 | 7 | 15 | 6 | 37 | 5.137 | df=3 t =7.82 P=0.162 p>0.05 NS |
| | 46-55 | 10 | 22 | 5 | 31 | | |
| | 56-65 | 15 | 35 | 2 | 13 | | |
| | >65 | 12 | 28 | 3 | 19 | | |
| Gender | Male | 24 | 54 | 9 | 56 | 0.014 | df=1 t =3.84 P=0.907 P>0.05 NS |
| | Female | 20 | 46 | 7 | 44 | | |
| Education status | No Formal Education | 5 | 11 | 2 | 12 | 0.487 | df=4 t=9.49 P=0.975 p>0.05 NS |
| | Primary | 11 | 16 | 4 | 25 | | |
| | Higher Secondary | 16 | 36 | 5 | 32 | | |
| | Graduate | 8 | 18 | 4 | 25 | | |
| | Post Graduate and above | 4 | 10 | 1 | 6 | | |
| Occupation | Government | 11 | 25 | 1 | 6 | 4.497 | df=3 t =7.82 P=0.213 p>0.05 NS |
| | Private | 19 | 43 | 8 | 50 | | |
| | Business/Self-employees | 4 | 10 | 4 | 25 | | |
| | Home Maker | 10 | 22 | 3 | 19 | | |
| Socio Economic Status | High | 21 | 47 | 11 | 68 | 5.257 | df=1 t =3.84 P=0.072 P<0.05 |
| | Moderate | 7 | 16 | 4 | 25 | | |
| | Low | 16 | 37 | 1 | 7 | | |

| | | | | | | | |
|---------------------------------------|------------------------|----|----|----|----|-------|--|
| Types of Lifestyle | Physically Active | 10 | 23 | 2 | 13 | 1.195 | S* df=2 t =5.99 P=0.550 p>0.05 NS |
| | Moderately Active | 21 | 48 | 10 | 62 | | |
| | Occasionally Active | 13 | 29 | 4 | 25 | | |
| Bread winner of the family | Yes | 27 | 62 | 11 | 69 | 0.276 | df=1 t =3.84 P=0.600 p>0.05 NS |
| | No | 17 | 38 | 5 | 31 | | |
| Dietary Pattern | Vegetarian | 15 | 35 | 5 | 32 | 0.043 | df=1 t =3.84 P=0.836 p>0.05 NS |
| | Non-vegetarian | 29 | 65 | 11 | 68 | | |
| Duration of Hyperlipidemia | Less than 1 year | 20 | 46 | 8 | 50 | 0.097 | df=1 t =3.84 P=0.755 p>0.05 NS |
| | 1-5 Year | 24 | 54 | 8 | 50 | | |
| Family History of Heart Disease | Yes | 26 | 60 | 11 | 68 | 0.463 | df=1 t =3.84 P=0.496 p>0.05 NS |
| | No | 18 | 40 | 5 | 32 | | |
| Previous History of co morbid illness | DM | 23 | 53 | 7 | 44 | 2.049 | df=2 t =5.99 P=0.359 p>0.05 NS |
| | HTN | 14 | 32 | 8 | 50 | | |
| | CVA | 7 | 15 | 1 | 7 | | |
| Habits of Smoking | Yes | 20 | 45 | 8 | 50 | 0.097 | df=1 t =3.84 P=0.755 p>0.05 NS |
| | No | 24 | 55 | 8 | 50 | | |
| Habits of Alcoholism | Yes | 20 | 45 | 5 | 32 | 0.974 | df=1 t =3.84 P=0.324 p>0.05 NS |
| | No | 24 | 55 | 11 | 68 | | |
| Tobacco Chewing | Yes | 20 | 45 | 6 | 38 | 0.302 | df=1 t =3.84 P=0.582 p>0.05 NS |
| | No | 24 | 55 | 10 | 62 | | |
| Source of Information Regarding IHD | Print/Electronic media | 7 | 15 | 2 | 12 | 0.406 | df=2 t =5.99 P=0.810 p>0.05 NS |
| | Health personal | 19 | 44 | 6 | 38 | | |
| | Friends/Neighbours | 18 | 41 | 8 | 50 | | |

The computed χ^2 value(5.257) for knowledge scores with socioeconomic status of clients is greater than table value (3.84) and $df = 1$, $p < 0.05$ level, which shows that there is a significant association between socio economic status and the pre-test knowledge scores on ischemic heart diseases. Hence hypothesis H_2 is accepted. Rest of the base line variables(age,

gender, educational status, occupation ,type of life style , bread winner of the family, dietary pattern ,duration of hyperlipidemia ,family history of heart disease , previous history of co morbid illness ,type of habit , previous source of information regarding ischemic heart diseases) were non significant considered H_2 was rejected.

V. DISCUSSION

The study revealed from the study after administration of Self Instructional Module on Ischemic heart diseases with hyperlipidemia.

- There was significant increase in the level of knowledge scores of hyperlipidemic clients after the administration of self instructional module regarding anticipated risk of ischemic heart diseases .
- There was statistically significant association between pre test knowledge scores of the clients with socio economic status and no significant association between the other base line variables .(age, gender, educational status, occupation ,type of life style , bread winner of the family, dietary pattern ,duration of hyperlipidemia ,family history of heart disease , previous history of co morbid illness ,type of habit , previous source of information regarding ischemic heart disease) .
- In post test the computed χ^2 value for knowledge scores with all base line variables of clients is lesser than table value $p>0.05$ (age, gender, educational status, occupation, socioeconomic status ,type of life style , bread winner of the family, dietary pattern ,duration of hyperlipidemia ,family history of heart disease , previous history of co morbid illness ,type of habit , previous source of information regarding ischemic heart diseases) were no significant . Hence hypothesis H_2 is rejected.
- The study findings proved that self instructional module was effective in increasing the knowledge of hyperlipidemic clients regarding anticipated risk of ischemic heart diseases .

IMPLICATIONS:

NURSING PRACTICE

- ❖ Nurses can plan to conduct health teaching to the patients on one-one basis in the wards about risks of ischemic heart diseases.
- ❖ Information booklets can be prepared and distributed to the patients in OPD about risk factors and management of Ischemic heart diseases.
- ❖ Nurses can learn to motivate the patients to follow healthy lifestyle practices to prevent the risk of ischemic heart diseases and importance of periodic checking of serum cholesterol levels once in 3 months.

NURSING EDUCATION

- ❖ Nursing students can be encouraged to improve their knowledge regarding risk factors, management and prevention of ischemic heart diseases by attending workshops and conferences.
- ❖ Nursing students can plan to conduct health awareness camps regarding prevention of ischemic heart diseases to the public.

NURSING ADMINISTRATION

- Nurse administrator have a pivotal role in updating the knowledge of the newly recruited staffs regarding

management and prevention of ischemic heart diseases through in service education programmes .

- Nurse educator can plan to conduct educational programmes in the wards, medical and cardiology outpatient departments regarding early identification of risk factors and treatment of ischemic heart diseases.

NURSING RESEARCH

- The results of the study serves as a basis for student nurses to conduct an extensive research studies in future .
- Further studies can be conducted on risk factors and prevention of ischemic heart disease among hyperlipidemic clients .
- Dissemination of findings through conferences and professional journals will make the application of research findings to be more effective.

COMMUNITY HEALTH NURSING

- Community health nurse can prepare and distribute Pamphlets about risks and management of ischemic heart diseases in the community.
- Group health education can be planned regarding risks and prevention of ischemic heart diseases with the use of appropriate AV aids.

SUGGESTIONS

The hospital authority should take interest in conducting awareness programmes on ischemic heart diseases ,hyperlipidemia and its effect on health.

LIMITATIONS

- The study was limited to the hyperlipidemic clients in a selected hospital ,Bengaluru.
- Limits generalization as purposive sampling used.

RECOMMENDATIONS

- A similar study can be performed with larger sample size to draw more definite conclusions and make generalizations.
- A descriptive study could be conducted to assess the knowledge regarding IHD.
- A similar study could be conducted using various methods of teaching such as video assisted teaching, planned teaching programme.

VI. CONCLUSION

- The study findings proved that self instructional module was effective in increasing the knowledge of hyperlipidemic clients regarding anticipated risk of ischemic heart diseases .

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***“Education is the most powerful weapon
which you can use to change the world.”***

Nelson Mandela

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Genetic Algorithm for Shortest Path Optimization In Network

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Abstract : An Internet Service Provider (ISP) is an organization that provides services for accessing, using or participating in the internet. Internet service providers may be organized in various forms, such as commercial, community-owned, non-profit, or otherwise privately owned. Routing of data packets can affect network Resources utilization. I have implemented a genetic algorithm to finds the set of optimal routes to send the traffic from source to destination.

Keywords – Genetic Algorithm, Chromosomes, Cross over, Mutation.

I. INTRODUCTION

Data Network routing is a process of transferring packets from source node to destination node with minimum cost (delay-transmission, processing and queuing delay, bandwidth, load, jitter, reliability etc.) Routing is complex in large networks because of the many potential intermediate destinations a packet might traverse before reaching its destination. Hence routing algorithm has to acquire, organize and distribute information about network states. It should generate feasible routes between nodes and send traffic along the selected path and also achieve high performing.

The weights of links in network are assigned by the network operator. The lower the weight, the greater the chance that traffic will get routed on the like [BLU00]. When on sends or receives data over the Internet. the information id divided into small chunks called packets or datagram's. A header, containing the necessary transmission information, such as the destination Internet Protocol (IP) address, is attached to each packet. The data packets are sent reaches a router, the incoming datagram's are stored in a queue to await processing. The router reads the datagram header, takes the IP destination address and determines the best way to forward this packet for it to reach its final destination.

Genetic algorithm is one in which the population associated with each node co-evolve to solve the problem.

II. NETWORK ROUTING

A router is a process of selecting path along which the data can be transferred from source to be destination. A router works at the network layer in the OSI and internet layer in TCP/IP model. A router is a networking device that forwards the packet based on the information available in the packet header and forwarding table. The new router are generated based on the factors like traffic, link utilization. bandwidth, jitter, delay etc which is aimed at having maximum performance. Other classification of routing policy is optimal routing (global routing) and shortest path routing (local routing). Some of the shortest path algorithms are distance vector algorithm and link state algorithm. Each node in the network is of the type store and forward. The like performance may be measured in terms of bandwidth or link delay. The topology of the network may change due to growth in number of nodes, or failure of node. This change in topology should be reflected in the routing table, which in turn helps the routing protocol to generate optimal route for the current state of network. Some of the protocols are Routing Information Protocol (RIP). Interior gateway routing protocol (IGRP), Open source shortest path first (OSPF) and Border gateway protocol (BGP). OSPF is a link state routing protocol used in IP networks which uses shortest path first algorithm to compute low cost route to destination.

III. GENETIC ALGORITHM

Concerning its internal Functioning, a genetic algorithms is an iterative procedure which usually operates on a population of constants size and is basically executed in the following way :

An initial population of individuals (also called "Solution candidates" or "chromosomes") is generated randomly or heuristically. During each iteration step, also called a "generation," the individuals of the current population are evaluated and assigned a certain fitness value. In order to form a new population, individuals are first selected (usually with a probability proportional to their relative fitness values), and then produce offspring candidates which in turn form the next generation of parents. This ensures that the expected number of times an individual is chosen is approximately proportional to its relative performance in the population. For producing new solution candidates genetic algorithms use two operation, namely crossover and mutation:

- Crossover is the primary genetic operator : It takes two individuals called parents, and produces one or two new individuals, called offspring, by combining parts of the parents. In its simplest form, the operator works by swapping (exchanging) substrings before and after a randomly selected crossover point.
- The second genetic operator, mutation, is essentially an arbitrary modification which helps to prevent premature convergence by randomly sampling new points in the search space. In the case of bit strings, mutation is applied by simply flipping bits randomly in a string with a certain probability called mutation rate.

Genetic algorithms are stochastic iterative algorithms, which cannot guarantee convergence; termination is hereby commonly triggered by reaching a maximum number of generations or by finding an acceptable solution or more sophisticated termination criteria indicating premature convergence.

IV. PROBLEM DEFINITION

The network under consideration is represented as $G=(V,E)$, a connected graph with N nodes. The metric of optimization is cost of path between the nodes. The total cost is the sum of cost of individual hops. The goal is to find the path with minimum total cost between source node V_{src} and destination V_{dest} , where V_{src} and V_{dest} belong V . This paper presents the efficient on-demand, source initiated routing algorithm using genetic algorithm. Finally data is sent along the generation path.

1.1 Initialization of routing table

A module is used to generate all possible paths from a given node to all other nodes in the network. Initially, n' random paths are considered (chromosome). This ' n ' defines the population size. These chromosomes act as population of first generation.

1.2 Optimal paths generation

This module deals with finding the optimal path using genetic algorithm. The input to this module is the set of paths generated. Each path is called as chromosome. As the source node receives m' (say 10-population size) chromosomes –

- (a) Calculate the fitness of each of the chromosome.

The fitness of the chromosome is evaluated as : $Fitness = no\ of\ hops\ in\ path * 10 - total\ cost\ of\ path$ Number of hops defines the number of intermediate nodes visited along the path from source to destination and total cost is the sum of cost of individual links in the path.

- (b) Select best two chromosome as parents (using some selection method-Roulette Wheel)
(c) Perform crossover with probability 0.7.
(d) Perform mutation with probability 0.01.
(e) Place children in the population and eliminates the worst chromosome having very poor fitness values.
(f) If termination condition is not attained then repeat the steps.
(g) Refresh the path after duration of t seconds to know the current status of dynamic networks.

1.3 Selection

It is a feature of GA for selecting parents for next generation. Current work is based on roulette wheel selection. Fittest chromosomes get larger slice. Some of the other selection methods are rank selection, elitist selection, scaling selecting, tournament selection, etc.

1.4 Crossover

Crossover operator combines sub parts of two parent chromosomes and produces offspring that contains some part of both the parent genetic material. This paper deals with PMX crossover. In Partially Matched Crossover [SIV08], two string are aligned, and two crossover point are selected uniformly at random along the length of the strings.

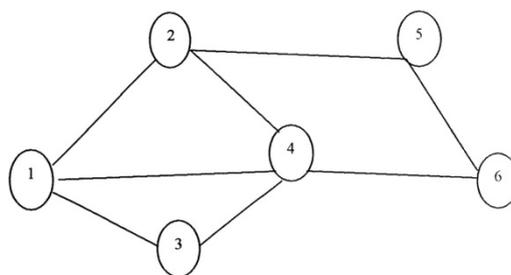
Each offspring contains ordering information partially determined by each of its parents. PMX can be applied to problems with permutation representation. Generated offspring should be validated. Validation is done by checking the offspring with all possible routes. If offspring belongs to all possible routes then its fitness is computed and sent to next operation. If the offspring does not belong to all possible route set, then it is dropped as route does not involve valid connection of nodes in network.

1.5 Mutation

Crossover operation may produce degenerate population. In order to undo this, mutation operation is performed. The paper uses insertion method. In case of insertion a node is inserted at random position in the string. This is because a node along the optimal path may be eliminated through crossover. Using insertion, it can be brought back. Once mutation is completed, the offspring generated by mutation have to be validated with the same process used in crossover.

1.6 Termination Criteria

It allows the convergence of algorithm Maximum generation, No change in population fitness and stall generation are considered as algorithm stopping condition. We have taken the maximum number (say 1000) of generation as it will allow algorithm to check, upto what number of generations there is improvement in chromosome fitness. A second stopping criterion is until some chromosome reaches a specified fitness level. As the optimal solution is generated using GA, data is transmitted along that path. There may be change in topology of network as some nodes may join the network or some nodes may leave the network or some nodes may fail. Under these circumstances the optimal path may no more be the shortest. Hence the network has to be refreshed at every t seconds and new routes may be generated.



Sample Network Topology

V. RESULT

Current work is based on network consisting 6 nodes. Initially 15 random chromosomes are generated, out of which best ten are considered for 1st generation. At each generation the chromosomes are validated and best fit chromosomes are sent to next generation. It is found that fitness value improves at each generation from chromosomes. Generates 15 random chromosomes.

We have taken population size of 10 in first generation. By selecting the chromosome based on roulette selection and application of GA operators generations are performed. After the path to all nodes from source node 1 is computed, the set of paths to a specific node will be displayed. Let the destination node is node 6. Following is the set of paths from node 1 to node 6. The optimal path returned is 1,3, 4 and 6 with delay factor of 8.

VI. CONCLUSION

GA is well suited for solving problems where the solution space is huge and time taken to research exhaustively is very high. As the size of network increase, the possible solution for transferring data between two nodes increase. Adding of few new nodes in the network increases the size of search space exponentially. So, GA is well suited for routing problem as it explores chance to attain local optimum. GA has ability to solve problems with no previous knowledge.

Current work can be improved by using some intelligent approach for populating routing table and using better crossover, mutation probabilities and enhancing it to support for load balancing.

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Characteristics of the Histopathology of Liposarcoma in the Anatomic Pathology Laboratory of North Sumatera University Medical Faculty/ Anatomic Pathology Unit of Haji Adam Malik Medan General Hospital in 2016-2018

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Abstract-Background: Liposarcoma is soft tissue malignancy with an incidence of 9.8% of all musculoskeletal sarcomas. However, the rare incidence causes little case publication or clinical clinicatology in these tumors, especially in Indonesia.

Objective: To determine the characteristics of liposarcoma in the Anatomical Pathology Laboratory of the USU Medical Faculty and the H. Adam Malik General Hospital Medan in 2016-2018.

Methods: All clinical and pathological characteristics were obtained through medical records and pathology. This is a descriptive study with cross sectional approach.

Results: The results showed that the incidence of liposarcoma in the Anatomic Pathology Laboratory of the USU Medical Faculty and the H. Adam Malik General Hospital in Medan that could be used as the study sample were 34 people, the youngest age was 14 years and the oldest was 73 years. The incidence in men is more frequent than women, the most common age is ≥ 61 years, and the most common location is in the abdomen. The type of myxoid liposarcoma is the most common.

Conclusion: Musculoskeletal sarcoma is a heterogeneous group of rare malignant tumors involving bone and soft tissue. Determination of histopathological grading is very important in determining therapeutic choices. Also in determining the prognosis of the histopathological subtype is also very helpful.

Index Terms- Characteristics, liposarcoma, subtype, grading.

I. INTRODUCTION

Musculoskeletal sarcoma is a heterogeneous group of rare malignant tumors involving bone and soft tissue. Sarcoma are rare, with most occurring less than 5 per 1,000,000 residents. The most common are leiomyosarcoma, Kaposi sarcoma, malignant fibrous histiocytoma, followed by liposarcoma and fibrosarcoma.¹ Cases of soft tissue malignancy are relatively rare cases of malignancy compared to other cases of malignancy. In Europe there have been 4-5 / 100,000 / year cases of soft tissue malignancy and liposarcoma is the most common case of all sarcomas. The literature states that the incidence of liposarcoma occurs in 2.5 cases in 1 million population. Most often middle age, namely the fifth decade but can also occur in all ages,

including children and adolescents. Myxoid liposarcoma often arises at a younger age (children), compared to well-differentiated liposarcoma and pleomorphic. The incidence in men is slightly higher than in women.²⁻⁴

Liposarcomas are malignant neoplasms with adipocyte differentiation. They occur most often in the fifth and sixth decades of life, and are one of the most common soft tissue sarcomas in adults, with an annual incidence estimated at around 2.5 per million in the Swedish population and relative incidents between liposarcomas and other sarcomas ranging from 9.8 % to 16.0%.^{5,6} Liposarcomas are usually large and most often occur in all parts of the body, about 50% are in the lower extremity (thigh), and one third involves the abdomen, and about 3% occur in the head and neck.⁷⁻⁹ Etiology and also the pathogenesis of liposarcoma until now has not been known with certainty, it is thought that this condition is associated with genetic and environmental disorders. These genetic abnormalities vary depending on liposarcoma subtypes such as ALT / WDL amplification on chromosome 12q14-15, myxoid liposarcoma translocation on chromosomes (12; 16) (q13; p11), dedifferentiated liposarcoma amplification occurs on chromosome 12q13-21, and pleomorphic liposarcoma amplification occurs on chromosome 12q14-15. In some cases liposarcoma can be induced by radiation.^{5,10-13}

II. MATERIAL AND METHODS

Sample selection

This is a descriptive study, using a cross sectional approach. The study was conducted at the Department of Anatomical Pathology, Universitas Sumatera Utara/ H. Adam Malik General Hospital, Medan and includes 34 cases of liposarcoma. The research was held from 2016 until 2018. All samples were obtained through surgical procedure. Inclusion criteria were liposarcoma cases with adequate clinical data, and histopathological slide tissue of liposarcoma patients. Detailed clinical data were obtained from medical records or pathology archives consisting of age, sex, and location of the tumor. Histological type and grade were determined independently by researchers

through hematoxyllin and eosin stained slides examination.

III. RESULT

Patients' characteristics

The mean age for liposarcoma patients was 48,5 (± 16,6) years. The most common in > 61 years age group. Twenty-one patients (61,8%) were males, only 13 patients (38,2%) were females. All the tumors were located in abdomen was the predominance. The histological subtypes of liposarcoma varied and myxoid liposarcoma was the majority of this case. Clinical basic characteristic of liposarcoma patients were summarized in table 1. Representative H&E sections are shown in figure 1.

Table 1. Characteristic of liposarcoma patients

| Characteristics | Number of cases | Percentage (%) |
|---|-----------------|----------------|
| Age, mean ± SD, years | 48,5 ± 16,6 | |
| 11-20 years | 2 | 5,9 |
| 21-30years | 4 | 11,8 |
| 31-40 years | 6 | 17,6 |
| 41-50 years | 6 | 17,6 |
| 51-60years | 5 | 14,7 |
| >61years | 11 | 32,4 |
| Sex | | |
| Male | 21 | 61,8 |
| Female | 13 | 38,2 |
| Location | | |
| Extremitas | 12 | 35,3 |
| Retroperitoneum | 9 | 26,5 |
| Abdomen | 13 | 38,2 |
| Subtype | | |
| Atypicallipomatous tumor/welldifferentiated | 10 | 29,4 |
| Myxoid liposarcoma | 18 | 52,9 |
| Dedifferentiated liposarcoma | 1 | 2,9 |
| Pleomorphic liposarcoma | 5 | 14,7 |
| Histological grade | | |
| Grade 1 | 10 | 29,4 |
| Grade 2 | 17 | 50,0 |
| Grade 3 | 7 | 20,6 |

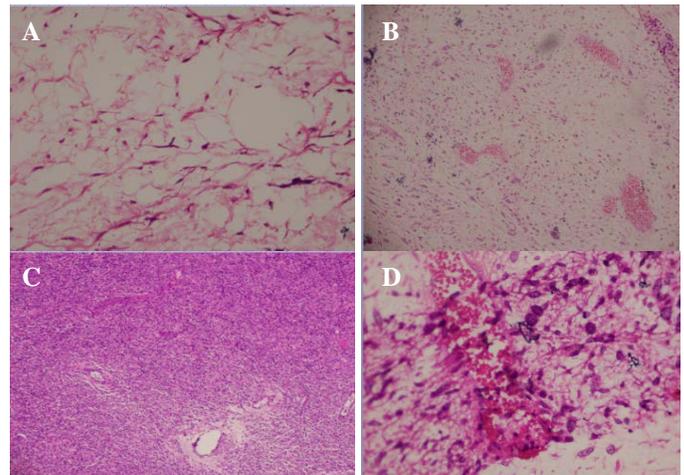


Figure 1. Histological type. A, Atypical lipomatous tumor/well-differentiated liposarcoma B, Myxoid liposarcoma. C, Dedifferentiated liposarcoma. D, Pleomorphic liposarcoma.

IV. DISCUSSION

In the research conducted from 2016-2018 at the Anatomical Pathology Laboratory of the USU Medical Faculty and the H. Adam Malik Central General Hospital in Medan, 34 patients were diagnosed histopathologically as liposarcomas. In this study it was found that the number of liposarcoma patients was found at ≥ 61 years of age, namely 11 patients (32.4%), and the least found at the age of 11-20 years as many as 2 people (5.9%), Afiati *et al* (2013) which divided cases with a median age below <58.5 years and ≥ 58.5 years, the highest age was found at age <58.5 years because in this study there were many cases of liposarcoma subtypes at a young age namely myxoid liposarcoma.¹⁴ Alaggio *et al* (2009) reported that myxoid liposarcoma is the most common subtype with an excellent prognosis in patients younger than 22 years.¹⁵

In this study, the number of liposarcoma patients was more common in men than in women. According to WHO the incidence of liposarcoma in men is slightly higher than that of women.¹⁰ Hartati *et al* (2015) which states that most sufferers are female (60%), with a ratio of women: men of 1.6: 1.¹⁴ Cheng J *et al* (2012) stated that liposarcoma is more common in women.¹⁶

Most locations in this study were found in abdomen followed by limbs and retroperitenium. The results of this study are also different from those of Afiati *et al* (2013) which stated that the highest location of liposarcoma is in the lower extremity.¹⁴ This is in accordance with the statements of several literatures which state in general the location of liposarcomas, respectively, in the lower limb, retroperitoneal, perirenal, then mesenteric region, and others. Knebel *et al* (2017) which states that most liposarcoma locations are in the extremities, differences in location may occur because the liposarcoma subtype has the most different prediction of location.¹⁰

In this study the most common liposarcoma subtype was the myxoid liposarcoma subtype. Afiati *et al* (2013) stated that the most subtypes were myxoid liposarcoma. According to Tos *et al* (2010) this myxoid liposarcoma is a disease at a young age and in both cases studies are often encountered at a young age compared to other subtypes.¹⁷

Knebel *et al* (2017) obtained different results from this study, namely atypical lipomatous tumors / well-differentiated ALT / WDL, which were the highest results.¹⁸

The liposarcoma grading in this study which was most often found was grade 2 followed by grade 1 and grade 3. Jourge *et al* (2015) who received the most grading, namely grade 2.¹⁹ Baig MA (2015), which states that the results of his research found the highest grade 3.²⁰

V. CONCLUSION

The number of patients with liposarcoma is more common in men. Most are at the age of tahun 61 years and the least at the age of 10-20 years. In location most are found the abdomen and are the least common in the retroperitoneum. The most histopathological type of liposarcoma is the myxoid liposarcoma type. Grading of liposarcoma is most commonly found in grade 2.

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Applying exercises to improve and enhance physical strength according to standards of healthy police soldiers for students of the University of Fire

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Abstract-The use of exercises to improve and enhance physical strength for students has been used relatively diversely, abundantly by teachers of universities and intermediate schools. However, the use may be infrequent, so the effectiveness of the exercises is not high, and their advantages have not fully developed. Therefore, the selection of thematic exercises has a very important meaning in improving the physical strength for students of the University of Fire (UOF) in particular and for the other universities and intermediate schools in general, such exercises will help students to improve their physical fitness as well as help them to comprehensively develop important qualities and capabilities such as the strength, endurance, flexibility, agility and coordination in various exercise activities in order to achieve the standard of physical training for healthy police soldiers

Index Terms- Physical training endurance, flexibility, healthy police soldiers

I. INTRODUCTION

University of Fire belongs to the system of People's Police Schools and is an unique institution for training and retraining staff, doing scientific research on fire prevention and fighting and rescue in Vietnam. The UOF requires students to have a certain health to be able to serve the study of general subjects, and students also have to participate in studying subjects requiring physical strength such as National Defence Education, Martial Arts for People's Policemen, Physical Education, and specialized subjects including: Personal fire fighting techniques, high-rise fire fighting tactics, fire fighting tactics for industrial zones, forest fire fighting tactics, rescuing victims stuck in the fire and stuck in high-rise buildings.... Therefore, doing exercises and sports regularly is the responsibility and obligation of each police officer and soldier in general and of each student of the UOF in particular, for the purpose of physical training and physical development for each student from the time of their study at university, which will help them quickly integrate with the practical work and fulfill all assigned tasks successfully after graduation from university.

On April 11, 2013 The Ministry of Public Security issued Circular No. 24/2013 / TT-BCA on regulations and standards for physical training in the people's police force This Circular is applied to units in the People's Police [1]; officers, non-commissioned officers and soldiers serving for a definite time; students of institutes and schools; People's Public Security officers and employees (hereinafter referred to as People's Police officers and soldiers) aged between 18 and 50 for men and 18 to 45 for women (calculated according to birth month) have rights and obligations to perform physical training according to the standards. Annually, the UOF has a plan to inspect healthy public security officers for the officials, teachers and trainees courses to assess the physical training process from which to be considered for emulation during the academic year.

Through the teaching practice of physical education subject with limited duration of course, the small sports field in respect of area, the exercises for training physical fitness according to the standard of healthy public security officers still lack of both quantity and attractiveness, the rate of not reaching the standard of physical training for healthy police soldiers also accounts for a relatively high proportion in both the staff and teachers in general and the students in particular [2].

The quality of physical training of students of the UOF first and foremost depends on the views, policy and guidelines of the Public Security Sector in general and the views of the leaders of the UOF in particular about physical training work. In addition, the

guarantee factors such as cadre work, facilities, sports and physical education organization and management,... are important factors that greatly affect the quality of students' physical training in the University of Fire. Besides, the effectiveness of physical training activity also depends on the effectiveness of studying the regular physical training hours and extracurricular training. In other words, it is decided by the quality of physical education in the university, where the process of teaching sports and physical education plays a key role.

The assessment of the sport and exercise activities and physical training of the UOF in the recent years shows that: Since the beginning of the academic year, the UOF has issued a resolution on special subject in the aspect of leadership to build the movement of doing exercises and sports and physical training with an aim of improving physical fitness for cadres, teachers and students in the university. Thereby, the specific implementation of the resolution of the UOF's Party Committee, coordinating with the specific characteristics and conditions of their unit is carried out to organize exercises and sports activities and physical training movements with high results and attract many officials, teachers and students to participate. Since then, cadres, teachers, students can be clearly aware of the importance of physical training which is necessary and needs to be thoroughly grasped by each individual in their units.

However, in reality, there are still many outstanding issues that do not meet the renovation requirements such as the awareness of some management staff, leaders, teachers and students is still insufficient, and sometimes it has deviant expression, disregarding the position, role, effects of physical education and physical training subject. The movement is sometimes up and down, and has not formed a extensive dynamic and regular movement which has a practical effect in the study and daily life.

Therefore, in order for the sports and physical training in the university to be better and more deeply developed, besides the interest of the Party organizations and the authorities at all levels, there should be close and regular coordination across departments, faculties, departments, unions and especially it is necessary to raise awareness about sport activities and physical training for students.

II. REAL SITUATION

The University of Fire is an education institution under the Ministry of Public Security, so 100% of students are staying in the dormitories within the university campus [3]. Besides, the UOF also has a team of teachers working as form teachers (the form teachers belong to the student management department) are always available with students to supervise and manage all activities of students after the regular main lessons in the class. It can be said that the team of form teachers is the team that sticks close on students most (eating, playing, staying with students) in sports exercise and extracurricular activities. In the UOF, each student of each class must register the contents of the exercises sports, physical training and extracurricular activities with the form teacher, and the form teacher must be responsible for all aspects of the class he or she is in charge of management and reporting to the upper level leaders. Yearly, there is a review of emulation votes among excellent form teachers; excellent classes and there are accompanied authentic rewards, so it is a great motivation for the form teachers to be closer to the class and the class collective also strives its best to achieve the highest honours [4-6].

The subject of Physical Education has 10 units including 1 theoretical unit, 09 practicing units which are taught within 135 period lessons in the first and the second semesters of the first academic year. Of the units, the athletics subjects are taught in the first semester, the subjects of football, swimming are taught in the second semester.

- In terms of knowledge: the subject of PE provides learners with understanding of: Views of the Party and the State on sports and exercises, the meaning and the effect of sports, exercise and physical training on the body, how to handle injuries in practice, keep hygiene in practice, and grasp the principles of performing techniques of short distance running, hurdle, medium distance running, long jump, high jumps, single beams, swimming and the sports of soccer and volleyball. Knowing the methods of organizing sports competition...

- In term of skills: After completing the course, the learners will be able to perform athletics contents such as short distance running, hurdle running, medium distance running, long jumps, high jumps, single beams, swimming and the sports of soccer, volleyball Meet the standard of training healthy police soldiers of the Ministry of Public Security and the standards of physical fitness of the Ministry of Education and Training.

Table 1. Content of techniques required to study physical education program

| <i>Unit</i> | <i>Content</i> | <i>Total</i> | <i>Theory</i> | <i>Practice</i> | <i>Checking</i> |
|-------------------------------|---|--------------|---------------|-----------------|-----------------|
| Part I | | 75 | 11 | 56 | 8 |
| Unit 1 | General theory of sports and physical fitness | | 5 | | |
| Unit 2 | Techniques of short distance running | 0 | 1 | 8 | 1 |
| Unit 3 | Techniques of hurdle running | 0 | 1 | 8 | 1 |
| Unit 4 | Technique of single bar | 0 | 1 | 8 | 1 |
| Unit 5 | Techniques of long jump | 0 | 1 | 8 | 1 |
| Unit 6 | Technique of high jump | 0 | 1 | 8 | 1 |
| Unit 7 | Techniques of medium distance running | 5 | 1 | 14 | 1 |
| Mid-term test | | | | | 5 |
| Part II | | 0 | 4 | 49 | 7 |
| Unit 8 | Football | 5 | 2 | 12 | 1 |
| Unit 9 | Volleyball | | | | |
| Unit 10 | Swimming techniques | 0 | 2 | 37 | 1 |
| Final examination of module 2 | | | | | 5 |
| Sum | | 135 | 15 | 105 | 15 |

On April 11, 2013, the Ministry of Public Security issued Circular No. 24/2013 / TT-BCA on regulations and standards for physical training in the People's Police force, including the four following criteria:

- 100-metre distance running (15 sec)
- 1500-metre distance running (6 min 30 sec)
- Long jump (or jump away) (2,45m)
- Hand shrinking/ bending with single bar (16 times)

The test subject is 72 first-year students (D34 course) who are studying the first part of the subject of Physical Education at the University of Fire Fighting and Prevention. Test results are presented on Fig 1.

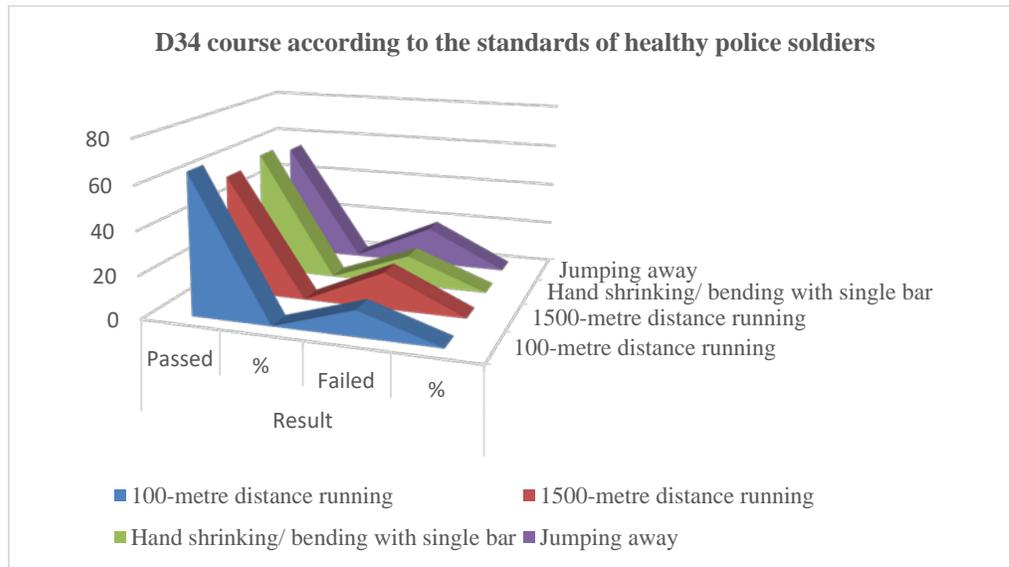


Figure 1. Results of physical fitness test of boy students of D34 course according to the standards of healthy police soldiers.

The test results show: For the first year boy students, among 72 students there are only 50 satisfactory students in 100-metre distance running, 45 satisfactory students in 1500-metre distance running; 30 satisfactory students in hand shrinking/ bending with single bar; and 33 satisfactory students in jumping away. Thus, it can be seen that in the first year, the number of boy students who did not meet the checking criteria for healthy police soldiers is relatively high. In all 4 contents, there have been a number of unsatisfactory students accounted for from 30.6% to 58.4%.

III. SOLUTIONS TO IMPROVE PHYSICAL FITNESS

Physical education for students of the UOF is relatively good, but there are still shortcomings that may be due to objective reasons such as new enrolment in the subjects and limited sports fields, and unclear awareness of physical training, so the results of physical training in accordance with the standards of healthy police soldiers are not high, and there are still a quite large number of unsatisfactory students when taking the fitness test according to the required standards. Therefore, the research and selection of exercises to improve physical fitness for students following the standards of training healthy police soldiers are extremely necessary.

Exercise 1: 30-metre distance running with high starting (s)



Purpose: to develop agility

How to do it: Running on the running track with starting and finishing lines

Volume: Running 3-5 times x 30m with maximum intensity, break time of 1-2 minutes.

Requirements: quick reaction, fast frequency, using the following pedal force.

Exercise 2: 100-metre distance running with high starting(s)



Purpose: to develop agility

How to do it: Running on the running track with starting and finishing lines

Volume: 2-3 times. Maximum intensity, 2-3 minute break time

Requirements: Focussing attention with maximum effort

Exercise 3: Continuous jumping up and down on a 30-40cm high platform

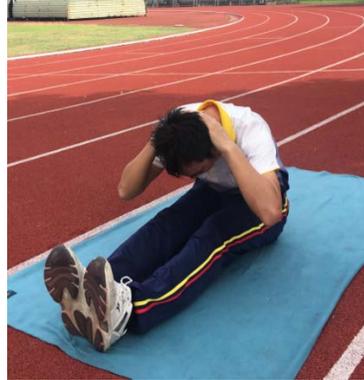


Purpose: to develop the strength of the legs

How to do: choose a wooden platform, a bench or cement platform on the sport training ground with a height of about 30-40cm. Stand in a horizontal line and jump up to and down from the platform continuously.

Requirements: Jump up to the platform, after standing straight up, jump up to the platform and then drop down from the platform to the original position, such action is continuously performed. Perform 4-5 times x 20 '' with break time of 30 ''.

Exercise 4: *Lie supine and bend abdominal muscles*



Purpose: to develop a group of abdominal muscles

How to do it: In preparing posture, 2 people sit linking one's legs with another person's legs , bending knees to create a 60 degree angle, put 2 hands on the nape, leaning backward in a lying position, quickly bend body and then sit up coming back to the original posture.

Requirement: Perform maximum bending and stretching amplitude, head is not allowed to touch the ground. Perform in 3 groups, from 20-30 times/ group, 1-minute break time.

Exercise 5: *Lie on stomach, lean hands and push body upwards.*

Purpose: to develop the moving strengths of the muscle groups when bending and stretching arms.

Requirement: For each time of performance, you have to bend and stretch your arms with maximum the amplitude. Perform 3 teams, from 10-15 times / team, rest between 2 minutes.

Exercise 6: *800-metre distance running*



Purpose: to develop common endurance

How to do it: Gather on the starting line, when command is given out, run around the yard or run on the running track with a distance of 800 metres.

Requirements: Run at a stable speed, take deep breath. The running intensity is about 80-85% of strength power.

Exercise 7: Lying on stomach and bending the back muscles

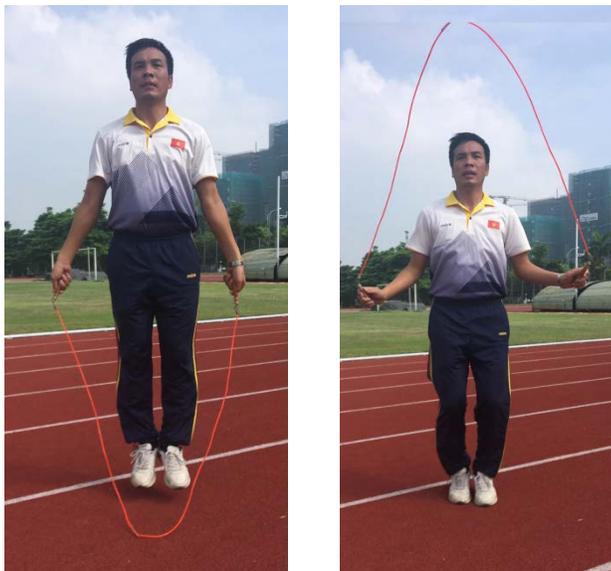


Purpose: to develop the strength of the back muscles group

How to do it: In the preparing posture, performing person has to lie on his stomach stretching body straight, while the helper sits on the heel of the performing person. The performing person put his hands on the nape and then lift up the upper body from the ground with all power and then lower it.

Requirements: Perform movements up and down with maximum amplitude from 20-30 times/ group. Perform in 3 groups, 1- minute break time.

Exercise 8: Jumping rope



Purpose: Develop the endurance of speed and ability to coordinate movements.

How to do it: stand in a horizontal line 2 metre apart, in the preparing posture, two hand hold the rope and then jump at the same time turn round the wrist swinging the rope from the back up to the top and down to the front, and two legs jump over and take the rope through the beneath of the foot.

Requirements: Perform smooth coordination between hands and feet Perform in 3 groups, each team performs for 2 minutes, 1- minute break time.

Exercise 9: Jumping up like a toad

Purpose: to develop the strength of leg muscles group.

How to do: In the preparing posture, squat on 2 legs, put 2 hands behind the nape when a signal is given out, immediately push up body ahead (distance from 25-30m).

Requirements: perform continuously, bounce legs straight ahead with maximum power. Perform in 2 groups, 1-minute break time.

Exercise 10: Jumping up and away from the spot (m)



Purpose: to develop strength of the leg muscles group .

How to do it: Person who is tested stand naturally on 2 legs, 2 tips of feet are set close to the edge of the jump line, 2 hands are raised high, lower the centre of gravity, fold the elbow joint, bend the body, the upper body rushes slightly ahead, head bends slightly , 2 hands are lowered to the back, use the whole power to coordinate the entire body to press strongly the tips of the toes into the ground, and then jump out with 2 arms swinging forward when jumping away and when landing two feet perform simultaneously. The measured results are calculated by the length from the feet stamping line to the last touch point of the heel, the length of the jump is measured in centimetre, taken every single centimetre.

Requirements: perform with the best effort, properly and subject to the rules, 3-5 times x 3 groups. Break time is around 60-90 ''.

After 3 months of experiment, by applying research and selection exercises, the training of the students has brought much higher efficiency than before the specific experiment. Test results are presented on Fig 2.

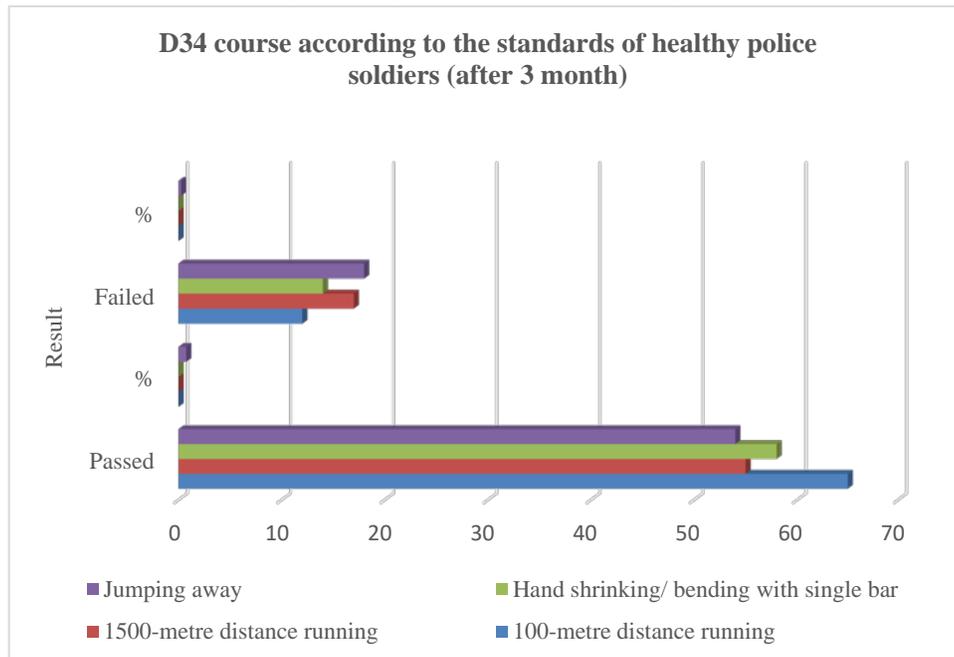


Figure 2. Results of physical fitness test of boy students of D34 course according to the standards of healthy police soldiers after 3 month.

For the first year boy students after 3 month, among 72 students there are 65 satisfactory students in 100-metre distance running (90,3%), 55 satisfactory students in 1500-metre distance running (76,4%); 58 satisfactory students in hand shrinking/bending with single bar (80,5%); and 54 satisfactory students in jumping away (75%). Thus, it can be seen that after 3 month, the number of boy students who did not meet the checking criteria for healthy police soldiers is relatively low. In all 4 contents, there have been a number of unsatisfactory students accounted for from 9,7 % to 25%.

IV. CONCLUSION

The research has selected 10 exercises to improve physical fitness for students in the University of Fire in accordance with the standards of physical training in the Public Security force for students. The selected exercises are closely practical and suitable for scope of students' sports and extracurricular activities. The exercises have shown the effectiveness clearly demonstrated at the physical fitness level of the students participating in the experiment in all four criteria of physical fitness.

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Status of Institutional Credit in Assam with Special References to Small and Marginal Farmers

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Abstract- Institutional credit is essential for economic development. It is considered as a pre condition for macroeconomic stability and monetary policy execution. It is also a key element of agricultural modernisation and increased crop production; it makes production possible even for those who do not possess their own funds for it. In India, along with institutional credit, a parallel system of non institutional credit delivery is highly prevalent in the rural areas. The interest rates are very high in this system. They also operate without any physical collateral and are very adaptable and flexible in their operations. In the fifty years of nationalisation of commercial banks, there has been a considerable progress made in the expansion of institutional credit in the rural areas. But the credit has not reached the small and marginal farmers who cultivate 75% of the total operational holdings. They still borrow heavily from the traditional moneylenders and landlord class who charge exorbitant high rates. In the process, they are not able to clear off their loans and the debt of the farmer goes on increasing. The policymakers have also stressed the need to give preference to the small and marginal farmers in providing formal credit. In Assam, also, there is wide spread inequality in the distribution of credit in the rural areas; the rural population constitutes 86% of the total state population; in of which 84.3% are marginal farmers and 12.3% are small farmers. Therefore, this study deals with the status of institutional credit in the rural areas of Assam and also the problems faced by the small and marginal farmers in availing it.

Index Terms- Institutional credit, small and marginal farmers, informal credit, loans, agriculture.

I. INTRODUCTION

Credit has been conceived to play a crucial role in fostering rural development. Since long, the policy makers have been expressing concern for transforming the credit delivery mechanism to enhance the rural household's access to institutional credit (Kumar et al, 2015). Agriculture and its allied sector are contributing around 13.9% to the total GDP of India. Agricultural exports also constitutes a fifth of the total exports of the country. In sync with this situation, it has become very urgent for the government to ensure that the farmers get the right access to credit. Since the early phase of institutional credit in India, such credit was viewed from the angle of protecting these borrowers from the grip of moneylenders and later on, as an instrument of production enhancement. Thus institutional credit is the nucleus of the system

of farm operation. It can prevent loss, affect an economy or create something materially valuable and can provide a flow to the system averting ruins which could not have occurred due to the lack of monetary capacity of the farmer. Thus the overall economic development of a nation largely depends on the financial resources available in that country.

In India, the beginning of the banking sector dates back to the days of British rule. It started with the Bank of Hindustan in Calcutta in the 18th century. The Imperial Bank of India (presently the State Bank of India) also came into existence in 1921 by emerging three banks viz. Bank of Calcutta, Bank of Madras and Bank of Bombay. Eventually, many banks like Punjab National Bank, Central Bank of India, Allahabad Bank etc were established in the pre-independence period. After independence, in 1969 a historic incident took place where 14 banks were nationalised by the Government of India. An important argument in favour of bank nationalisation was that the commercial banks have kept themselves aloof from the problems of agriculture and remained indifferent to the credit needs of the farmers for agricultural operations and land improvements. The nationalised banks were expected to go vigorously in support of the farmers in general and small cultivators in particular. But, for obvious reasons these banks concentrated their attention on large cultivators and other special category farmers such as those engaged in raising high yield varieties of food grains. The commercial banks also seem to struggle with the coverage vis-a-vis the organisation and the personnel available to them. Also, the co-operative banking system which started operating way back with the passing of Co-operative Societies Act in 1904 was and is still facing the problem of heavy over dues in almost all the states of India.

In such a situation, in 1975 the Regional Rural Banks (RRBs) were conceived as institutions that combine the local feel and familiarity of co-operative societies and the business organisation abilities of commercial banks. In the beginning, RRBs had successfully maintained their image as a small man's bank by confining their credit facilities to the target groups viz. small and marginal farmers, agricultural labourers, artisans and small enterprises for productive activities but their recovery position on the whole was not satisfactory. However, recent reports say that, the rural branches of commercial banks in general and branches of RRBs in particular have been under financial strain on account of higher transaction costs involved in handling of large no. of small size loan accounts and somewhat lower account as a result of concessional rate of interest on small size loans. The lower proportion of current deposits in total deposits of

rural branches has also placed them at a disadvantage with regard to cost of resources.

Soon after nationalisation, the Reserve Bank of India (RBI) also asked the commercial banks to be especially concerned with the financing of priority sector, known as priority sector lending (PSL), which include agriculture, micro and small enterprises, education, housing, export credit and others. The banks were given a target of 33.33% as share of the priority sector in the total bank credit. Initially the concept of PSL intended to improve the condition of small and marginal farmers, artisans, village and cottage industries, scheduled caste and scheduled tribes. But this enthusiasm gradually waned off because of their anxiety to reach the target of 40% they went in for indiscriminate lending. They were unable to monitor the distribution, follow-ups and recovery of tiny loans. The bank's lending to priority sector was also not uniform in all states leading to regional imbalance. The PSL classifications were revised and re-examined in August 2011, as proposed in the Monetary Policy Statement 2011-12 by the Reserve Bank of India. The recommendations were: a target of 40% for foreign banks; distinction between direct and indirect agriculture; establishment of Agricultural Credit Risk Guarantee Fund for Small and Marginal farmers; inclusion of loan for setting up off-grid solar and other renewable energy resources and ceiling for various activities for qualifying under priority sector to be revised. These changes are yet to bear the fruit which will benefit the small borrowers.

II. OBJECTIVE OF THE STUDY

The study has set before itself the following objectives:

- To study the status of institutional credit in rural areas of Assam.
- To study the problems faced by the small and marginal farmers in addressing formal credit institutions.

III. REVIEW OF LITERATURE

India has the co-existence of dual financial systems- formal and informal. They both operate in the rural credit market providing long term and short term loans. The formal credit institutions includes: i) co-operatives ii) regional rural banks (RRB) iii) scheduled commercial banks iv) non banking financial institutions v) self help groups vi) micro- financial institutions and vii) other government agencies. The informal credit sources comprise of village moneylenders, friends, relatives, traders/shopkeepers and others (Das et al, 2009). In India access to formal credit is not scale neutral in spite of the efforts towards financial inclusion. Large segments of agricultural households still remain outside the formal credit system. Poor families are often excluded because they lack collateral or guarantors (Ray, 1998; Shoji et al, 2012).

In India with the growing population, the agricultural land holdings are being subdivided. The sizes of these holdings are thus declining year by year. It is leading to an increase in the number of marginal and small farmers in the country. The small and marginal farmers are those farmers cultivating (as an owner or tenant or share cropper) agricultural lands of more than 1 hectare

up to 2 hectare and land up to 1 hectare respectively (RBI, 2008). The land holdings can be more specifically categorised as shown in the table below.

Table1: Categorisation of farmers in India.

| Sl.No. | Category | Operated Area |
|--------|----------------------|--------------------------|
| 1 | 2 | 3 |
| 1 | Marginal holdings | Below 1.00 hectare |
| 2 | Small holdings | 1.00 – 2.00 hectares |
| 3 | Semi-Medium holdings | 2.00 – 4.00 hectares |
| 4 | Medium holdings | 4.00 – 10.00 hectares |
| 5 | Large holdings | 10.00 hectares and above |

Source: Agricultural Census, 2010-2011.

Land size plays a crucial role in enhancing agricultural household's access to formal credit compared to marginal landowners, the probability of medium and large farm owners accessing formal credit is higher (Kumar et al, 2017). Therefore, the relationship between land size and access to formal credit is positive. Apart from this, the continuance of informal credit in rural areas can be attributed to several factors like minimal formalities, fast disbursement, geographical and personal proximity and flexibility in repayment (Das et al, 2009). Thus, accessibility has a role to play. Accessibility includes the access to the information about the bank loans, special schemes and subsidies, the ability of the small borrowers to contact the bank or the agency and their capacity to avail the services provided by the credit institutions.

The term access can further be divided into two, namely, formal access and effective access. The presence of or functioning of the bank branches, cooperative societies, marketing centres in the selected villages indicate the formal access of the small borrowers to such agencies. The effective access will be measured in terms of the small borrower's participation in the above said institutions and organisations, which in turn increase their economic well-being (Mohanasundaram, 1993).

Utilisation of loans borrowed for institution purposes have interested researchers for a long time. If a household borrows a loan and invest it in income generating purpose then it is likely to generate future income. It is also likely to enable the household to repay the loan in the first place. However if the loan is used for unproductive purposes, then repaying the loan becomes problematic (Gupta and Chakraborty, 2014). A study suggests that 40% of the loan amount borrowed by farmers for agricultural purposes is used on marriages, education, health etc (Tiwari, 2012).

An important aspect that has emerged is that credit is obtained by the small and marginal farmers for survival and by the large farmers to further enhance their income (Das et al, 2009). The effect of rural credit expansion on crop output is not large, but it has strongly increased fertiliser use and private investment in machine and livestock (Binswanger & Khandelkar, 1992). The impact of agricultural loans largely depends on their equitable distribution. There are also several gaps in the present agricultural credit delivery system like inadequate provision of credit to small farmers, paucity of medium and long term lending, limited deposit

mobilisation and heavy dependence on borrowed funds by major agricultural purveyors (Das et al, 2009). Facilitating credit through input dealers, NGOs etc who are vertically integrated with the farmers through contract farming or critical inputs could increase the impact of agricultural loans.

IV. METHODOLOGY

The present study has been based on both primary and secondary sources of data. Information regarding various aspects of the study is collected from different sources. Various reports from Reserve Bank of India(RBI), Census of India, NABARD ,various rounds of NSSO surveys and various independent studies and reports has been consulted. These secondary sources of data provide a broader picture of the status of institutional credit prevailing in the state. In addition to this analysis, questionnaires were framed to collect primary data/information from the study area. The farmers were enquired about their accessibility to banks, problems faced by them in banks and any assistance from Village Level Extension Workers (VLEW).

Area of Study

It may be mentioned at the outset that due to constraints of time and resources, and for operational convenience, the selection of villages for this study is restricted to three districts: Lakhimpur, Nagaon and Sivasagar. These districts are selected purposively on the basis of the following conditions.

- The credit deposit ratio in the Regional Rural Banks (RRBs) is 73% in Lakhimpur, 50% in Sivasagar and 46% in Nagaon district.
- According to the composite index of backwardness of the districts of Assam, Lakhimpur is one of the most backward districts with rank 3, Nagaon is at rank 9 and Sivasagar is the least backward district of Assam ranked 23.
- In Lakhimpur, 75% of the total farmers are marginal and 19.3% are small farmers. In Nagaon, the figures stand at 78.7% and 16.3% respectively. And in Sivasagar, the figures are 86.5% and 12.4% respectively.

From these three districts, three blocks are purposively selected for the study. They are Rupahi block of Nagaon, Dhakuakhana block of Lakhimpur and Demow block of

Sivasagar. These blocks are selected on the basis of the above criteria used for the district. Moreover, the agro-climatic conditions are uniform within the districts. This facilitated the selection of one block from each district. From these blocks, six villages have been selected randomly. Size of the sample is determined by the following formula given by Taro Yamane:

$$n = \frac{N}{1 + N * (e)^2}$$

Where, n- the sample size,

N- the population size,

e- the acceptable sampling error.

*95% confidence level and p= 0.5 are assumed

V. DISCUSSION

In Assam, the financial institutions are playing a major role in mobilising deposits and credits. With the spread of banking networks the dependence per bank branch has been reduced over the years. The Scheduled Commercial Banks (SCBs) , as in all over India, in Assam also are grouped under i) State Bank and its Associates ii) The nationalised banks iii) Foreign Banks iv) Regional Rural Banks v) Private Sector Banks. Assam also has two regional rural banks (RRBs) functioning in all over the state- The Assam Gramin Vikash Bank (AGVB) and Langpi Dehangpi Rural Bank (LDRB). The AGVB is operating in both the Brahmaputra Valley and Barak Valley covering 25 districts with 362 bank branches and LDRB in confined to 2 hill districts with 46 branches as on March 2011. The aggregate deposit of RRB was Rs 4653.08 crore at the end of March 2011 compared to Rs 3691.39 crore as on March 2010. Thus, registering a growth rate of 26%. Also, the volume of credit disbursed by these banks increased to Rs 2230.87 crore compared to Rs 1753.55 crore as on March 2010 indicating an increase of 27.2%.

The following table category wise shows the no of branches of SCBs, their deposits and their credit in Assam:

TABLE 2: Bank group-wise no. of branches of SCBs in Assam

| Bank Group | Assam/ India | No. of offices* | Deposits (Rs. in crore) | Credit (Rs. in crore) |
|---|-----------------|-----------------|----------------------------|--------------------------|
| State Bank of India and its Associates | Assam | 265 | 24556 | 8766 |
| | India | 17899 | 1171917 | 902979 |
| Nationalised Banks | Assam | 734 | 26974 | 8612 |
| | India | 43908 | 2875049 | 2153335 |
| Foreign Banks | Assam | 2 | 109 | 48 |
| | India | 298 | 236405 | 197959 |
| Regional Rural Banks | Assam | 409 | 4650 | 2230 |
| | India | 15658 | 163928 | 98244 |
| Old Private Sector Banks | Assam | 10 | 629 | 216 |
| | India | 4779 | 250638 | 187375 |
| New Private Sector Banks | Assam | 84 | 2184 | 1181 |
| | India | 6568 | 728574 | 536976 |
| All Scheduled Commercial Banks | Assam | 1504 | 59101 | 21053 |
| | India | 89110 | 5426510 | 4076868 |

Source: Quarterly Statistics on Deposits and Credit of Scheduled Commercial Banks March, 2011, Reserve Bank of India.

The State Co-operative Agriculture and Rural Development (SCARD) banks have been playing an important role in investing capital in the agricultural sector. Overall, both the SCARD banks and ST (short-term) Co-operative credit structure have contributed to the growth in agricultural lending in the recent past. In 1993-94, the share of co-operative in the flow of agricultural credit was Rs 10,117 crore constituting 58% of the total. This has gradually declined. The performance of co-operatives has been very unsatisfactory in Assam. The Gaon Panchayat Samabai Samitees and other multipurpose societies which are the primary lending units in the co-operative credit structure of the state are most non functional since 1984-85, as far as, agricultural lending is

concerned. Some studies even indicate that the people are mostly unaware of the existence of such banks (Khaund, 2002). The annual statements (1991-96) of ASCARD banks regarding loan disbursement also confirm the above observation. The statements also indicates that out of Rs 1.6 crore only Rs 29 lakh has been lent out for farm mechanisation and other land development measures during 1991-92, but this proportion has gradually decreased over the years. Presently these banks are facing closure due to large scale misappropriation of funds meant for agricultural investment in Assam. The following table shows the different sources of formal and informal credit accessed by farmers in India.

TABLE 3: Percentage distribution of outstanding loans by farm size

| Source of Loan | Size Class of Land Possessed (hectares) | | | |
|---|---|------------|------------|------------|
| | <=0.40 | 0.41– 1.00 | 1.01– 2.00 | Above 2.00 |
| Government | 3.9 | 3.8 | 1.7 | 1.4 |
| Co-operative society | 14.1 | 17 | 2.5 | 22.8 |
| Bank | 24.4 | 32 | 35.4 | 42.6 |
| Total: Institutional | 42.4 | 52.8 | 57.6 | 66.8 |
| Agricultural/Professional Money Lender | 32.4 | 30.8 | 25.9 | 20 |
| Trader | 4.9 | 4.6 | 4.2 | 6 |
| Relatives & friends | 15.2 | 9.1 | 8.8 | 5.2 |
| Doctor, lawyer & other professionals | 1.4 | 0.7 | 0.8 | 0.8 |
| Others | 3.6 | 2 | 2.6 | 1.2 |
| Total: Non Institutional | 57.6 | 47.2 | 42.4 | 33.2 |

Source: Computed using NSS unit level data 59th Round on Situation Assessment Survey of Farmers 2003.

Thus in India, it can be seen that that the large farmers have monopolised the agricultural credit cooperatives and thus derived the maximum benefits from this agency. In Assam also, the

situation is similar. The majority of the poor small and marginal farmers, landless agricultural labourers, rural artisans etc are left out of agricultural extensions and credit systems. In our study, in

which we have surveyed 297 small and marginal farmer's households from six villages in the Nagaon, Lakhimpur and Sivasagar district of Assam, it was found that the concerned farmers were excluded from the benefits provided by the formal credit institutions due to many reasons. These reasons are listed below:

- Firstly, the farmers are not aware of the facilities the credit institutions to them are providing at a much lower rate of interest.
- These farmers are not acquainted with paper works in their day to day activities. They find the bank paperwork difficult and lengthy. Moreover, many banks ask them to open accounts in their branch before the credit is disbursed. The farmers find it difficult to cope up with the formalities as KYC (Know Your Customer) is essential for opening an account now-a-days.
- Accessibility to credit is a major problem in the process of financial inclusion. Most of the villages in Assam do not have any bank branch in their periphery.
- The farmers have the fear of being a defaulter. They consider formal loans as a burden; which they think that if they are unable to repay in time, the bank will take them to the court and sell their property.
- These small and marginal farmers also do not find the behaviour of the bank officials very welcoming. The big farmers are preferred over them.

VI. CONCLUSION

Therefore, we can see that the credit to these farmers has not come to be institutionalised. For the longest period, they have been exploited by the landlords, money lenders, traders and commission agents. To ascertain their well being and growth, they must be covered by the formal credit institutions. They are suffering due to lack of innovative technologies, access to physical units, lack of food and nutritional security and minimum support price protection. This suggests the need for simplification of the credit disbursement procedures; so that even the less educated and illiterate farmers can have access to them. The bank should also focus on forming farmer's club in collaboration with the National Bank for Agriculture and Rural Development (NABARD). These clubs can do commendable work such as helping the banks to identify farmers for issue of loans, organise training for the farmers, mobilising deposits, helping in recovery of loans etc. This will also make them more aware of the loan schemes available. This will ultimately help the small and marginal farmers to escape

the vicious circle of poverty and contribute towards economic development of the country.

The proposed study will highlight the status of the formal credit banking expansion in the rural areas of Assam. It will focus on relevant issues such as accessibility of rural poor to institutional credit, the utilisation of credit and the impact of credit on the economic condition of the small and marginal farmers. This study may contribute some relevant ideas to the existing literature. The foremost need of the hour is to ensure higher productivity of institutional credit and better recycling of funds. The analysis of the empirical data in this study may provide more insights into the particular aspect. Since, the strength and weakness of the credit delivery system in the rural sector need to be reassessed. The present work in a modest way would help to develop some policy measures to improve the rural credit delivery system.

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Determination of Nutritional Values in Three Brands of Pastry

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Abstract- Pastry is generally made by mixing flour and sugar together, which are excellent sources of carbohydrates and a sufficient amount of energy. Milk and eggs that containing in pastry products which are known to be some of the major sources of protein and minerals. In this research, three brands of pastry sample I, sample II and sample III locally known as *Nan-Khatai* were selected for nutritional analysis. These samples were purchased from local market in Mandalay, Mandalay Region. Nutritional compositions such as pH, moisture, ash content, fat, protein, reducing sugar, carbohydrate and elemental composition of these samples were determined by some sophisticated methods. The pH values were detected by using pH meter. The ash and moisture contents were determined by dry-ashing and oven drying methods. The fat contents were determined by Soxhlet extraction method and protein contents were analyzed by using Kjeldahl's analyzer. The reducing sugar contents of samples were examined by using iodometric titration method and carbohydrate contents were analyzed by phenol-sulphuric acid method. Quantitative determination of mineral contents in sample I, II and III were carried out by applying Energy Dispersive X-ray Fluorescence (EDXRF) spectrophotometer. The overall experimental data indicated that the selected three brands of pastry samples in Myanmar contain suitable nutritional compositions.

Index Terms- pastry, nutritional values, Kjeldahl's analyzer, EDXRF, phenol-sulphuric acid method

I. INTRODUCTION

The nutritional value of food refers to its capacity to nourish the body with the substance needed to live and grow. The body relies on food for fuel and to obtain the chemical compounds it needs to function. The seven major types of nutrients are carbohydrates, fats, proteins, water, fiber, vitamins and minerals. The first five nutrients are considered macronutrients, which are the nutrients the body requires in relatively large quantities. The last two nutrients vitamins and minerals are considered micronutrients, which the body only needs in relatively small amounts. The body primarily uses carbohydrates and fats as fuel to supply the body with the energy, or calories, it needs for activity. Proteins are important because they are the body's only source of essential amino acids. Amino acids are the "building blocks of life" [6].

Pastry is generally made by mixing flour and sugar together, which are excellent sources of carbohydrates. They can provide the entire body, including muscles, brain and nervous system, with a sufficient amount of energy. Milk and eggs that containing in pastry products which are known to be some of the major sources of protein and minerals.

Eating pastry can provide with numerous health benefits and help body stay fit. However, long term consumption of sugar based products result in obesity and the consequent problems since these are made with a high level of energy and calories [7].

Normally, 85% of daily energy use is from fat and carbohydrates and 15% from protein. In humans, nutrition is mainly achieved through the process of putting foods into our mouths, chewing and swallowing it. All kinds of foods contain different components and proportions. People eat different kinds of food to satisfy the body's needs for various nutrients.

In the present work, customer favorable brands of pastry were selected and labeled as sample I, sample II and sample III for investigation of nutritional contents in these samples.

II. MATERIALS AND METHODS

Sampling

Three brands of pastry (samples I, II and III) locally known *Nan Khatai* were purchased from local market in Mandalay. They were chopped into small pieces to be grounded to powder and then store in air-tight well stopped bottles for further use.



sample I



sample II



sample III

Figure (1) Pastry of sample I, II and III

Determination of pH

The pH values of samples were measured by using pH meter [1].

Moisture Content

5 g of sample was accurately weighed and then dried in an oven for about 2 hr at 101°C. It was then removed from the oven and cooled in a desiccators at room temperature and weight. The procedure was repeated until the constant weight was obtained [3].

Ash Content

The sample 5 g was weight and placed in a preheated cooled and weighed the crucible. The crucible was heated carefully in the furnace at 525°C for 4 hours burned off without flaming or until all the carbon was eliminated. When the materials are converted to white ash powder, the crucible was cooled at room temperature in a desiccators and weighed again. To obtain a constant weight, the heating, cooling and weighing were repeated [1].

Fat Content

Fat contents were determined by using the Soxhlet extraction method.

50 g of sample accurately weighed was introduced into a thimble and a piece of cotton wool was placed the open end of the thimble. The thimble containing sample was then placed in a soxhlet apparatus. Then the apparatus was fixed with 500 mL round-bottomed flask containing 350 mL petroleum ether (b.p 40-60 C). The extraction flask was heated on the water bath for 8 hours at the boiling point of petroleum ether. After the extraction was completed, most of the ether extract was distilled off. The content in the flask were carefully transferred to a weight specimen tube. The remaining ether in the specimen tube was vapourized until constant weight was obtained [2].

Protein Content

1 g of sample was weighted and placed in the Kjeldahl's digesting flask. 5 g of $K_2SO_4 + (0.5g)CuSO_4 \cdot 5H_2O$ and 10 mL of 98% sulphuric acid and 10 mL of distilled water were added into it in such a way as to wash solid adhering to the neck. The flask was shaken until the contents were thoroughly mixed and it was heated till the mixture became colorless.

The digestion was continued for half an hour to make sure that all nitrogen in the sample was converted to ammonium sulphate. Then it was allowed to cool.

The Kjeldahl's distillation apparatus was setup, taking care that the tip of the condenser extended below the surface of the 4% boric acid solution 50 mL in the receiver. The digested solution was poured into the flask together with 50 mL of 40% sodium hydroxide to make mixture strongly alkaline. The sample is distilled until 100 mL of distillate are collected in 50 mL of 4% boric acid. The evolved ammonia was distilled off.

Add 2-3 drops methyl red indicator to the conical flask containing boric acid and titrate it with 0.1M HCL until a faint pink color is obtained. A blank determination was carried out without sample using the reagents as in the case of sample. The nitrogen content of sample can be calculated by using following formula [1].

$$\text{Nitrogen (\%)} = \frac{(V_s - V_b) \times M \times 14.01}{W \times 10}$$

Where,

- V_s = the volume of acid used in the test
- V_b = the volume of acid used in the blank
- M = the concentration of acid used
- 14.01 = atomic weight of N
- W = the weight of sample,
- 10 = Factor to convert mg/g to %
- F = Factor to convert N to protein
Protein (%) = Nitrogen \times 6.25

Where,

- 6.25 = a factor of protein – Nitrogen conversion

Carbohydrate Contents

The water soluble carbohydrate was determined by phenol-sulphuric acid colorimetric method in terms of glucose.

0.1 g of sample powder was dissolved in 100 mL of hot water and shaken for ten minutes. 1 mL of this solution was then diluted to 10 mL with water and this solution was taken as the sample extract.

100 mg (0.1g) of hydrated glucose was exactly weighted and dissolved in 100 mL of distilled water. 1,2,4,6,8 and 10 mL of these solutions were drawn out and put in each 100 mL volumetric flask and dilute to the mark with distilled water. These solutions contained 10, 20, 40, 60, 80 and 100 μ g of glucose per ml respectively.

1 mL of sample solution and six standard sugar solutions containing 10, 20, 40, 60, 80 and 100 μ g of glucose per mL were put in each test tube. 1mL of 2% phenol solution was also added to each test tube and mixed. A blank also prepared with 1 mL of distilled water instead of sugar solution. 5 mL of 96% sulphuric acid was again added to each tube so that the stream hit the liquid surface directly to produce good mixing. Each test tube was agitated during the addition of acid.

After ten minutes, the tube was shaken and placed in water bath at 25- 30°C for twenty minutes. The yellow orange color was stable for several hours. Absorbance was measured at 490 nm using UV- visible spectrophotometer.

A standard curve was plotted by the absorbance of the standard solution against the concentration in μ g per mL. Using this standard curve, the concentration of glucose in the sample was calculated [4].

Sugar Contents in Pastry

Determination of Concentration of Iodine Solution

10 mL of glucose solution was taken in conical flask and 20 mL of 0.05 M iodine solution and 45 mL of 0.1 M sodium hydroxide solution were added into the flask. The flask was closed and left in the dark place for 15 minutes. Then, 6 mL of 1 M hydrochloric acid was added and titrated with 0.05 M sodium thiosulphate solution. When the liquid became straw color, 1 mL of starch solution was added. The liquid became dark blue color again and titrated until the colorless content was obtained. From the experimental data, the concentration of iodine solution can be calculated.



Figure (2) Determination of Iodine Concentration

Determination of Sugar Content in Samples

10 mL of sample solution was taken in conical flask and 20 mL of 0.05 M iodine solution and 45 mL of 0.1 M sodium hydroxide solution were added into the flask. The flask was closed and left in the dark place for 15 minutes. Then, 6 mL of 1 M hydrochloric acid was added and titrated with 0.05 M sodium thiosulphate solution. When the liquid became straw color, 1 mL of starch solution was added. The liquid became dark blue color again and titrated until the colorless content was obtained. From the experimental data, sugar content in sample can be calculated [5].

Mineral Content

Mineral contents were measured by applying EDXRF (Energy Dispersive X-Ray Fluorescence) spectroscopy.

III. RESULTS AND DISCUSSION

The results of nutritional composition of three samples were shown in Table 1, 2, 3, 4, 5 and 6.

Table 1. Results of pH samples

| Nutritional Parameters | Sample-I | | Sample-II | | Sample-III | |
|------------------------|----------|----------|-----------|---------|------------|---------|
| pH | 6.7 | 6.8±0.12 | 6.6 | 6.6±0.2 | 6.9 | 6.7±0.2 |
| | 6.9 | | 6.8 | | 6.7 | |
| | 6.7 | | 6.4 | | 6.5 | |

Table 2. Results of Moisture Content and Ash Content

| Nutritional Parameters | Sample-I | | Sample-II | | Sample-III | |
|------------------------|----------|----------|-----------|----------|------------|----------|
| Moisture (%) | 8.4 | 8.4±0.25 | 8.5 | 8.5±0.7 | 6.4 | 6.5±0.16 |
| | 8.7 | | 8.7 | | 6.7 | |
| | 8.2 | | 8.3 | | 6.5 | |
| Ash (%) | 5.0 | 4.9±0.1 | 4.6 | 4.7±0.14 | 3.6 | 3.6±0.15 |

| | | | | | | |
|--|-----|--|-----|--|-----|--|
| | 4.9 | | 4.9 | | 3.9 | |
| | 4.8 | | 4.7 | | 3.7 | |

Table 3. Results of Fat Content of Samples

| Nutritional Parameters | Sample-I | | Sample-II | | Sample-III | |
|------------------------|----------|----------|-----------|-----------|------------|-----------|
| Fat (%) | 23.0 | 23.1±0.1 | 23.6 | 23.6±0.16 | 21.2 | 21.4±0.16 |
| | 23.2 | | 23.8 | | 21.5 | |
| | 23.1 | | 23.5 | | 21.4 | |

Table 4. Results of Protein of Samples

| Nutritional Parameters | Sample-I | | Sample-II | | Sample-III | |
|------------------------|----------|----------|-----------|---------|------------|---------|
| Protein (%) | 9.2 | 9.3±0.25 | 9.3 | 9.5±0.2 | 9.9 | 9.7±0.2 |
| | 9.5 | | 9.5 | | 9.7 | |
| | 9.3 | | 9.7 | | 9.5 | |

Table 5. Results of Carbohydrate Content of Samples

| Nutritional Parameters | Sample-I | | Sample-II | | Sample-III | |
|------------------------|----------|----------|-----------|-----------|------------|------------|
| Carbo-hydrate (%) | 35.0 | 35.0±0.2 | 35.3 | 33.3±0.25 | 30.33 | 30.32±0.25 |
| | 35.3 | | 35.1 | | 30.32 | |
| | 35.1 | | 35.2 | | 30.31 | |

Table 6. Results of Sugar Content of Samples

| Nutritional Parameters | Sample-I | | Sample-II | | Sample-III | |
|------------------------|----------|-----------|-----------|----------|------------|----------|
| Reducing sugar (%) | 28.0 | 27.9±0.16 | 24.0 | 24.1±0.1 | 26.0 | 25.9±0.1 |
| | 27.9 | | 24.2 | | 25.9 | |
| | 27.7 | | 24.1 | | 25.8 | |

Table (7) Result for Comparison of Relative Abundance of Elemental Contents in Samples I, II and III

| Mineral | Si (%) | S (%) | P (%) | K (%) | Ca (%) | Cu (%) | Fe (%) | Mn (%) |
|------------|--------|-------|-------|-------|--------|--------|--------|--------|
| Sample I | 0.120 | 0.069 | 0.053 | 0.049 | 0.009 | 0.001 | 0.001 | ND |
| Sample II | 0.097 | 0.070 | 0.045 | 0.051 | 0.023 | 0.001 | 0.001 | 0.001 |
| Sample III | 0.112 | 0.083 | 0.134 | 0.055 | 0.022 | 0.001 | 0.001 | ND |

According to the EDXRF results, the samples contained silicon, sulfur, phosphorous and potassium are significant amount than the others. The presence of heavy toxic metals was

not detected. Based on the aspect of heavy toxic metals, eating pastry is safe for human health.

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IV. CONCLUSION

In this research work, three brands of pastry samples (*Nan-Khatai*) were purchased from local Market, Mandalay and nutritional contents in samples were investigated. The pH contents (6.8, 6.6 and 6.7) were found to be in all samples. Moisture contents in samples were found to be 8.4%, 8.5% and 6.5%. The ash contents were obtained 4.9%, 4.7% and 3.6%. Fat contents (23.1%, 23.6% and 21.4%) were found to be in all samples. Protein contents (9.3%, 9.5% and 9.7%) were observed and reducing sugar contents in samples were found to be (27.9%, 24.1% and 25.9%). Carbohydrate contents were found to be (35.0%, 33.3% and 30.32%). Quantitative elemental analysis data obtained by EDXRF indicated that silicon is highest content in sample I, silicon and sulfur are found to be highest in sample II, phosphorous and silicon are found to be highest in sample III. It can be concluded that three brands of pastry contain valuable nutrients and should be consumed for the nutrient.

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Water Quality Assessment and Treatment of Tube Well Water from Selected Areas in Mandalay Region, Myanmar

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Abstract- In this research work, the tube well water samples (1, 2, 3 and 4) were collected from Kanthayar Ward, Chanmyathazi Township, Mandalay on August, 2018 to determine the quality of groundwater. The physical and chemical properties of collected water samples such as color, pH, total dissolved solid (TDS), total hardness, total alkalinity, calcium, magnesium, sulphate and chloride were determined. Organic pollutant parameters such as DO (dissolved oxygen), BOD (biochemical oxygen demand) and COD (chemical oxygen demand) were also investigated. The content of heavy metals such as arsenic, lead and cadmium were determined by using atomic absorption spectrophotometer (AAS). The bacteriological examination of all water samples were investigated. The collected water samples from site 2 was treated by using rice-husk charcoal, sand and sponge as adsorbents. The physicochemical properties and heavy metals of tube well water sample before and after treatment were also determined. The present study provides information on the quality of tube well water from collected area in Mandalay Region.

Index Terms- tube well water, groundwater, heavy metals, bacteriological examination

I. INTRODUCTION

The chief resources of fresh water body generally obtained from surface water (lakes, ponds, rivers, streams etc.) and ground water (bore holes and well water). Groundwater plays an important role in various purposes such as domestic uses, industrial supply and irrigation in all over the world. As a result of increasing in world's population, industrialization and urbanization may cause contamination of groundwater. The groundwater should not be used for drinking purposes until it has not been tested. Hence it is necessary to protect quality of groundwater. According to WHO 80% of diseases are arises due to contamination groundwater (Smith, A.H., 2000).

The quality of globe freshwater supplies is under increased threat of contamination. While water contains natural contaminants, it is becoming more and more polluted by human activities, such as open defecation, inadequate wastewater management, dumping of garbage, poor agricultural practices, and chemical spills at industrial sites. Chemical contamination of drinking water both naturally occurring and from pollution is a

very serious problem. Ansinic and fluoride alone threaten the health of hundreds of millions of people globally. But even more serious is microbiological contamination, especially from human feces. Fecal contamination of drinking water is a major contributor to diarrheal disease. Globally, an estimated 2,000 children under the age of five die every day from diarrheal diseases. Almost 90% of child deaths from diarrheal diseases are directly linked to contaminated water, lack of sanitation, or inadequate hygiene. (UNICEF Canada., (2013))

Heavy metals in water refers to the heavy, dense, metallic elements that occur in trace levels, but are very toxic and tend to accumulate, hence are commonly referred to as trace metals. The major anthropogenic sources of heavy metals are industrial wastes from mining sites, manufacturing and metal finishing plants, and domestic waste water and run off from roads. Many of these trace metals are highly toxic to human, such as Hg, Pb, Cd, Ni, As, and Sn. Their presence in surface and underground water at above background concentration is undesirable. Some heavy metals such as Hg, Pb, As, Cd, Fe, Co, Mn, Cr etc., have been identified as deleterious to aquatic ecosystem and human health. (American Public Health Association.,(1998), 20 Ed.,)

In this research work, the investigation of four contaminates tube well water samples were collected from different sites of Chanmyathazi Township, Mandalay Region. The most contaminated tube well was also carried for treatment.

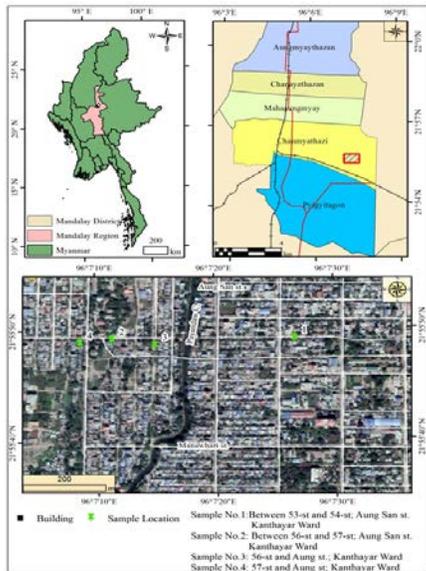


Figure (1) Location Map of Tube Well Water Samples Collected Area

II. MATERIALS AND METHODS

Sample Collection

The value of a water analysis is largely dependent on correct sampling. The water samples were collected in clean plastic or glass bottles which had been washed with a detergent and rinsed with tap water and distilled water and then two or 3 times with water which were to be collected.

The water samples were analyzed as soon as possible after collection. In this research, water samples were collected directly from tube wells as well as reservoirs at four different sites of Chanmyathazi Township, Mandalay Region on August, 2018.

All of the tube well waters located within Chanmyathazi Township were found to be the range of (120-183 ft).

Site 1 = Between 53 street and 54 street, Kanthayar Ward

Site 2 = Between 56 street and 57 street, Kanthayar Ward

Site 3 = 56 street, Kanthayar Ward

Site 4 = 57 street, Kanthayar Ward

Determination of Physical Properties of Water Samples

Estimation of Total Dissolved Solid

The total dissolved of tube well water samples were determined by evaporation method. (S.P. GAUTAM., (2005), 21st Edition)

The evaporating porcelain basin was cleaned thoroughly with concentrated nitric acid and washed with distilled water. The basin was dried in an oven at 200°C for 1 hour. The basin was cooled, desiccated, weighed and stored in desiccators. 100 mL of water sample was quantitatively transferred to the preweighed basin and evaporated to dryness on a steam bath. Then the sample in the basin was dried in an oven at 103-105°C for 1 hour. The basin holding residue was cooled in desiccators and weighed. The cycle of drying at 103-105°C, cooling, desiccating and weighing was repeated until the constant weight was obtained.

Estimation of pH Value

The pH value of tube well water samples were determined by electrometric method direct measurement with pH meter. (S.P. GAUTAM., (2005), 21st Edition)

The basic principle of electrometric pH is the determination of the activity of the hydrogen ions by potentiometric measurement using a glass electrode and reference electrode. The pH of a specific solution can be measured by a pH meter or by pH indicators. pH meter is an apparatus with electrodes sensitive to hydrogen (hydronium) ions. This instrument measures the small voltage produced by the presence of hydrogen ions and reads out the pH.

Electrodes were rinsed with distilled water and dried by gently cleaning with a soft tissue. The instrument was standardized by immersing electrodes in a buffer solution of pH 7. Then the pH of sample was measured by dipping electrodes after cleaning into well stirred for 1 minute.

Estimation of Color

The color of tube well water samples were determined by platinum cobalt standard method (spectrophotometer). (S.P. GAUTAM 2005, 21st Edition)

Color is determined by comparison of sample with known concentration of colored solution. It is the standard method, until of color being that produced by 1 mg platinum/L in the form of the chloroplatinate ion. The color of water is extremely pH dependent and invariably increases as the pH of the water is raised.

25 mL of water sample was placed in the sample cell and the color was determined at 455 nm of dematerialized water as blank.

Determination of Chemical Properties of Water Samples

Estimation of Total Hardness

The total hardness of tube well water samples were determined by EDTA titrimetric method. (S.P. GAUTAM., (2005), 21st Edition)

20 mL of the water sample was pipetted out into a clean conical flask. 5 mL ammonia buffer and 2 drops of EBT indicators are added and titrated against EDTA from the burette. The end point was the change of color from wine red to steel blue. For blank titration, distilled water was used instead of water sample.

Estimation of Total Alkalinity

The total alkalinity of tube well water samples were determined by (acid-base titration) titrimetric method. (S.P. GAUTAM., (2005), 21st Edition)

20 mL of water sample was titrated with standard 0.02 N H₂SO₄ solution using indicator until color changed from pink to colorless. Then, 2 drops of methyl orange indicator were added and the titration was continued until the color turned faint red orange.

Estimation of Calcium

The calcium of tube well water samples were determined by EDTA titrimetric method. (S.P. GAUTAM., (2005), 21st Edition)

25 mL of water sample was mixed with 25 mL of distilled water. 2 mL of NaOH solution and 0.2 g of murexide indicator were added to the sample. The sample was titrated immediately with EDTA solution until the color changed as blank. EDTA titrant was added to the blank to procedure as unchanging color. For blank titration, distilled water was used instead of water sample.

Estimation of Magnesium

Magnesium can be calculated by the following formula.

$$\text{Mg mg/L} = [\text{Total hardness as CaCO}_3/\text{L} - \text{Ca hardness as CaCO}_3/\text{L}] \times 0.244 \times 1000.$$
 (S.P. GAUTAM., (2005), 21st Edition)

Estimation of Sulphate

The sulphate of tube well water samples were determined by gravimetric method. (S.P. GAUTAM., (2005), 21st Edition)

The pH of 150 mL sample was adjusted with HCl to 4.5-5.1. BaCl₂ solution was added with stirring until precipitation appears to be complete, then about 2 mL in excess BaCl₂ was added wherever the amount of precipitate was small. The precipitate was digested to 80°C to 90°C. The precipitate was filtered and washed with warm distilled water until washing were free of chloride as indicated by testing with AgNO₃-HNO₃ reagent. The precipitate was dried, ignited 800°C for 1 hour, cooled in desiccator and weighed.

Estimation of Chloride

The chloride of tube well water samples were determined by argentometric method. (S.P. GAUTAM., (2005), 21st Edition)

10 mL of sample was mixed with 90 ml of distilled water. 1 mL of K₂CrO₄ indicator solution was added and titrated with standard AgNO₃ solution to a pinkish yellow end point. For blank titration, distilled water was used instead of water sample.

Determination of Organic Pollutant Parameters

Estimation of Dissolved Oxygen (DO)

The dissolved oxygen of tube well water samples were determined by the Winkler’s method. (S.P. GAUTAM., (2005), 21st Edition)

Estimation of Biochemical Oxygen Demand (BOD)

The biochemical oxygen demand of tube well water samples were determined by titrimetric method. (S.P. GAUTAM., (2005), 21st Edition)

Estimation of Chemical Oxygen Demand (COD)

The chemical oxygen demand of tube well water samples were determined by permanaganate method. (S.P. GAUTAM., (2005), 21st Edition)

Determination of Heavy Toxic Metals (Arsenic, Lead and Cadmium)

The content of heavy metals (arsenic, lead and cadmium) of water samples were examined by Atomic Absorption Spectrophotometer. The arsenic, lead and cadmium of tube well water samples were determined by inductively coupled plasma method/AAS. (S.P. GAUTAM., (2005), 21st Edition)

Determination of Bacteriological Examination of Tube Well Water Samples

Probable coliform count and *E.coli* of the water samples were measured at Public Health Laboratory, Mandalay City.

Preparation of Filter and Supporting Media

Sand and activated carbon are used as a filter media in treatment process. The sand was collected from Chanmyathazi Township, Kanthayar Ward, was purified step by step washing with water to obtain pure sand, dried in room temperature and sieved with 40-60 mesh screen.

200 g of rice-husk charcoal were placed into a plastic container. 1L of 5% NaOH solution was added to neutral rice-husk charcoal and stand for 1 hour. The mixture filtered and washed with distilled water until neutral.

Finally, 1 liter of 5% NaOCl solution was added to neutral rice-husk charcoal and stand for 24 hours. The mixture were filtered and neutralized by washing the distilled water and dried in sunlight. The activated charcoal powder was sieved by 40-60 mesh size sieves. The activated decolorized rice-husk charcoal was obtained.

The sponge was used as a supporting media and collected purchased from local market and purified by washing with water. 3 pieces of sponge were placed into a plastic container. 1 L of distilled water was added to the sponge and stand for 3 hours. Then, the mixture were filtered and washed with distilled water until neutral. The sponge was placed in sunlight to dry. The activated sponge was obtained.

Treatment of Water Sample (Site 2)

The water sample site 2 was treated by filtration method using adsorbents. Rice-husk charcoal was used as biosorbents. Sand was used as geochemical sorbents. Sponge and cotton were used. 95.92 g of sand, 23.24 g of rice-husk charcoal and 2 in of sponge were put into 900 ml column by successive layers. The water sample was added slowly into the column containing adsorbents, and stand for one hour. Then, the water was allowed to flow a rate of 4 ml per min. One liter of filtered water was collected. The heavy metals of collected water were determined.(Hala Ahmed Hegazi., (10 March 2013), *HBRC Journal*).

III. RESULTS AND DISCUSSION

Table 1. The Results of Physical Properties of Tube Well Water Samples (August, 2018)

| No | Physical Parameter | Site-1 | Site-2 | Site-3 | Site-4 | WHO Recommendation* | |
|----|--------------------|--------|--------|--------|--------|-------------------------|---------------------------|
| | | | | | | Highest desirable level | Maximum permissible level |
| | | | | | | | |

| | | | | | | | |
|---|-------------------------------|-----|------|-----|------|----------|------------|
| 1 | Color (Pt-Co) | 5 | 5 | 5 | 6 | 5 | 50 |
| 2 | pH | 8.3 | 8.2 | 8.2 | 8.0 | 7 to 8.5 | 6.5 to 9.2 |
| 3 | Total dissolved solids (mg/L) | 875 | 1030 | 920 | 1150 | 500 | 1500 |

The physical properties of tube well water samples in August, 2018 the color of the site 4 water sample was greater than other sites. The pH of all water samples were between 7 to 8.5, they are slightly alkaline. The amount of total dissolved solids of site 4 water sample was higher than other sites. According to the physical properties, site 4 water sample is more polluted than other sites.

Table 2. The Results of Chemical Properties of Tube Well Water Samples (August, 2018)

| No | Chemical Parameter | Site 1 | Site 2 | Site 3 | Site 4 | WHO Recommendation* | |
|----|-------------------------|--------|--------|--------|--------|-------------------------|---------------------------|
| | | | | | | Highest desirable level | Maximum permissible level |
| 1 | Total Hardness (mg/L) | 105 | 130 | 170 | 130 | 100 | 500 |
| 2 | Total Alkalinity (mg/L) | 630 | 760 | 670 | 890 | 200 | 950 |
| 3 | Calcium (mg/L) | 24 | 53 | 35 | 50 | 75 | 200 |
| 4 | Magnesium (mg/L) | 15 | 12 | 20 | 50 | 30 | 150 |
| 5 | Chloride (mg/L) | 20 | 40 | 50 | 40 | 200 | 600 |
| 6 | Sulphate (mg/L) | 115 | 113 | 95 | 79 | 200 | 400 |

*World Health Organization standard for drinking water (2006)

According to the chemical properties of water samples, the amount of total alkalinity of site 4 water sample was greater than other sites. The amount of total hardness of water samples were found to be in the range WHO recommendation limits.

The amount of calcium, magnesium, chloride and sulphate of all water samples were found within the range of WHO standard limits. According to the physical and chemical properties site 4 water samples was found to be more polluted than other sites.

Table 3. The Results of Bacteriological Examination of Tube Well Water Samples (August, 2018)

| No | Test | Site-1 | Site-2 | Site-3 | Site-4 |
|----|-------------------------|--------------|--------------|--------------|--------------|
| 1 | Probable Coliform Count | 0/5 | 0/5 | 0/5 | 0/5 |
| 2 | Escherichia coli Count | Not Isolated | Not Isolated | Not Isolated | Not Isolated |

E.coli was not isolated with all sites of water samples.

Table 4. The Results of Organic constituents of Tube Well Water Samples (August, 2018)

| No | Chemical Parameter | Site 1 | Site 2 | Site 3 | Site 4 | WHO standard* | EPA Std** |
|----|--------------------|--------|--------|--------|--------|---------------|-----------|
| 1 | DO (mg/L) | 3.4 | 3 | 3 | 3.5 | - | 4-6 |
| 2 | BOD (mg/L) | 2.5 | 1.5 | 1.5 | 1 | 6 | 5 |
| 3 | COD (mg/L) | 5.221 | 2.309 | 0.659 | 0.735 | 10 | 5 |

*World Health Organization standard for drinking water (2006)

**Environmental Protection Agency for domestic water (2003)

According to the results of dissolved oxygen (DO) value of all water samples were found within the range of 3 to 3.5 mg/L. These values fall within the range of 4 to 6 mg/L proposed by EPA for drinking water standard. Biochemical oxygen demand (BOD) and chemical oxygen demand (COD) values of site 1 water samples were higher than those of other sites.

Table 5. The Results of Heavy Metals in Tube Well Water Samples (August, 2018)

| No | Element | Site 1 | Site 2 | Site 3 | Site 4 | WHO Recommendation* | |
|----|---------|--------|--------|--------|--------|-------------------------|---------------------------|
| | | | | | | Highest desirable level | Maximum permissible level |
| 1 | Lead | 0.000 | 0.005 | ND | ND | 0.3 | 1.0 |
| 2 | Cadmium | ND | ND | ND | ND | 1 | 3 |
| 3 | Arsenic | 0.004 | 0.009 | 0.007 | 0.001 | 0.05 | 0.01 |

*World Health Organization standard for drinking water (2006)

ND = not detected

According to the results of heavy metals, the amount of lead and arsenic contents at site 2 water samples were higher than other sites. Cadmium content of tube well water samples was not detected.

Treatment of Tube Well Water Sample from Site 2 by Using Adsorbents

The Atomic Absorption Spectrophotometer (AAS) of site 2 was most polluted than other sites. So site 2 was treated by filtration with adsorbents.

Method = 95.92 g sand, 23.24 g rice-husk charcoal, 2 in sponge

Treatment of tube well Water form site 2 by using sand, rice-husk charcoal and sponge as adsorbents. 95.92 g of sand, 23.24 g of rice-husk charcoal and 2 in of sponge were placed at the column. Site 2 water sample was added slowly into the column and stand for 1 hour. The water was along to flow

adsorbents at a range of 4 ml per min. 2 L of filtered water were collected. The physicochemical properties and heavy metals of collected water sample were determined.



Figure (2) Treatment of Tube Well Water Sample 2

Table 6. Comparison of Physical and Chemical Properties of Site 2 Water Samples (Before and After Treatment)

| No | Test | Sample 2 | | WHO Recommendation* | |
|----|------------------------------|------------------|-----------------|-------------------------|---------------------------|
| | | Before Treatment | After Treatment | Highest desirable level | Maximum permissible level |
| 1 | Color | 5 | 5 | 5 Units | 50 Units |
| 2 | pH | 8.2 | 8.2 | 7.0 to 8.5 | 6.5 to 9.2 |
| 3 | Total dissolved solid (mg/L) | 1030 | 945 | 500 | 1500 |
| 4 | Total Hardness (mg/L) | 130 | 110 | 100 | 500 |
| 5 | Total Alkalinity (mg/L) | 760 | 740 | 600 | 950 |
| 6 | Calcium (mg/L) | 53 | 32 | 75 | 200 |
| 7 | Magnesium (mg/L) | 12 | 10 | 30 | 150 |
| 8 | Chloride (mg/L) | 40 | 50 | 200 | 600 |
| 9 | Sulphate (mg/L) | 118 | 130 | 200 | 400 |

After filtration with sand, rice-husk charcoal and sponge the color of water sample were the same as before water. The amount of total dissolved solid (TDS), total hardness, total alkalinity and calcium of after treatment water were found to lower than that of before water.

Table 7. Comparison of Heavy Metals (Lead and Arsenic) of Site 2 Tube Well Water Samples (Before and After Treatment)

| No | Test | Water Sample On August "2018" | | WHO Recommendation* | |
|----|---------|-------------------------------|-----------------|-------------------------|---------------------------|
| | | Before Treatment | After Treatment | Highest desirable level | Maximum permissible level |
| 1 | Lead | 0.006 | ND | 0.3 | 1.0 |
| 2 | Arsenic | 0.009 | 0.001 | 0.05 | 0.01 |

According to the comparison of heavy metals, after treatment site 2 water sample the content of lead and arsenic were reduced than that of before treatment.

IV. CONCLUSION

In August, 2018 the tube well water samples were collected from Kanthayar Ward, Chanmyathazi Township, Mandalay Region. The quality of different sites of water samples were compared. The pH, calcium, chloride and sulphate of all the water samples were found within the range of WHO standard limits. The colour, the amount of total dissolved solid, total hardness, total alkalinity and magnesium of water samples were existed between the highest desirable level and maximum permissible level. DO value of all water samples were found within 3 to 3.5 mg/L. BOD and COD value of site 1 water samples were higher than those of other sites. According to the physicochemical properties, site 4 water samples were found to be more polluted than other sites. *E.coli* was not isolated of all sites of water samples. The amount of lead and arsenic contents at site 2 water samples were higher than other sites. Cadmium content of tube well water samples were not detected.

According to the result of heavy toxic metals, site 2 was found to be more polluted than other sites. So according to the physical and chemical parameters site 2 water sample was chosen for treatment. Rice-husk charcoal, sand and sponge were used as adsorbents for filtration. Sand and activated carbon are used as a filter media and sponge for supporting media in treatment process. After treatment of site 2 water sample, the amount of total dissolved solids (TDS), total hardness, total alkalinity and calcium were found to be less than before treatment. The content of heavy metals lead and arsenic were significantly decreased after treatment. However, according to this overall studies result, the quality of water is unsatisfactory. So, the tube well waters from Kanthayar Ward, Chanmyathazi Township not be used for drinking purpose without treating.

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Phytochemical Screening, Antimicrobial Activities and Extraction of Essential Oil from the Peel of *Citrus reticulata* Blanco

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Abstract- The famous fruit, *Citrus reticulata* Blanco was selected for chemical analysis and collected from the Pyin Oo Lwin Township, Mandalay Region in Myanmar. The preliminary detection of phytochemical compounds present in the sample was carried out by standard procedures. The sample gave rise to positive results for alkaloid, flavonoid, glycoside, polyphenol, tannin, reducing sugar and terpene respectively. The antimicrobial activities of sample in various solvent systems were determined by agar well diffusion method on six selected microorganisms such as *Bacillus subtilis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus pumilus*, *Candida albicans*, and *E. coli*. The main objective of essential oil was extracted from the peel of *Citrus reticulata* Blanco by steam distillation method. The yield of essential was found to be 0.4960% based on the sample weight. Moreover, the extracted essential oil was analyzed by Gas Chromatography Mass (GC-MS) Spectrometry.

I. INTRODUCTION

Plants as a source of medicinal compounds have continued to play a dominant role in the maintenance of human health since ancient times. According to the World Health Organization plant extracts or their active constituents are used as folk medicine in traditional therapies of 80% of the world drugs are of natural product origin. (Kirbag, 2009) Medicinal plant materials have been successfully used for the treatment of fungal and bacterial infections in humans (Akinyosoye and Oladumoye, 2000), suggesting that some plant materials may also possess antifungal and antibacterial constituents which are useful in controlling plant diseases (Amadioha, 1998).

Antimicrobial screening of plant extracts and phytochemicals, then, represents a starting point for antimicrobial drug discovery. Phytochemical studies have attracted the attention of plant scientists due to the development of new and sophisticated techniques. These techniques played a significant role in the search for additional resources of raw material for pharmaceutical industry (Ryan, 4th edition). The development of bacterial resistance to presently available antibiotics has necessitated the need to search for new antibacterial agents. Gram positive bacteria such as *Staphylococcus aureus* are mainly responsible for post-operative wound infections, toxic shock syndrome, endocarditis, osteomyelitis and food poisoning. Gram negative bacterium such as *Escherichia coli* is present in human intestine and causes lower urinary tract infection, coleocystis or

septicaemia (Benhassaini, 2003). These antimicrobial substances are of natural origin, and it is thought that their influences on the environment are few and can be used as biological control agents. However, some medicinal herbs for some reasons have not found wider application and sometimes are referred as 'forgotten plants'. Even though pharmacological industries have produced a number of new antibiotics in the last three decades, resistance to these drugs by microorganisms has increased. In general, bacteria have the genetic ability to transmit and acquire resistance to drugs, which are utilized as therapeutic agents (Cheng, 2009).

The essential oil of citrus genus belongs to the Rutaceae family (Mozafarian, 1998). The essential oils are aromatic compounds that are widely used in the perfume, pharmaceutical and food industries. Essential oils are mixtures of more than 200 different compounds. These compounds are mainly formed of monoterpene and sesquiterpene hydrocarbons and their oxygenated derivatives such as esters, alcohols and aliphatic aldehydes and ketones. Essential oils are generally created by aromatic plants. The specific gravity of essential oils is often less than water and only a small number of essential oils have a higher specific gravity than water. Essential oils are non-miscible with water but can transfer their odors to aqueous layer. These compounds are solved in most of organic solvents such as diethyl ether, hexane and ethyl acetate. Essential oils in the presence of air and heat are evaporated, therefore they might be called volatile oils or ethereal oils (Aberoomand *et al.*, 2011; Kamal *et al.*, 2011). Essential oils are present in various aromatic plants generally grown in tropical and subtropical countries. They are obtained from various parts of the aromatic plants, including leaves, flowers, fruits, seeds, buds, rhizomes, roots, and barks. Several techniques have been used to obtain essential oils from the plant. They are hydrodistillation, solvent extraction, cold pressing, and supercritical fluid extraction (Billot, 1975; Handa, 2008; Simon, 1990). Nowadays, approximately 3000 essential oils are known, about 300 of which are commercially available. The major constituents of essential oils are terpenes/ terpenoids and aromatic and aliphatic compounds, which are characterized as low-molecular-weight aroma chemicals (Gonzalez-Burgos, 2011; Betts, 2001). In the modern era, essential oils and some of their components have been used in various products such as cosmetics, household cleaning products and air fresheners, hygiene products, agriculture, and food, as well as in medicinal uses. Essential oils are also used in aromatherapy and other para-

medicinal practices (Silva, 2003; Hajhashemi, 2003; Perry, 2003).

Botanical Description

| | |
|----------------|-----------------------------------|
| Family | -Rutaceae |
| English name | - Tangerine |
| Botanical name | - <i>Citrus reticulata</i> Blanco |
| Myanmar name | - Pya- lein-hmaw |
| Part used | - Peel |



Figure (1) The peel of Pya- lein-hmaw

II. MATERIALS AND METHODS

Sample collection

The fruits of *Citrus reticulata* Blanco were collected from Pyin Oo Lwin Township, Mandalay Region in Myanmar. The fruits were peel and chopped into small pieces and used throughout the experiment.

Preliminary Phytochemical Constituents of Peel of *Citrus reticulata* Blanco

The phytochemical tests were carried out to detect the presence or absence of organic constituents in the peel of *Citrus reticulata* Blanco. (Harborne, 1993)

Test for Alkaloid

The dried powder of sample (2 g) was boiled with 1% hydrochloric acid (10 mL) for about 10 minutes, allowed to cool and filter. The filtrate was divided into two portions and tested with Dragendroff's reagent. The red precipitate was obtained, that indicated the presence of alkaloid.

Test for Flavonoid

(0.5 mL) of ethanol extract, 3-10 drops of concentrated hydrochloric acid and a small piece of magnesium was added in a test tube. The solution was boiled for few minutes. The appearance of pink color indicates the presence of flavonoid.

Test for Glycoside

The dried sample (2 g) was boiled with distilled water for about 10 minutes, allowed to cool and filter. The filtrate was tested with 10 % lead acetate solution. The formation of white precipitate indicates the presence of glycoside.

Test for Polyphenol

The ethanol extract of sample (10 mL) was treated with (1 mL) of 1% potassium ferrocyanate and (1 mL) of 1 % ferric chloride solution. The appearance of greenish blue color indicates the presence of polyphenol.

Test for Tannin

The dried sample (2 g) was boiled with distilled water for about 10 minutes, allowed to cool and filter. The filtrate was tested with a few drops of 10 % ferric chloride solution. If a bluish black color is produced, which disappeared on addition of a few drops of dilute sulphuric acid solution followed by the formation of a cream precipitate the presence of tannin.

Test for Reducing Sugar

(5 mL) of Benedict's solution was added to (0.5 mL) of aqueous extract of sample and boiled for 5 minutes. On cooling down, brick red precipitates indicate the presence of reducing sugar.

Test for Terpene

A mixture of (2 mL) of concentrated sulphuric acid, (1 mL) of acetic anhydride and (2.5 mL) of chloroform was added to ethanol extract of sample. Formation of brown color indicates the presence of terpene.

Antimicrobial Activities of Crude Extracts of Peel of *Citrus reticulata* Blanco

The antimicrobial activities of crude extract sample of the peel of useful fruits were examined by using agar well diffusion method on six selected microorganisms, at Central Research and Development Centre (CRDC), Insein, Yangon. (Magaldi, 2004) (Valgas, 2007)

In this case, the nutrient agar medium was prepared and the study of antimicrobial activities was performed as below. Firstly, nutrient agar was boiled and then 20-25 mL of it was poured into the test tube, plugged with cotton wool and sterilized at 121°C for 15 minutes in an autoclave. After sterilizing, the tubes were cooled down to 30-35°C, the agar in the tube was poured into the sterilized Petri-dish and 0.1-0.2 mL of test organisms were also added into the dish. These were allowed to set the agar for 2-3 hours. After the agar was set, 7 mm petals agar well were made by the help of sterilized agar well cutter. After that, about 0.2 mL of sample was introduced into the agar well and incubated at 37°C for 24-28 hours. The inhibition zone appeared around the agar well indicates the presence of antimicrobial activity.

Extraction of Essential Oil by Steam Distillation

The extraction of essential oil was done by steam distillation method at Department of Chemistry, University of Mandalay. The yield percent of extraction oil was determined. (Pratt, 2013) The apparatus was used, 2 L of distilled water was poured into the still body and perforated cone was set over it, 430 g of the sample was placed on the perforated cone of the still. It was heated carefully without decomposition of oil. The time taken was five hours per day.

After heating for five hours, a mixture of volatile oil and steam was came out passed into the condenser. The oil

collecting on the surface of the water was separated by using petroleum ether and separating funnel. And then petroleum ether in essential oil was allowed to evaporate. The filtrate was stored for the use of next chemical composition determination. The dehydrated oil obtained by passing through the anhydrous sodium sulphate preserves for best quality. The above experiment was carried out for three times, each time using 430 g of sample.



Figure (2) Steam distillation apparatus

Determination of Chemical compositions by GC-MS

The peel of *Citrus reticulata* Blanco was extracted with steam distillation and analyzed by GC-MS using pet-ether as solvent for identification of different compounds, at the Department of Chemistry, University Research Center (URC), Mandalay.

III. RESULTS AND DISCUSSION

Preliminary Phytochemical Screening of the Peel of *Citrus reticulata* Blanco

Table (1) Results of Phytochemical Screening of the Peel of *Citrus reticulata* Blanco

| No. | Test | Reagent | Observation | Bark |
|-----|----------------|--|------------------------------|------|
| 1. | Alkaloid | 1 % HCl, Dragendroff's | Red ppt | + |
| 2. | Flavonoid | Conc: HCl, Mg turning | Pink color solution | + |
| 3. | Glycoside | 10 % lead acetate | White ppt | + |
| 4. | Polyphenol | 1 % FeCl ₃ and 1 % K ₃ [Fe(CN) ₆] | Greenish blue color solution | + |
| 5. | Tannin | 1% gelatin solution | Cream ppt | |
| 6. | Reducing Sugar | Benedict's solution | Brick red ppt | + |
| 7. | Terpene | Acetic anhydride, CHCl ₃ , conc: H ₂ SO ₄ | Brown ppt | + |

(+) = presence (-) = absence ppt = precipitate

According to above table, the sample contained alkaloid, flavonoid, glycoside, polyphenol, tannin, reducing sugar and terpene compounds respectively.

Determination of Antimicrobial Activities of Crude Extracts of the Peel of *Citrus reticulata* Blanco

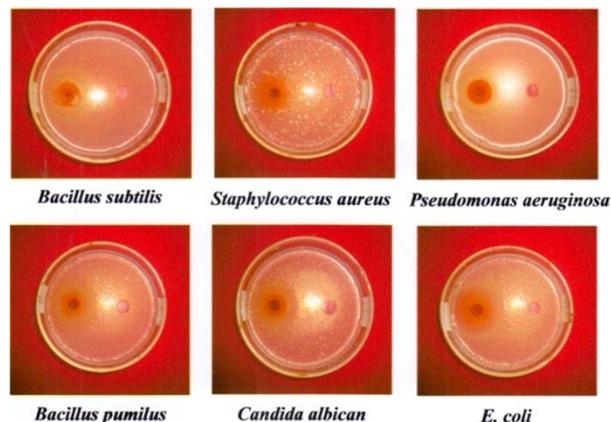


Figure (3) Antimicrobial Activities of *Citrus reticulata* Blanco

Table (2) The Results of Antimicrobial Activities of Crude Extract Sample of the Peel of *Citrus reticulata* Blanco

| | | Inhibition Zone | | | | | |
|---|---------|-----------------|--------------|--------------|-------------|--------------|---------------|
| Samples | Solvent | I | II | III | IV | V | VI |
| Peel of <i>Citrus reticulata</i> Blanco | EtOH | 16mm (++) | 19mm (++) | 17mm (++) | 12mm (+) | 15mm (++) | 38mm (+++) |
| Control | EtOH | - | - | - | - | - | - |

Agar well
~ 10 mm Organism
10 mm ~ 14 mm (+) = low activity
15 mm ~ 19 mm (++) = medium activity
20 mm ~ above (+++) = high activity
I = *Bacillus subtilis*
II = *Staphylococcus aureus*
III = *Pseudomonas aeruginosa*
IV = *Bacillus pumilus*
V = *Candida albicans*
VI = *E. coli*

According to this table, ethanol extract of useful peel are activity on all microorganisms. Moreover, ethanol extract of sample gives rise to medium activity on four organisms such as *Bacillus subtilis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Candida albicans*. The highest activities was found on *E. Coli*.

Extraction of Essential Oil by Steam Distillation Method

Table (3) The Yield (%) of Essential Oil by Steam Distillation Method

| No. of Experiment | Weight of Sample (g) | Weight of extracted essential oil | % of essential oil |
|-------------------|----------------------|-----------------------------------|--------------------|
| 1 | 430 | 2.1550 | 0.4960 |
| 2 | 430 | 2.1550 | 0.4960 |

| | | | |
|---|-----|--------|--------|
| 3 | 430 | 2.1550 | 0.4960 |
|---|-----|--------|--------|

According to this table, the average yield percent of essential oil is 0.4960% based on the weight of peel of *Citrus reticulata* Blanco.

Identification of Components by GCMS

Identification of the extracted oil components was based using a National Institute of Standards and Technology (NIST) mass spectral library according to the reference mass spectra from published sources, and retention indices (RI). The essential oil from the peel of *Citrus reticulata* Blanco by GC-MS analysis showed the presence of some compounds, shows in Table.

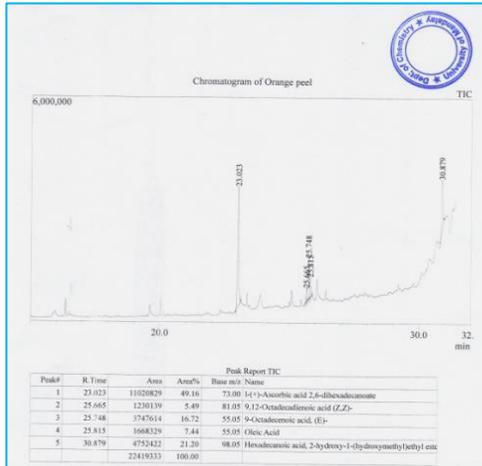


Figure (4) Total ion chromatogram of extracted essential oil

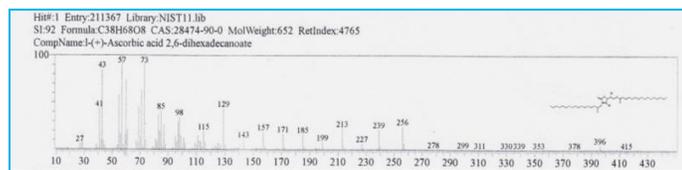


Figure (5) EI mass spectrum of Ascorbic acid 2,6-dihexadecanoate

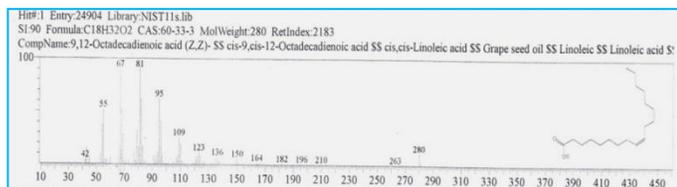


Figure (6) EI mass spectrum of 9, 12-Octadecadienoic acid

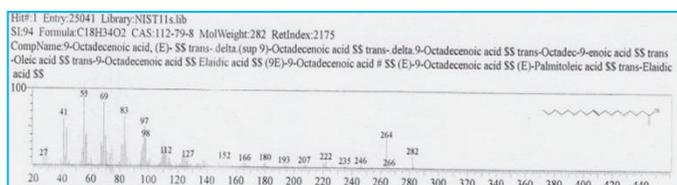


Figure (7) EI mass spectrum of trans-9-Octadecenoic acid

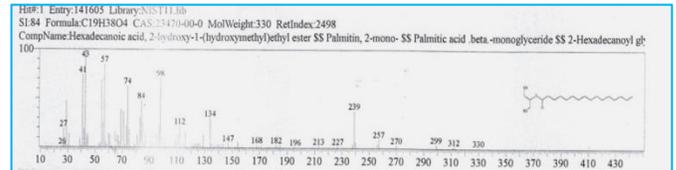


Figure (8) EI mass spectrum of Hexadecanoic acid

This is the total ion chromatogram for essential oil extract of the peel of *Citrus reticulata* Blanco by GC-MS using steam distillation. In this spectrum, X-axis represents time (min) and Y-axis represents percent(%).

According to this experimental data, the extracted essential oil comprised the high level of Ascorbic acid 2, 6-dihexadecanoate is comparison with other.

IV. CONCLUSION

In this research work, the peel of *Citrus reticulata* Blanco were collected from Pyin Oo Lwin Township in Mandalay Region. According to phytochemical screening which gave positive tests for alkaloid, flavonoid, glycoside, polyphenol, tannin, reducing sugar and terpene compounds respectively. The antimicrobial activities of various solvent systems were tested by agar well diffusion method on six selected organisms. The ethanol extract of useful plants are activities on all microorganisms. Moreover, ethanol extract of sample gives rise to medium activity on four microorganisms such as *Bacillus subtilis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Candida albicans*. The highest activities on *E.coli*. In addition, the essential oil was isolated by steam distillation method. The yield percent of essential oil was found to be 0.4960% based in crude sample. The results obtained in this study showed that possess essential oil in the peel of *Citrus reticulata* Blanco and that their oil compositions were quantitatively different. Ascorbic acid 2, 6-dihexadecanoate was found to be the highest constituent 23.023% in peel extract. It can be used for the purpose of medicinal and beneficial to mankind.

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Modeling via Wavelet GARCH Algorithm on Multivariate ENSO Index

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Abstract- Modeling and forecasts of global oceanographic index has important implications for decision making. An effective management on climate anomalies impact depends on the performance towards better accuracy and forecasts. In this paper, an algorithm which makes use of wavelets together with a time series model, GARCH is implemented in order to improve the performance of forecasts in global climate data series. Multivariate ENSO index, MEI, for the period January, 1950 to February, 2018 is used to compare the GARCH model and a newly proposed tools with W-GARCH(1, 1) model. The goodness of performance is calculated via the Akaike information criterion, Schwarz criterion, Hannan-Quinn criterion and RMSE. The results showed that although both models fit the MEI data well, the forecast produced by the GARCH(1, 2) model underestimates the observed score while the newly proposed W-GARCH(1, 1) model generates a better accuracy of forecasts for the given data. Hence the proposed W-GARCH(1, 1) should be applied for forecasts in the fields reflected by MEI variability.

Index Terms- Multivariate ENSO index, Forecast accuracy, Wavelet-GARCH

I. INTRODUCTION

The analysis of global climate time series data provides crucial information to describe, explore and predict climate variability. It stipulates useful information about the physical, biological, or socio-economic system that affects. The purpose of global climate time series analysis is crucial as to determine some of its key properties by modeling and forecasting certain features. These properties can help to understand and forecast the system's future behavior (Ghil et al., 2002).

In this sense global climate time series index data, Multivariate ENSO index (MEI), influenced by oceanographic tele-connected factors over different time horizons that range from minutes to years, in the past, present, and future have become a topic of interests to the meteorological experts as well as data analysts for long days. It is a strong climate-dominant mode in the tropical Pacific, which has major effects on the global climate system and ecosystem as well as significant socio-economic consequences around the globe (Chen et. al., 2002; Ropelewski, 1987; Shabbar & Khandekar, 1996). Operational and strategic decision-making based on ENSO has been taken into account not just the realized effects of climate variability, but also potential effects in the decision making in different areas (Pabon, 2016).

Thus, a better accuracy of performance and effective decision is vital via modeling and forecasts of MEI data series.

Following ARCH tools, GARCH takes into account excess kurtosis and volatility clustering features, two important characteristics of time series data, and provides accurate forecasts of variances and covariance's to model time-varying conditional variances. In line with this, GARCH models are useful across a wide range of applications; nevertheless it's are only part of a solution. GARCH models are parametric specifications that operate best under relatively stable conditions (Gourieroux, 2012). But GARCH often fails to capture highly irregular phenomena, especially in climatic oscillation and other highly unanticipated events that can lead to significant change in the respective arena. Furthermore, GARCH models often fail to fully capture the fat tails observed series. Heteroskedasticity explains some of the fat tail behaviors, but typically not all of it. Fat tail distributions, such as student-*t*, have been applied in GARCH modeling, but often the choice of distribution is a matter of trial and error.

Despite GARCH is unable to handle some properties in the time series data. Over the past years, GARCH model has been widely used in predicting of geophysical as well as hydrological time series (Darda, 2014; Lee et. al., 2011; Modarres & Ouarda, 2013, 2014; Romilly, 2005; Taylor & Buizza, 2004; Trombe et. al., 2012).

Contrary to that, wavelet transform, a nonlinear component, has been applied in many engineering, signal processing, and statistical problems (Chaovalit et. al., 2011) since the recent decade as to overcome the pitfalls of GARCH. It has also shown excellent performance in hydrological modeling (Nourani et. al., 2009; Okkan, 2012 as well as in multiple atmospheric and environmental applications (Pal & Devara, 2012; Pal et al., 2015). Wavelet transformation decomposes the main time series into subcomponents such that the decomposed data improve the model's performance by capturing useful information at various resolution levels (Karim et. al, 2013). Struzik (2001) used wavelet decomposition in forecasting time series. Hsieh et al. (2011) used Haar wavelet decomposition for removal of noise from the stock price time series data with the aim to achieve more precise forecasts. Milidiu et. al. (1999) used Haar wavelet together with a clustering algorithm to partition input data into different regions. In line with this, it is evident in the previous works that wavelet transform has also been considerably improved forecasting accuracies. Even though, we are not satisfied about simple wavelet for better accuracy of performance as model building is a continuing process of research.

In recent years, in the field of time series research, hybrid models are being proposed as an effective way to overcome the limitations of each components model as well as able to improve forecasting efficacy. More hybrid forecasting models have been proposed applying Box-Jenkins models including an ARIMA model with GARCH to time series data in various fields for their good performance. (Wang et. al., 2005) proposed an ARMA-GARCH error model to capture the ARCH effect present in daily stream flow series. Zhou et. al. (2006) applied the ARIMA-GARCH model in forecasting internet traffic, while Chen et. al. (2011) suggested ARIMA-GARCH model for short-time traffic flow prediction. Meanwhile, Liu (2013) applied ARMA-GARCH for wind speed forecasts. In accordance with that wavelet-based ARIMA model has achieved higher prediction accuracy than the conventional ARIMA and GARCH model (Kriechbaumer et. al., 2014; Rahman & Hasan, 2014; Szolgayová et. al., 2014).

To address as a key indicator of climate variability measure index in longer time domain, this paper employs time series tools, GARCH, with Wavelet Transformation (WT) techniques to develop an efficient model with applications to MEI data.

In this sense, the objective(s) of this study is to gain a better per formant accuracy in modeling and forecasts by Wavelet Transform with GARCH algorithm based on oscillatory oceanographic data series like, MEI. Therefore, the study compares the forecast error results obtained using the straight GARCH(1, 2) model with the forecast error obtained using the W-GARCH(1, 1) model about Gaussian, student-t and generalized error distribution.

Finally, as far as the authors are aware of, multivariate ENSO index (MEI) has not been yet tested on modeling and forecasting process on hybrid statistical forecasts tools like the proposed algorithm.

The paper is structured as; in section two we describe data description used in this study. In section three, four, five and six, wavelet, GARCH and data analysis method(s) is outlined. Finally, in section seven and eight presents the main discussion and conclusions of the study.

II. METHODS AND MATERIALS

A. Data Description

MEI, a more informative approach has been developed at NOAA's Climate Diagnostics Center in Boulder Colorado with multivariate ENSO index (MEI) that is derived from tropical Pacific Comprehensive Ocean-Atmosphere Data Set (COADS) integrates more information than other indices; it reflects the nature of the coupled ocean-atmosphere system better than either component (Allan et. al., 1991; Mazzarella et. al., 2010; Rasmusson & Carpenter, 1982; Ropelewski & Jones, 1987). MEI is a multivariate measure of the climatic signal calculated as the first principal component of six variables over the tropical Pacific such as sea surface temperature, sea level pressure, zonal and meridian components of the surface wind, air temperature and total cloudiness fraction of the sky. The computation details of Multivariate ENSO Index may be seen in Wolter and Timlin (1993, 1998,

www.cdc.noaa.gov/people/klaus.wolter/MEI/table.html).

B. Time series forecasting model

Over the years, various time series forecasting models have been developed in literature. The random walk, autoregressive (AR), moving average (MA), and ARIMA are some widely recognized statistical forecasting models which predict future observations of a time series on the basis of some linear function of past values and white noise terms (Chaovalit et al., 2011). As such, these models impose the inherent constraint of linearity on the data generating function. To overcome this, various nonlinear models have also been developed in literature. One widely popular among them is GARCH that has many salient features. (Zhang, 2013) has rationally combined both ARIMA and ANN hybrid models in order to considerably increase the forecasting accuracy.

C. Methods of framework

In this paper the Approximation series has been used since this series behave as the main component of the transform, while the detail series provides "small" adjustments. The procedure explained in this paper is as follows:

- Decompose through the wavelet transform by Haar wavelet transform the data.
- Use a specific GARCH model fitted to each one of the Approximation series to make the forecasting.
- The technique is compared with GARCH model used directly to forecast the data series using the standard criteria.

D. Model Selection

All of the models were fitted by the method of maximum likelihood. Some of the fitted models are not nested. Discrimination among them was performed using various criteria: The Akaike Information Criterion due to (Akaike, 1974) defined by:

$$AIC=2k-2\ln L(\hat{\Theta})$$

Where k denotes the number of unknown parameters, Θ the vector of the unknown parameters and $\hat{\Theta}$ their maximum likelihood estimates; Bayesian information criterion due to (Schwarz, 1978) defined by:

$$BIC=kl\ln n - 2\ln L(\hat{\Theta})$$

Where n denotes the number of observations; The Consistent Akaike Information Criterion (CAIC) due to (Bozdogan, 1987) defined by:

$$CAIC=-2\ln L(\hat{\Theta})+k(\ln n+1)$$

The corrected Akaike Information Criterion (AICc) due to (Hurvich & Tsai, 1989) defined by:

$$AICc=AIC+2k(k+1)(n-k-1);$$

III. RESULTS AND GRAPHS

Analytical results are explored in two ways: graphical method and estimated numerical facts. Both are supportive to each other. Below model Identification, Diagnostic and Adequacy Plots are explored and discussed

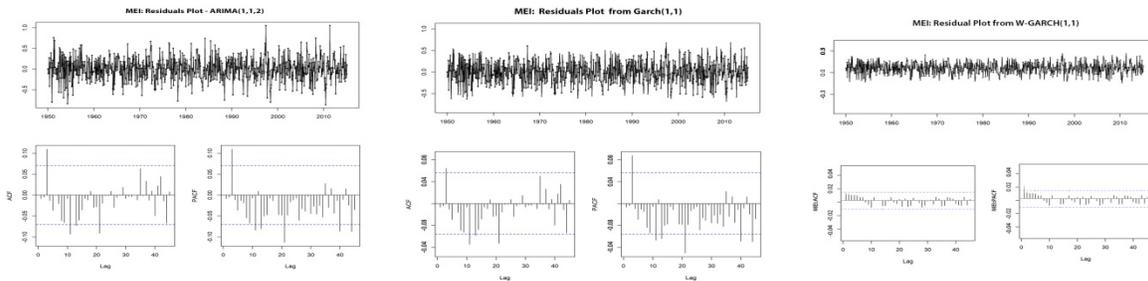


Figure 3.1: Residual plot, ACF and PACF for ARIMA, GARCH and W-GARCH

From Figure 3.1, it is evident that W-GARCH is superior to ARIMA and GARCH as in run sequence plot residuals are decreasing sequentially over the fitted models respectively. Accordingly in ACF and PACF, residuals are within the limit other than two.

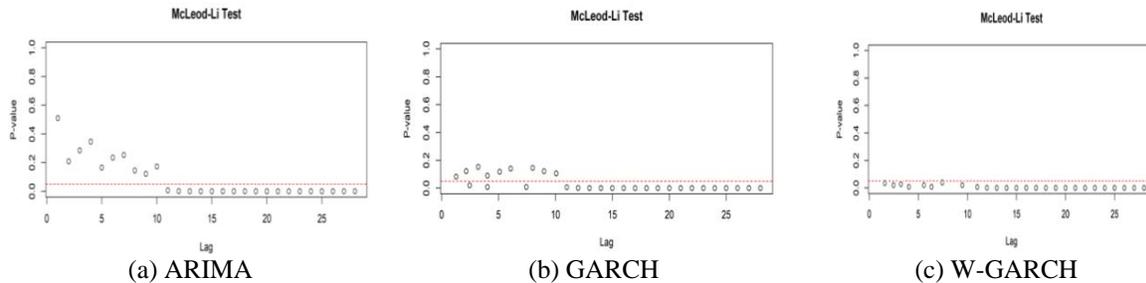


Figure 3.2: Plots of test data about McLeod-Li test for ARIMA, GARCH and W-GARCH model

In Figure 3.2, according to McLeod-Li test it also suggests an improvement is observed for W-GARCH.

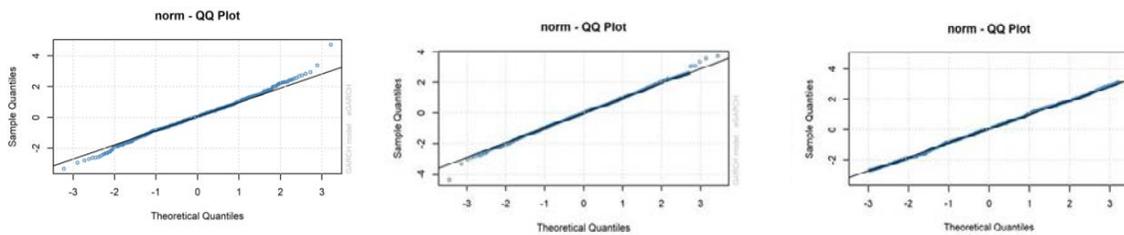


Figure 3.3: QQ Plots of for ARIMA, GARCH and W-GARCH model

In Figure 3.3 the standardized residuals from the three models are presented. The QQ plot for the W-GARCH is the only plot showing residuals that can be considered to follow a normal distribution, while for the ARIMA and G this assumption is not achieved.

IV. PERFORMANCE OF MODELS

Table 1: Model selection about Normal, Student-t and Generalized Error Distributions (GED)

| Model | Normal | | Student's t | | GED | |
|----------------|------------|--------------|-------------|--------------|------------|--------------|
| | GARCH(1,2) | W-GARCH(1,1) | GARCH(1,2) | W-GARCH(1,1) | GARCH(1,2) | W-GARCH(1,1) |
| R ² | 0.919 | 0.991781 | 0.879206 | 0.903889 | 0.919193 | 0.913856 |
| AIC | 0.265 | -4.303453 | 0.209454 | -1.426408 | 0.259436 | --- |
| SC | 0.307 | -4.267684 | 0.307145 | -1.384678 | 0.307128 | --- |
| HQ | 0.281 | -4.289697 | 0.277794 | -1.41036 | 0.277777 | --- |
| DW | 1.944 | 0.6123 | 1.627257 | 1.789733 | 1.933189 | 1.79673 |

In this paper, the minimum value of R-squared, AIC (Akaike information Criteria), SC, DW and HQ is considered to select the best model for the experiment. All choices of GARCH

models for data are included in this test between (0, 1) and (2, 2). Some of the combination measures based on degree of parameters

are complex roots that should not be satisfied the estimation procedure.

The GARCH model for the original index data is considered as GARCH (1,2) with AIC (Akaike Information Criteria) about Gaussian distribution to 0.259454 as presented in table-1, while the GARCH model for the transform data by using wavelet transform is selected as Wavelet-GARCH (1, 1) with AIC equal to -4.303453 as presented in table-1 as well. Although the fit GARCH model for the transform data using Haar wavelet transform is selected as Wavelet-GARCH(1, 1) based on AIC about Gaussian distribution equal to -4.303453, table-1 shows some other criteria of various distributions about the result. All of these criteria explain that the Wavelet GARCH model is better than the GARCH model.

Moreover, the Haar wavelet transform gives more sufficient result and better than Daubechies wavelet transform in the forecasting that is not cited here. However, in some statistical literature, Daubechies wavelet transform is better than Haar wavelet in the decomposition, but in this paper we found a different result, the reason is related to the data set since just the approximation series have used in the comparison.

Furthermore, the standard errors of model parameters which measure the variation between index data after wavelet transforms are also small. All of these criteria explain that the Haar wavelet transform gives more sufficient result and better than GARCH in the forecasting.

V. CONCLUSION

An effective management on climate anomalies impact depends on the performance towards GARCH and Wavelet are two widely used forecasting models captured better accuracy. Although wavelet and GARCH both are suitable for an irregular low and high frequency signals in global climatic time series but their hybrid effect gives a better results of forecasts. As such, in this paper, we have proposed a hybrid forecast method that applies GARCH and Wavelet in conjugate.

In concluding remarks of the study, if the Wavelet transform is used for forecasts in MEI data series, then the result of the W-GARCH(1, 1) model attained better forecast and forecasting accuracy is more stable than the original index data.

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Strategy of Household Wastewater Management with Reduce, Reclaim and Reuse System (3R)

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Abstract- Clean water used in daily activities in the household will mostly be wasted as waste, both gray water and black water. Waste water classified as black water is generally processed simply using septic tanks while used water is discharged directly into the drainage channel and then into the environmental media. Waste water should be managed before being discharged into environmental media. Waste water management can be carried out through reduction, processing and utilization or disposal. The method used in this study is to review the results of previous research by adding primary data to develop a strategy for managing household wastewater. Interviews were conducted with stakeholders of household wastewater management to formulate wastewater management policies that will be carried out and allow them to be implemented in the future. Based on the simulation results obtained the value of sensitivity O/M ratio obtained an average value of 1.91. Simulation of optimistic conservative conditions should be a concern in determining wastewater management policies, especially at the stage of wastewater treatment which has a value that is 2 times greater than moderate conservative conditions. Waste water treatment is more effective in reducing the BOD pollution load that will enter the environmental media compared to the reduction and reuse of waste water. Wastewater treatment can reduce pollution loads by up to 41.1% but with integrated wastewater treatment with reduction of wastewater and reuse of waste water can reduce BOD pollution load to reach 71.28%. The strategy is to arouse and build public awareness through counseling to reduce waste water and reuse waste water that has been treated.

Keywords- Strategy, household wastewater management, reduce, reclaim, reuse

I. INTRODUCTION

Water is a resource that is vital for the survival of humans and other living things. Therefore, water resources must be protected so that they can still be utilized properly by humans and other living creatures. The use of water for various purposes must be carried out wisely, while still calculating the interests of the current generation without reducing the interests of future generations to obtain the same water resources that we have now. Lately, water has become a problem that needs serious attention and savings. To get good water according to its designation standards, it is now an expensive item because a lot of water is

polluted by waste originating from human activities, such as household activities, industry, agriculture, livestock, and other activities [1].

Household, industrial, and all activities that produce waste water should carry out waste water management. If all human activities pay attention to the management of waste water produced, the problem of shortages and water pollution does not really need to worry. But in reality there are many industries and other activities that dispose of their waste into environmental media through drainage, canals, rivers, sea and other water bodies without management. Disposal of waste water directly into environmental media which is the cause of water pollution. Waste, both in liquid and solid form even the gas that enters the environmental media causes a deviation from the normal state of water. Water irregularities from normal conditions indicate water pollution has occurred.

Waste water management carried out, especially by business actors and / or activities is still limited to wastewater treatment; not yet integrated waste water management. Waste water management should be carried out through stages of reducing, processing and reusing waste water.

Reduction of Household Wastewater

Reduction of household wastewater, especially used water, is carried out at the source, namely from households. Reduction of used water in the household can be done by reusing used water according to its designation. Domestic wastewater can also be processed simply and the results can be used for watering plants, pet consumption, fertilizer sources for plants or for fish ponds [2], [3], [4], [5].

Management of wastewater or used water at the household level is carried out by: 1) general disposal through waste water storage located on the yard, 2) used for watering plants in the garden, 3) discharged into the infiltration field, 4) flowing to open channels, and 5) are channeled into closed channels or gutters with a filtration system [6], [7]. While excreta management is carried out with a dry system or night soil such as digging pit latrines and wet systems such as septic tanks [8], [9], [10].

Based on the [11], it is explained that by increasingly relying on the industrial sector to sustain economic growth, the added value of manufacturing is expected to increase 13-fold and the resulting waste increases 10-fold if the process continues as it is today. If it cannot be stopped or reduced, the cost of processing and disposal of waste water so that the quality standard of waste

and environmental quality standards can be met will be very high. If no processing is carried out, the level of pollution will increase considerably from the current high pollution level. Therefore, it would be more effective to try to "minimize waste water" and save costs for wastewater treatment. In addition, minimizing wastewater not only reduces waste water that must be collected, processed and disposed of but also reduces the use of raw materials, energy and water [12]. Furthermore, the pollution load that enters the environmental media will also decrease. Pollution load in urban areas in Java with and without waste minimization illustrates how a minimization factor of 50% can reduce pollution loads from 370,000 tons to 185,000 tons in 2020 [11].

The wastewater management strategy should be a strategy that starts where waste is produced until the waste water is discharged. This kind of strategy can be divided into steps and actions in synergy, namely: 1) minimizing wastewater, efforts to reduce wastewater both from industry and those produced from households, 2) improving services, this program is more directed at improving household wastewater services, because industrial wastewater is usually managed by each industry, and 3) processing and disposal, the waste produced still needs to be processed and disposed of in an environmentally friendly manner [13], [14], [15], [16].

Waste water management has been concentrated in improving service, processing and disposal, while minimizing wastewater is still lacking in attention [17], [18]. To achieve success, the three steps above must be implemented in an integrated and inseparable manner [19], [20], [21].

Reduction of waste water can be done by making efficient use of water. Efficiency of water use can be applied by using water-saving technology, for example replacement of bathtub to shower, changing shower pressure by using lower pressure, applying reuse of towels and bed sheets and using recycled waste water for watering plants [22], [23]. The implementation of an efficient water use program has been implemented in hotels in Yogyakarta, Indonesia, indicating that the efficiency of water use can save clean water use by 7.2 - 8.9% per year. With a comprehensive study of all activities that use a lot of clean water, water efficiency efforts that are carried out consistently can reduce the level of water consumption by 23-30% [24].

Reclaim or Recycle of Household Waste Water

Waste water sourced from households consists of gray water [25], [26] and waste water mixed with excreta in the form of feces and urine (black water). Waste water classified as gray water is generally discharged directly into sewers or rainwater channels [27], [28], while wastewater classified as black water is channeled to individual or group septic tanks [29].

Based on observations in the field that the disposal and treatment of human waste with existing systems mainly relies on local systems, in areas with low ground water levels with low to moderate population densities, and suitable soil conditions are considered still sufficient. But in areas with high population density, where the distance between houses and septic tanks is getting closer, the processing of the local system is already not possible because it can pollute ground water. According to [30], that 40% of well water samples are known to contain *E. coli* with the number of colonies identified, namely > 2400/100 ml. This

shows that the well water has been contaminated with *E. coli* bacteria and does not meet the requirements of clean water.

Well designed and operated septic tanks can significantly reduce BOD [30]. Most septic tank sanitation systems are not managed properly, so their ability to treat wastewater is also limited. Septic tanks are not routinely emptied and mud collection services from septic tanks often dispose of mud in canals or rivers [11]. In contrast to the processing of WWTPs which significantly reduced BOD to 58%, although BOD concentrations still exceed the required quality standards [31], [32].

Waste water treatment aims to reduce BOD, COD, nutrients, particles mixed and kill pathogenic organisms [33], [34], [35], [36]. In addition, additional processing is needed to eliminate nutrients, toxic components, and materials that cannot be degraded so that the concentration becomes low [37].

The wastewater treatment system consists of an on-site system and an off-site system. The selection of individual, communal and semi-communal systems is determined based on local conditions, rainfall, occupancy density, population and socio-economic conditions [38]. Communal and semi-communal systems can be applied to people who do not have private latrines, low economic levels, slums, and densely populated areas [39], [40].

The process of treating wastewater containing organic compound pollutants, the technology used in large part uses the activity of microorganisms to decompose organic compounds contained in natural wastewater. The process can take place in aerobic or anaerobic or in facultative conditions. The aerobic process is usually used for wastewater treatment with a BOD load that is not too large, whereas anaerobic process is used for wastewater treatment with a very large BOD load [41], [42].

The selection of waste water treatment technology must consider several things, including the amount of wastewater to be treated, expected quality of processed water, ease of management, availability of land and energy, and the lowest possible operational and maintenance costs [43]. Waste water treatment with on-site or decentralized systems and ecobiological systems are generally very simple, low-cost and easy to maintain.

Each type of wastewater treatment technology must pay attention to the technical aspects, economic aspects, environmental aspects and human resources that will manage these facilities [44], [45], [46]. The most important aspect to be considered in processing the benefits is the quality of treated water must meet the waste water quality standards. The choice of technology is always directed to get more innovative technologies to meet the waste water quality standards.

Reuse of Household Waste Water

Increasing population and economic growth, the potential for environmental pollution will also increase. Therefore, the management and safety of waste water disposal is very important to maintain public health and reduce the level of environmental degradation. In addition, adequate wastewater management is also needed to prevent contamination of water bodies for the purpose of preserving water resources.

One of the most promising efforts to stem the global water crisis is the processing of industrial wastewater and municipal wastewater for reuse [47]. The WaterReuse Association defines the reuse, recycling or reclamation of water as "water used more

than once before the water returns to the natural water cycle" [48], [49]. Thus, water recycling is the reuse of wastewater treated for beneficial purposes such as agriculture and landscape irrigation or household gardens, industrial processes, toilet flushing, or filling groundwater basins or as groundwater recharge, washing cars, and fire fighting [23].

Reuse of wastewater allows communities to become less dependent on groundwater and surface water sources and can reduce the diversion of water from sensitive ecosystems. In addition, reuse of water can reduce the nutrient burden of dumping waste water into waterways, reducing and preventing water pollution, and saving energy consumption [50]. This 'new' water source can also be used to fill water source quotas that have been used excessively [51], [52], [23].

According to [53], that Australia has changed the thinking pattern for 40 years about wastewater from the issue of disposal to recognize wastewater as a legitimate and valuable resource but recycled water that can be drunk directly does not receive community and political support in to date. In contrast to the Singapore government which has taken an active role in communicating accurate scientific facts and taking a persuasive approach to reuse of wastewater. Reuse of wastewater is part of the Singapore government's master plan to cover the water balance deficit by increasing the quality of urban wastewater to the quality of drinking water [54].

Waste water that has been through the processing will eventually be discharged into environmental media or water bodies, which are discharged into canals, rivers, lakes or into the sea. Waste water to be discharged into a water body must meet the required quality standards so as not to have an impact on the surrounding environment [47].

Domestic wastewater, especially those sourced from households should be seen as a resource, especially water resources and nutrient content contained therein [55]. Processed wastewater can be used for agricultural irrigation and the mud can be used as fertilizer [8], [56]. Waste water contains chemical elements needed by plants for their growth, both macro elements and essential elements. Therefore, the reuse of waste water can reduce the costs spent on fertilizers, and the resulting water is considered safe because it has been treated and is pathogenic free [57].

Waste water treatment systems are usually adapted to technical and economic criteria, such as the removal efficiency of specific pollutants, construction costs, but rarely based on their suitability for potential reuse [58]. However, recycling and reuse affect the entire "water cycle", from supply to final disposal. Therefore, these practices will influence how to design, build and operate water infrastructure and sanitation.

This study aims to formulate a strategy for managing household wastewater to reduce pollution load.

II. RESEARCH METHOD

The method used in this research is to review previous research by adding primary data to develop a strategy for managing household wastewater.

Data Collection Methods

The data collected in this study consists of primary and secondary data. Primary data was obtained from interviews with

stakeholders of household wastewater management in Makassar City, consisting of Local Development Planning Agency, Public Works Agency, Environmental Management Agency, Health Office, and Wastewater Management Units. Interviews were conducted with stakeholders of household wastewater management to formulate wastewater management policies that will be carried out and allow them to be implemented in the future. While the secondary data used is the data from the previous author's research on "the dynamic model of household wastewater management to reduce BOD pollution load" through the stages of reducing, processing and reusing household wastewater.

Primary data from interviews with stakeholders of household wastewater management and secondary data from previous studies were then simulated with the help of Powersim Studio 10 Academic software. The simulation results obtained are then used to formulate household wastewater management policies and strategies.

III. RESULTS AND DISCUSSION

Management of household wastewater should be carried out as a series of activities consisting of activities to reduce, process and reuse wastewater. According to [59], that the management of household wastewater through stages of reduction, processing and reuse can reduce the BOD pollution load entering the ambient environment to reach 71.28%. For details, can be seen in Figure 1 and Table 1.

The model scenario is simulated from controlled inputs which is a major factor in supporting a decrease in BOD pollution load originating from households. Factors that influence the behavior of the model which are also the needs of each stakeholder, namely: 1) extension of household wastewater management, 2) household waste treatment technology that effectively reduces BOD pollution load, 3) waste water management through a reduction , processing and utilization of household wastewater, and 4) law enforcement.

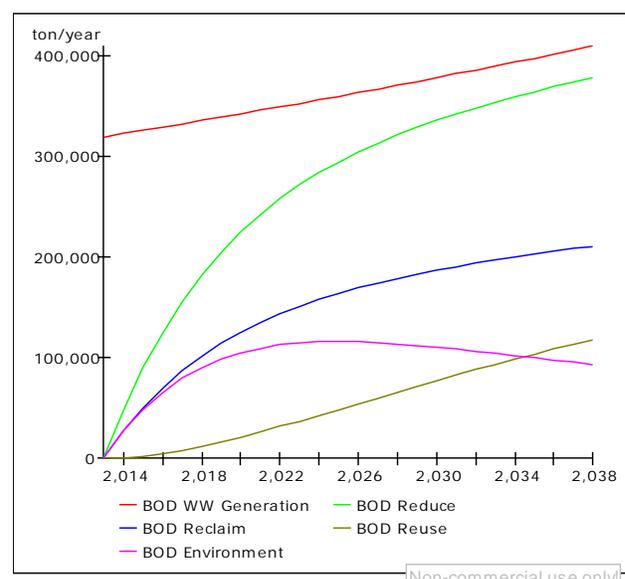


Figure 1. Projected Load of BOD Pollution that Enter Environmental Media After Management (Parabang, et al., 2019)

Table 1. Percentage of decreasing BOD pollution load in each management stage

| Management stage | BOD pollution load (ton/year) | Percentage | |
|--|-------------------------------|------------|--------------|
| | | Decrease | Accumulation |
| Without management | 409,966.60 | - | - |
| Reduce | 379,122.26 | 7.52 | 7.52 |
| Reclaim or recycle | 210,622.56 | 41.10 | 48.62 |
| Reuse | 117,740.66 | 22.66 | 71.28 |
| BOD pollution load that enters the environment | 92,881.90 | 28.72 | 100.00 |

Source: Parabang, et al., 2019

Based on the data in Table 1, a household wastewater management policy can be formulated by conducting a model simulation scenario. Model simulation scenarios are made from the largest sensitive values seen from existing (conservative) or untreated conditions to moderate, and from moderate to optimistic. For details, can be seen in Table 2.

The condition scenario in Table 2 is the result of discussions with stakeholders. This scenario is the dominant condition that will occur in the future that can be applied by stakeholders.

Table 2. Condition Scenario

| No | Policies | Future Conditions | |
|----|---|---|--|
| | | Moderate Conservatives | Optimistic Conservatives |
| 1 | Extension or awareness of household wastewater management | Increased counseling or awareness to increase home connections to 4.5% | Counseling the benefits of reducing and utilizing wastewater, increasing the home connection to 5% and counseling carried out twice a year |
| 2 | WWTPs Technology | WWTPs performance improvement 45% | Increasing home connection to 5.5% and WWTPs performance 50% |
| 3 | Management of household wastewater | Decrease in BOD reduction of 17.5%, utilization of 9% | Decrease in BOD reduction of 20%, utilization of 13% and performance of WWTP 50% |
| 4 | Law enforcement | The reduction in the 72% BOD pollution load is specified in the City Sanitation Strategy which is approved by the Mayor | Prohibition of disposing of waste water without management and a reduction in 75% BOD pollution load is specified in the City Sanitation Strategy which is approved by the Mayor |

Waste Water Reduction (R1)

BOD pollution load of waste water generation with no management conditions or bussiness as usual (BAU) in 2017 amounted to 332,451.84 tons which decreased to 155,315.81 tons in the same year by reducing wastewater or decreasing by 53.28 %. Along with the increase in population, at the end of the simulation in 2038 it increased again to 379,122.26 tons or only decreased by 7.53%. Therefore, policy interventions are needed to continuously reduce the BOD pollution load of wastewater which is disposed directly into the environmental media.

Policy interventions to reduce BOD pollution load are carried out by creating scenarios for moderate conservative and optimistic conservative conditions. The optimistic conservative scenario can reduce the BOD pollution load to 118,584.07 tons and moderate conservative conditions by 136,160.95 tons in 2017. The decrease in BOD pollution load until the end of the simulation in 2038 is 368,992.22 tons in a optimistic conservative condition and under conditions moderates conservative of 372,964.56 tons. Decrease in BOD pollution load with a optimistic conservative scenario of 1.07% of conservative conditions or 9.99% of BAU conditions.

The important thing to note in the scenario of reducing wastewater is the existence of extension activities. Extension activities can increase public awareness to reduce waste water. Reduction of wastewater can be done by utilizing waste water for flushing toilets, watering plants or parks and watering yard or roads. To be clear, the simulation of waste water reduction scenarios can be seen in Table 3 and Figure 2.

Table 3. Scenario of Decreasing BOD Pollution Load through Reduction of Household Wastewater

| year | (ton/year) | | | |
|-------|------------|-------------|------------|------------|
| | BAU | Konservatif | Moderat | Optimis |
| 2,013 | 319,441.73 | 0.00 | 0.00 | 0.00 |
| 2,014 | 322,645.73 | 47,916.26 | 39,930.22 | 31,912.23 |
| 2,015 | 325,881.86 | 89,125.68 | 75,668.96 | 62,560.11 |
| 2,016 | 329,150.46 | 124,639.11 | 107,618.41 | 91,527.82 |
| 2,017 | 332,451.84 | 155,315.81 | 136,160.95 | 118,584.07 |
| 2,018 | 335,786.33 | 181,886.21 | 161,655.05 | 143,629.98 |
| 2,019 | 339,154.27 | 204,971.23 | 184,433.02 | 166,659.68 |
| 2,020 | 342,555.98 | 225,098.69 | 204,800.09 | 187,730.70 |
| 2,021 | 345,991.82 | 242,717.28 | 223,034.50 | 206,942.02 |
| 2,022 | 349,462.12 | 258,208.46 | 239,388.31 | 224,417.78 |
| 2,023 | 352,967.22 | 271,896.51 | 254,088.54 | 240,295.53 |
| 2,024 | 356,507.48 | 284,057.12 | 267,338.77 | 254,717.85 |
| 2,025 | 360,083.25 | 294,924.67 | 279,320.78 | 267,826.43 |
| 2,026 | 363,694.89 | 304,698.46 | 290,196.28 | 279,758.13 |
| 2,027 | 367,342.75 | 313,547.92 | 300,108.72 | 290,642.43 |
| 2,028 | 371,027.20 | 321,617.15 | 309,184.93 | 300,599.93 |
| 2,029 | 374,748.60 | 329,028.65 | 317,536.83 | 309,741.54 |
| 2,030 | 378,507.33 | 335,886.65 | 325,262.89 | 318,168.31 |
| 2,031 | 382,303.76 | 342,279.75 | 332,449.63 | 325,971.56 |
| 2,032 | 386,138.26 | 348,283.35 | 339,172.90 | 333,233.22 |
| 2,033 | 390,011.23 | 353,961.59 | 345,499.10 | 340,026.46 |
| 2,034 | 393,923.04 | 359,369.03 | 351,486.24 | 346,416.24 |
| 2,035 | 397,874.09 | 364,552.13 | 357,184.98 | 352,460.04 |
| 2,036 | 401,864.77 | 369,550.43 | 362,639.47 | 358,208.53 |
| 2,037 | 405,895.47 | 374,397.58 | 367,888.18 | 363,706.25 |
| 2,038 | 409,966.60 | 379,122.26 | 372,964.56 | 368,992.22 |

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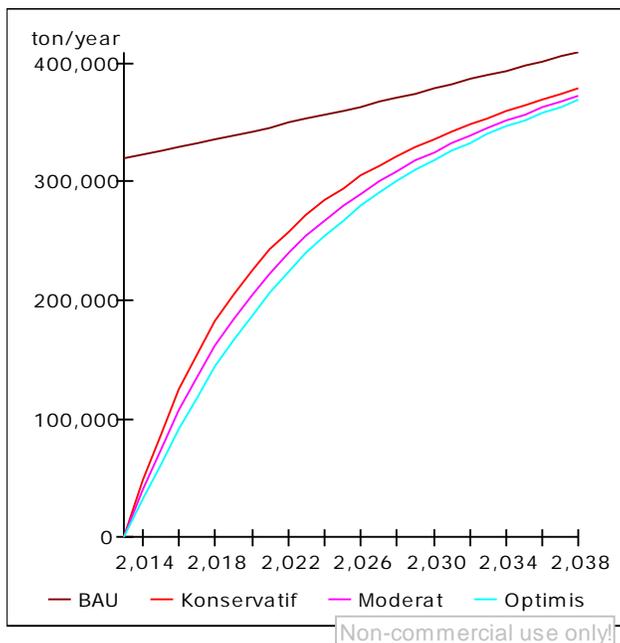


Figure 2. Scenario of Decreasing BOD Pollution Load through Reduction of Household Wastewater

Waste Water Reclamation or Recycling (R2)

BOD pollution load of waste water generation without management at the beginning of the simulation in 2013 was 319,441.73 tons, in 2017 it increased by 332.451.84 tons and continued to increase along with the increase in population, until 2038 or at the end of the simulation reached 409,996.6 tons. The BOD pollution load has decreased with the management through the stages of reducing and treating wastewater. Decreasing BOD pollution load by reducing it then continued with wastewater treatment reaching 48.63% from unmanaged conditions or BAU at the end of the simulation in 2038. Although the BOD pollution load has decreased but in quantity has increased with increasing numbers population. Therefore, there is a need for policy intervention to continuously reduce the BOD pollution load that enters the environmental media.

Policy interventions to reduce BOD pollution load are carried out by creating a scenario of moderate conservative and optimistic conservative. Moderate conservative conditions were able to slow the increase in BOD pollution load to 198,091.38 tons at the end of the simulation in 2038 or be able to reduce pollution load by 5.95% from conservative conditions. BOD pollution load with a optimistic conservative scenario at the beginning of the simulation in 2013 amounted to 25,027.38 tons, 2017 increased to 80,214.4 tons and at the end of the simulation in 2038 reached 180,083.07 tons. The decrease in pollution load is 14.52% of conservative conditions or 9.57% of moderate conservative conditions. To be clear, a simulation of a wastewater treatment scenario can be seen in Table 4 and Figure 3.

Decreasing BOD pollution load through wastewater treatment activities is largely determined by available processing infrastructure, technology or processing systems and capacity or capacity of WWTPs. The greater the capacity of the WWTP, the greater the number of house connections that can be accessed. Likewise, the better the performance of WWTPs,

the lower the BOD pollution load will increase. Based on Figure 2 shows that with the construction of the Losari WWTP with a capacity of 14,405 SR, the decrease in BOD pollution load began to decline in 2021 and reached the lowest decrease in BOD pollution load in 2024 for the optimistic conservative scenario. But the expansion in 2025 has increased again as the population increases but the increase is slower than the conservative and moderate conservative scenario.

Table 4. Scenario of Decreasing the Load of BOD Pollution through Household Waste Water Treatment

| (ton/year) | | | | |
|------------|------------|-------------|------------|------------|
| year | BAU | KOnservatif | Moderat | Optimis |
| 2,013 | 319,441.73 | 0.00 | 0.00 | 0.00 |
| 2,014 | 322,645.73 | 26,620.03 | 25,752.02 | 25,027.38 |
| 2,015 | 325,881.86 | 49,514.05 | 47,764.23 | 46,290.54 |
| 2,016 | 329,150.46 | 69,243.65 | 66,607.64 | 64,735.68 |
| 2,017 | 332,451.84 | 86,286.18 | 82,852.91 | 80,214.40 |
| 2,018 | 335,786.33 | 101,047.45 | 96,679.07 | 93,504.06 |
| 2,019 | 339,154.27 | 113,872.41 | 108,444.13 | 104,286.29 |
| 2,020 | 342,555.98 | 125,054.28 | 118,663.02 | 112,921.32 |
| 2,021 | 345,991.82 | 134,842.34 | 127,950.84 | 121,759.73 |
| 2,022 | 349,462.12 | 143,448.52 | 136,117.17 | 128,303.14 |
| 2,023 | 352,967.22 | 151,052.96 | 143,073.30 | 133,671.12 |
| 2,024 | 356,507.48 | 157,808.82 | 149,201.00 | 138,300.31 |
| 2,025 | 360,083.25 | 163,846.32 | 154,909.18 | 142,891.00 |
| 2,026 | 363,694.89 | 169,276.18 | 160,042.87 | 146,902.74 |
| 2,027 | 367,342.75 | 174,192.53 | 164,691.05 | 149,679.94 |
| 2,028 | 371,027.20 | 178,675.41 | 168,929.41 | 152,768.14 |
| 2,029 | 374,748.60 | 182,792.90 | 172,822.30 | 156,288.61 |
| 2,030 | 378,507.33 | 186,602.88 | 176,424.46 | 159,546.16 |
| 2,031 | 382,303.76 | 190,154.58 | 179,782.44 | 162,582.88 |
| 2,032 | 386,138.26 | 193,489.90 | 182,935.83 | 165,434.59 |
| 2,033 | 390,011.23 | 196,644.47 | 185,918.32 | 168,131.75 |
| 2,034 | 393,923.04 | 199,648.59 | 188,758.58 | 170,700.29 |
| 2,035 | 397,874.09 | 202,528.08 | 191,481.01 | 173,162.26 |
| 2,036 | 401,864.77 | 205,304.89 | 194,106.36 | 175,536.45 |
| 2,037 | 405,895.47 | 207,997.74 | 196,652.33 | 177,838.85 |
| 2,038 | 409,966.60 | 210,622.56 | 199,133.97 | 180,083.07 |

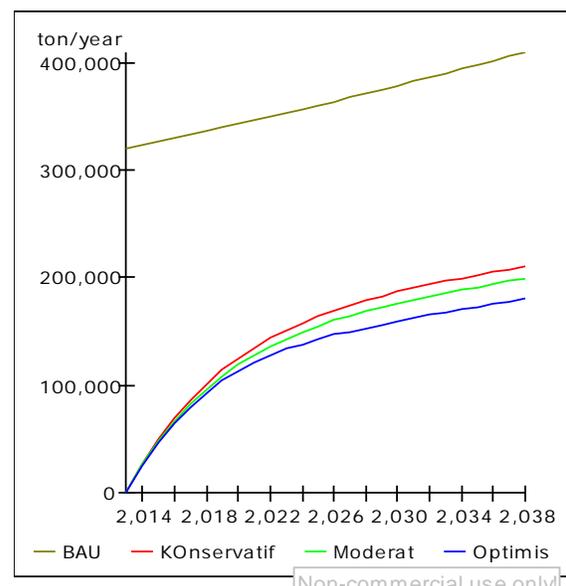


Figure 3. Scenario of Decreasing BOD Pollution Load through Waste Water Treatment

If the WWTP infrastructure is available, the important thing that needs attention is community participation in accessing WWTP infrastructure. One way to increase community participation in connecting houses or connecting to wastewater pipelines is to increase public awareness through counseling.

Waste Water Reuse (R3)

The decrease in BOD pollution load has decreased after gradual management through reduction and treatment of wastewater. The reduction in BOD pollution load can still be reduced by utilizing treated wastewater. The BOD pollution load from the BAU condition decreased by 71.28% after utilization. A decrease in BOD pollution load can be reduced through policy intervention. Policy intervention is carried out by making a moderate conservative and optimistic conservative scenario.

Moderate conservative conditions can reduce BOD pollution load by 1,064.8 tons in 2015, 2017 increased to 5,124.47 tons and at the end of the simulation reached 79,248.87 tons or a decrease of 32.69% from conservative conditions. The conservative optimistic condition is able to slow the increase in BOD pollution load until 2025, namely after the functioning of the Losari WWTP. But in 2026 there was an increase along with population growth, so that at the end of the simulation in 2038 it reached 62,259.55 tons or a decrease of 21.44% from moderate conservative conditions and 47.12% from conservative conditions. To be clear, a scenario simulation of waste water utilization can be seen in Table 5 and Figure 4.

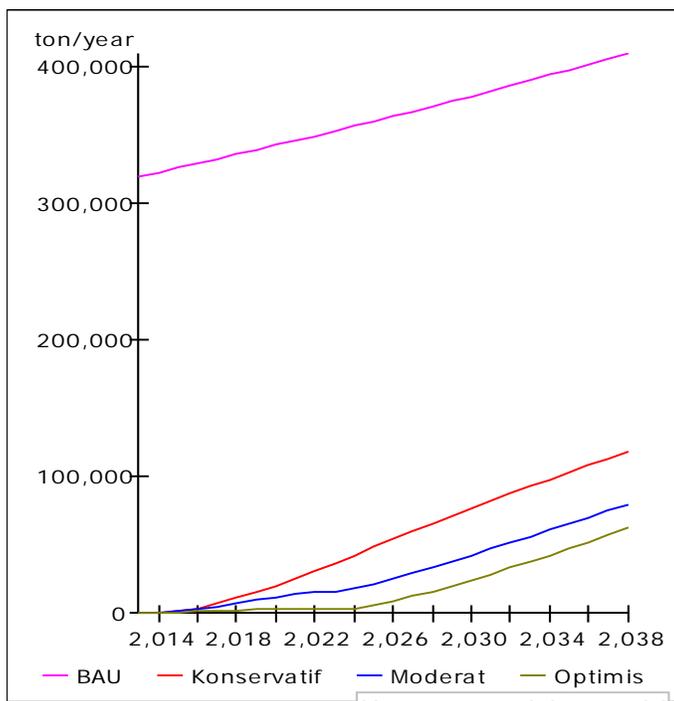


Figure 4. Scenario of Decreasing the Load of BOD Pollution through Household Waste Water Reuse

Utilization of waste water after processing or reclaim is an easy way to reduce the BOD pollution load. Processed wastewater can be used to water the garden or plants, water the street or yard and fire extinguishers [59]. Another designation of treated wastewater is for raw water drinking, injected into soil or ground

Table 5. Scenario of Decreasing BOD Pollution Load through Household Waste Water Reuse

| year | (ton/year) | | | |
|-------|------------|-------------|-----------|-----------|
| | BAU | Konservatif | Moderat | Optimis |
| 2,013 | 319,441.73 | 0.00 | 0.00 | 0.00 |
| 2,014 | 322,645.73 | 0.00 | 0.00 | 0.00 |
| 2,015 | 325,881.86 | 1,331.00 | 1,064.80 | 479.16 |
| 2,016 | 329,150.46 | 3,740.15 | 2,859.02 | 1,120.50 |
| 2,017 | 332,451.84 | 7,015.33 | 5,124.47 | 1,715.50 |
| 2,018 | 335,786.33 | 10,978.87 | 7,666.15 | 2,141.97 |
| 2,019 | 339,154.27 | 15,482.30 | 10,340.53 | 2,928.97 |
| 2,020 | 342,555.98 | 20,401.81 | 11,459.40 | 2,638.28 |
| 2,021 | 345,991.82 | 25,634.43 | 13,857.59 | 2,468.69 |
| 2,022 | 349,462.12 | 31,094.82 | 15,014.88 | 2,702.64 |
| 2,023 | 352,967.22 | 36,712.51 | 15,804.52 | 2,965.86 |
| 2,024 | 356,507.48 | 42,429.53 | 17,831.46 | 2,592.55 |
| 2,025 | 360,083.25 | 48,198.50 | 21,562.20 | 5,443.11 |
| 2,026 | 363,694.89 | 53,980.89 | 25,471.99 | 8,625.27 |
| 2,027 | 367,342.75 | 59,745.65 | 29,537.89 | 12,111.73 |
| 2,028 | 371,027.20 | 65,468.00 | 33,738.01 | 15,872.93 |
| 2,029 | 374,748.60 | 71,128.37 | 38,051.70 | 19,878.25 |
| 2,030 | 378,507.33 | 76,711.59 | 42,459.59 | 24,097.05 |
| 2,031 | 382,303.76 | 82,206.16 | 46,943.74 | 28,499.35 |
| 2,032 | 386,138.26 | 87,603.58 | 51,487.59 | 33,056.41 |
| 2,033 | 390,011.23 | 92,897.90 | 56,075.97 | 37,741.04 |
| 2,034 | 393,923.04 | 98,085.22 | 60,695.11 | 42,527.88 |
| 2,035 | 397,874.09 | 103,163.39 | 65,332.55 | 47,393.52 |
| 2,036 | 401,864.77 | 108,131.63 | 69,977.11 | 52,316.59 |
| 2,037 | 405,895.47 | 112,990.29 | 74,618.82 | 57,277.72 |
| 2,038 | 409,966.60 | 117,740.66 | 79,248.87 | 62,259.55 |

water, agricultural irrigation, and other suitable designation. However, the waste water that is used is very small at 5% because some people do not want to use it by reason of environmental impacts and health risks [60], social cultural acceptance [61], even religion [23]. Therefore, it is necessary to raise awareness for the community to utilize treated wastewater. Awareness can be done by providing counseling. Scenario simulation results on the use of wastewater in optimistic conservative conditions according to Figure 3 shows that 5% of the community uses wastewater to watering the road or yard, 5% for watering the garden or plants and 3% for fire hydrants, while for reinjection into the ground or recharge well 0%.

Strategy of Household Wastewater Management

Based on the conditions of various scenarios and controlled input simulations, it can be illustrated the behavior conditions of each sub-model in the future. Sensitivity to scenarios is obtained from conservative variables. Comparison between conservative conditions and optimistic conservative and moderate conservative conditions can be seen in Table 6

Table 6. Variable Sensivity in Scenarios.

| Simulation Variable | Konservative | Moderate | Optimistic |
|--------------------------------|--------------|------------|------------|
| Reduction | 379.122,26 | 372.964,56 | 368.992,22 |
| Recycling | 210.622,56 | 199.133,97 | 180.083,07 |
| Reusing | 117.740,66 | 79.248,87 | 62.259,55 |
| Simulation Variable | Percentage | | O/M |
| | Moderate | Optimistic | |
| Reduction | 1,62 | 2,67 | 1,65 |
| Recycling | 5,45 | 14,50 | 2,66 |
| Reusing | 32,69 | 47,12 | 1,44 |
| Sensitivity Value of O/M ratio | | | 1,91 |

Based on the O / M ratio sensitivity value, the average value of 1.91 is obtained. The optimistic conservative condition should be

a concern in determining wastewater management policies, especially at the stage of wastewater treatment which has a value that is 2 times greater than moderate conservative conditions. Waste water treatment is more effective in reducing the BOD pollution load that will enter the environmental media compared to the reduction of wastewater and utilization or reuse of waste water.

Some of the problems in household wastewater treatment include: 1) relatively small capacity of WWTP, average 45 home connections and limited land, 2) WWTPs performance is still low at 43.75% or can reduce BOD pollution load by 56.25%, and 3) wastewater treatment has not been carried out in an integrated manner.

Increased Capacity of WWTPs

The small capacity of WWTP is only able to process BOD pollution loads of 1.1826 tons / year per unit WWTP. As a result of the small capacity of WWTP, the processing of unprocessed BOD pollution load in 2017 amounted to 153,397.66 tons and the number of WWTPs was needed at 129,712 units and at the end of the simulation in 2038 needed 316,624 WWTP units. The increase in WWTP at the end of the simulation in 2038 amounted to 231.453 units so that there was a difference in the needs of WWTPs as many as 85,171 units.

According to the Directorate of PPLP Ministry of Public Works (2016), that the construction of WWTP anaerobic system with 50 home connection services requires land of 20 m². Limited land in urban areas resulted in WWTP facilities being built under road infrastructure or other public infrastructure.

Based on the projected needs and accretion of WWTP, another problem that will arise is the problem of operational and maintenance of WWTP facilities in the community. The results of research in the field show that up to 2017 the number of WWTPs that have been built is 131 units. Data obtained from the [62], showed that of the 131 units of WWTP that had been built, there were 60 units in good condition, 30 units were lightly damaged, and 37 units were severely damaged or not functioning. The data shows that 51.15% of WWTPs that have been built do not function properly physically, but the quality of the effluent produced is <10% which meets the quality standards of domestic wastewater.

The strategy that can be done to solve the problem of the large number of WWTPs needed and the addition of WWTPs and the number of WWTPs that are not functioning properly is to increase the capacity of WWTPs. As a comparison of the Losari WWTP as an urban WWTP with the number of house connections of 14.405 only able to process BOD pollution loads of 5,582.5 tons per year at the start of operations in 2021 and 12,696.51 tons per year after full operation in 2025. WWTP Losari only able to serve 2.974% of the population of Makassar City. Based on the description of Losari WWTP, to process all wastewater generated by residents of Makassar City, Indonesia, 34 WWTPs are needed. The operation and maintenance of WWTPs is 34 units if it is considered to be too heavy, so the WWTP capacity should be increased so that one unit of WWTP can serve 5% of the population of Makassar City, Indonesia. The number of WWTP units needed if the capacity can serve 5% of the population of Makassar City, then only 20 units of WWTP are needed but must also take into account the increase in pollution load due to the increase in population.

Effectiveness of WWTP Performance

The effectiveness of WWTP performance is influenced by several factors, among others: technology choices of WWTP, maintenance and operation of WWTPs. Based on observations in the field, the WWTP system that has been built in Makassar City is only one type, the anaerobic system. According to [41], that wastewater with high organic matter content can be processed with an anaerobic system.

According to [31] that WWTP can reduce BOD pollution load by 58%. This is not much different from the data obtained in this study that is equal to 56.25%. But it needs to be understood that the communal WWTPs that were sampled were the best WWTPs that were chosen purposively. According to [11], [63], [64], [65], [66], [67], that the septic tank is very good at maximum operation can reduce the BOD pollution load by 60%.

The strategy to maximize the performance of WWTPs to reduce pollution load can be done by: carrying out maintenance of WWTP on a regular basis, operating WWTP continuously so that the microorganisms contained in the reactor as breeding decomposers are not disturbed, avoiding waste water flow into the WWTP network containing ingredients chemicals that can kill microorganisms, such as cleaning agents or anti-septic substances, avoid flowing into the WWTP network of high-temperature wastewater. In addition, it is necessary to look for alternative WWTP systems or the construction of WWTPs in the future using a WWTP system that is different from the existing WWTP system. An example of WWTP system that needs to be applied to maximize the decrease in BOD pollution load is the trickling filter system. The trickling filter system combines anaerobes and aerobes, where wastewater is initially treated with an anaerobic system and wastewater is spread to the top surface of the media with the distributor's arm rotating and water dripping down through the media layer. According to [39], that wastewater from the food industry can be processed using trickling filters, the typical value of organic loads for trickling filters is 0.5 kg BOD₅ per m³ day. The characteristics of food industry wastewater have similarities with household wastewater containing high organic matter.

Integrated Waste Water Management

Based on the sensitivity values in Table 6, it shows that wastewater treatment is more effective in reducing BOD pollution load because it has a 2 times greater ratio between optimistic and moderate sensitivity values. The data in Table 1 also shows that wastewater treatment can reduce pollution loads by up to 41.1% but with integrated wastewater treatment with reduction of wastewater and reuse of wastewater can reduce the BOD pollution load to reach 71.28%.

Waste water treatment requires investment costs for the construction of WWTP infrastructure, in addition it requires routine and regular operational and maintenance costs. Reduction of wastewater and reuse of waste water does not require facilities and infrastructure or costs, only the willingness and awareness is needed to reduce the BOD pollution load that will enter the environmental media. Therefore, the strategy is to arouse and build public awareness through counseling to reduce waste water and reuse waste water that has been treated.

IV. CONCLUSION

Management of household wastewater must be a series of activities which include reducing, processing and reusing waste water. The simulation results show that the stages of wastewater treatment can reduce BOD pollution load by 41.1% and the ratio sensitivity value between optimistic and moderate conditions is 2 times greater but if done in an integrated manner between reducing, processing and reusing wastewater can reduce the BOD pollution load up to 71.28%.

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The Effect of Information Technology - Based Game on Fifth Graders' Critical Thinking Skill

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Abstract- This study aims to describe the effect of information technology-based game media on critical thinking skill of fifth graders on social studies subject under the theme of the Indonesia's struggle for independence. The research subjects were 26 fifth graders of SDN Lakarsantri III/474 Surabaya, 2018/2019. The research subjects were divided into 2 groups of control and experimental groups. Data collection was carried out through tests, observations, and validation of learning devices with information technology-based game media. Information technology -based game media significantly affected students' critical thinking skill. This result is based on Normalized gain (N-gain) or Gain Score and t test. The results of the Gain score calculation for the experimental group indicated an increase in students' critical thinking skills of 0.81 (High). T test analysis resulted in the Sig. (2-tailed) of 0,000 with a significant level of 0.05. in conclusion, information technology-based game media had a significant effect on students' critical thinking ability.

Index Terms- Game, Critical Thinking Ability

I. INTRODUCTION

Improvement of learning quality is developed with the right learning strategies that encourage students to be active in learning activities. Students' activitiveness in the learning process is expected to improve their critical thinking skills. In this case, the role of the teacher in determining learning strategies becomes highly important to make learning process run well. Learning process is a process in which there is an activity of interaction between teacher-student and reciprocal communication that takes place in an educative situation to achieve learning goals. Stated that learning resources are all things that contain information, ideas, concepts, and can facilitate, concretize, and simplify material so that students can understanding learning material faster and easier [1]. A conducive learning environment is able to create an effective and efficient learning process by utilizing everything that can channel messages and deliver messages from sources in a planned manner in the form of media.

Media is all forms of intermediaries that are used by humans to convey or spread ideas and the expressed ideas reach the intended recipient [2]. Games are structured or semi-structured activities that are usually aimed at entertainment and can sometimes be used as educational facilities [3]. Games containing educational content are usually known as educational games. This game aims to attract students' interest in material. Information Technology (IT) is defined as any technology that can help

humans in creating, changing, storing, communicating and disseminating information. Information technology brings together high-speed computing and communication for data, voice and video. Examples of information technology in addition to personal computers are telephone, television, electronic household appliances, and modern handheld devices [4].

Critical thinking is an intellectual process that actively and skillfully conceptualizes, implements, analyzes, synthesizes, and evaluates information collected or generated from observation, experience, reflection, reasoning or communication to guide beliefs or actions. Critical thinking requires effective communication and the ability to solve problems as well as a commitment to overcome the potentials of the state of egocentrism and sociocentrism of the perpetrators themselves. Interactive games developed as learning media can improve students' critical thinking skills. Based on the observations of researchers in January 2019 towards fifth grade students at Lakarsantri III Elementary School in Social Studies learning on theme 7, teachers still used conventional learning with the lecture method. Students were not active in the class because they only saw and listened to the lecture teacher during learning. From this observation, the researchers chose this problem to be used as an initial source of research to create new breakthroughs in the application of learning media that are in line with technological developments in the form of information technology-based game to improve critical thinking skills of elementary school students.

II. IDENTIFY, RESEARCH AND COLLECT IDEA

The research subjects were 26 fifth grade students of SDN Lakarsantri III/474 Surabaya, 2018/2019. The research subjects were divided into 2 groups. The first group is the control group, i.e a group of students who did not receive information technology-based game media. This group comprised 13 students (attendance number 1-13). The second group is experimental group, i.e a group of students who received information technology-based game media. This consisted of 13 students (attendance number 14-26). The study was conducted by testing information technology-based game media with Nonequivalent Control Group Design. This research was conducted by comparing groups that did not use information technology-based game media with group that used information technology-based game media.

III. RESULTS AND DISCUSSION

A summary of the results of lesson plan validation, Game Media, and Learning Outcomes Test that has been performed by

validator 1 (V1) and validator 2 (V2) is presented in the following table.

Table 1. Recapitulation of the Validation of Lesson plan, Game Media, and Learning Outcomes Test

| No. | Learning Media | Score | | Avergae | Category | R (%) |
|---------|------------------------|-------|------|---------|----------|-------|
| | | V1 | V2 | | | |
| 1. | Lesson plan | 3,1 | 3,3 | 3,2 | Valid | 80,0 |
| 2. | Game media | 3,7 | 3,6 | 3,65 | Valid | 91,3 |
| 3. | Learning Outcomes Test | 3,3 | 3,4 | 3,35 | Valid | 83,8 |
| Average | | 3,37 | 3,43 | 3,4 | Valid | 85,03 |

Table 1 shows that the two validators concluded that lesson plan, Game Media, and Learning Outcomes Test were valid and suitable for use in learning information technology-based game media. The efficiency or practicality of information technology-based game media in improving students' critical thinking skills can be assessed through classical completeness assessment shown in table 2.

Table 2. Pretest and Post-test scores of Control Group Students

| No. | Name | Pretest | Result | Posttest | Result |
|--|------|---------|--------|----------|--------|
| 1 | AI | 50 | Fail | 80 | Pass |
| 2 | AYD | 50 | Fail | 80 | Pass |
| 3 | AZR | 55 | Fail | 80 | Pass |
| 4 | ARE | 45 | Fail | 80 | Pass |
| 5 | AIS | 40 | Fail | 70 | Fail |
| 6 | CZS | 70 | Fail | 90 | Pass |
| 7 | DOW | 45 | Fail | 70 | Fail |
| 8 | DAP | 60 | Fail | 80 | Pass |
| 9 | DA | 55 | Fail | 80 | Pass |
| 10 | FMG | 60 | Fail | 90 | Pass |
| 11 | FAF | 45 | Fail | 80 | Pass |
| 12 | KA | 50 | Fail | 80 | Pass |
| 13 | KHD) | 60 | Fail | 100 | Pass |
| Total | | 685 | | 1060 | |
| Classical Average | | 52,7 | | 81,5 | |
| The percentage of students who passed the test | | 0 | | 84,6 | |
| The percentage of students who failed | | 100 | | 15,4 | |

Table 2 also shows the posttest results of students who experienced a significant increase. A total of 11 (84.6%) students scored above 75 and passed the test. Only 2 (15.4%) students scored below 75 and failed the test.

Table 3. Pretest and Post-test scores from experimental group students

| No. | Name | Pretest | Result | Posttest | Result |
|-----|------|---------|--------|----------|--------|
| 14 | MFA | 45 | Fail | 80 | Pass |
| 15 | MA | 60 | Fail | 90 | Pass |
| 16 | MRA | 45 | Fail | 90 | Pass |

| | | | | | |
|--|-----|------|------|------|------|
| 17 | MGA | 50 | Fail | 100 | Pass |
| 18 | MAH | 60 | Fail | 90 | Pass |
| 19 | NCL | 60 | Fail | 90 | Pass |
| 20 | NFI | 50 | Fail | 100 | Pass |
| 21 | RSA | 40 | Fail | 80 | Pass |
| 22 | RAK | 45 | Fail | 90 | Pass |
| 23 | RDA | 40 | Fail | 80 | Pass |
| 24 | RR | 75 | Pass | 100 | Pass |
| 25 | SAR | 70 | Fail | 100 | Pass |
| 26 | VNP | 75 | Pass | 100 | Pass |
| Total | | 715 | | 1190 | |
| Classical Average | | 55 | | 91,5 | |
| The percentage of students who passed the test | | 15,4 | | 100 | |
| The percentage of students who failed the test | | 84,6 | | 0 | |

Table 3 shows the posttest results of students who experienced a significant increase. A total of 13 (100%) students in the experimental group scored above 75 and passed the test. This means that the information technology based- game was efficiently applied on social studies subject with the theme of Indonesia’s struggle for independence in fifth graders of elementary school. The influence of information technology-based game media on students’ critical thinking skills can be determined by assessing the effectiveness of the game media and through the t test.

Table 4. Improvement of Critical Thinking Ability of Experimental Group

| No. | Name | Score | | N. Postes - N.Prestes | N. Maks. - N.Prestes | < G > | Improvement Category |
|-------------------|------|---------|----------|--------------------------|-------------------------|-------|-------------------------|
| | | Pretest | Posttest | | | | |
| 1 | AI | 50 | 80 | 30 | 50 | 0.6 | Moderate |
| 2 | AYD | 50 | 80 | 30 | 50 | 0.6 | Moderate |
| 3 | AZR | 55 | 80 | 25 | 45 | 0.6 | Moderate |
| 4 | ARE | 45 | 80 | 35 | 55 | 0.6 | Moderate |
| 5 | AIS | 40 | 70 | 30 | 60 | 0.5 | Moderate |
| 6 | CZS | 70 | 90 | 20 | 30 | 0.7 | High |
| 7 | DOW | 45 | 70 | 25 | 55 | 0.5 | Moderate |
| 8 | DAP | 60 | 80 | 20 | 40 | 0.5 | Moderate |
| 9 | DA | 55 | 80 | 25 | 45 | 0.6 | Moderate |
| 10 | FMG | 60 | 90 | 30 | 40 | 0.8 | High |
| 11 | FAF | 45 | 80 | 35 | 55 | 0.6 | Moderate |
| 12 | KA | 50 | 80 | 30 | 50 | 0.6 | Moderate |
| 13 | KHD | 60 | 100 | 40 | 40 | 1.0 | Moderate |
| Total | | 685 | 1060 | | | | |
| Avergae | | 52,7 | 81,5 | | | | |
| The highest score | | 70 | 100 | | | | |
| The lowest score | | 40 | 70 | | | | |

Calculation of G Score for Control is as follows:

$$G \text{ score} = \frac{(81,5 - 52,7)}{(100 - 52,7)} = \frac{28,8}{47,3} = 0,61$$

The results of the Gain score calculation for the control group showed an increase in students' critical thinking skills of 0.61 (moderate). This means that conventional learning has the effect of increasing the critical thinking skills of class V students on the concept of the material of Indonesian's struggle for independence with moderate level of improvement

Table 5. Improved Critical Thinking Abilities of the experimental group

| No. | Name | Score | | N.Postes - N.Pretes | N. Maks. - N.Pretes | < G > | Improvement Category |
|-------------------|------|---------|----------|------------------------|------------------------|-------|-------------------------|
| | | Pretest | Posttest | | | | |
| 14 | MFA | 45 | 80 | 35 | 55 | 0.6 | Moderate |
| 15 | MR | 60 | 90 | 30 | 40 | 0.8 | High |
| 16 | MRA | 45 | 90 | 45 | 55 | 0.8 | High |
| 17 | MGA | 50 | 100 | 50 | 50 | 1.0 | High |
| 18 | MAH | 60 | 90 | 30 | 40 | 0.8 | High |
| 19 | NCL | 60 | 90 | 30 | 40 | 0.8 | High |
| 20 | NFI | 50 | 100 | 50 | 50 | 1.0 | High |
| 21 | RSA | 40 | 80 | 40 | 60 | 0.7 | High |
| 22 | RAK | 45 | 90 | 45 | 55 | 0.8 | High |
| 23 | RDA | 40 | 80 | 40 | 60 | 0.7 | High |
| 24 | RR | 75 | 100 | 25 | 25 | 1.0 | High |
| 25 | SAR | 70 | 100 | 30 | 30 | 1.0 | High |
| 26 | VNP | 75 | 100 | 25 | 25 | 1.0 | High |
| Total | | 715 | 1190 | | | | |
| Average | | 55 | 91,5 | | | | |
| The highest score | | 75 | 100 | | | | |
| The lowest score | | 40 | 80 | | | | |

The calculation of G Score for the Experiment Group is as follows:

$$G \text{ score} = \frac{(91,5 - 55,0)}{(100 - 55,0)} = \frac{36,5}{45,0} = 0,81$$

The results of the Gain score calculation for the experimental group showed an increase in students' critical thinking skills of 0.81 (High). This means that learning with information technology-based game media could improve the critical thinking skills of class V students on the concept of Indonesia's struggle for independence with a high level of improvement.

Normality test is performed to test whether the sample being studied comes from a normal distribution. The test was carried out by Liliefors test with the results shown in table 6 and table 7.

Table 6. Results of Pretest Normality Test for Control and Experimental Group

One-Sample Kolmogorov-Smirnov Test

| | | Pretest of control group | Pretest of experimental group |
|----------------------------------|----------------|--------------------------|-------------------------------|
| N | | 13 | 13 |
| Normal Parameters ^{a,b} | Mean | 52.69 | 55.00 |
| | Std. Deviation | 8.321 | 12.583 |
| Most Extreme Differences | Absolute | .165 | .193 |
| | Positive | .165 | .193 |
| | Negative | -.118 | -.117 |
| Test Statistic | | .165 | .193 |
| Asymp. Sig. (2-tailed) | | .200 ^{c,d} | .200 ^{c,d} |

- a. Test distribution is Normal.
- b. Calculated from data.
- c. Lilliefors Significance Correction.
- d. This is a lower bound of the true significance.

Table 6 shows the results of the normality test in the Control and Experiment Group, each of which had a significance value of 0.200. This value is far greater than the alpha value (α) = 0.05. In conclusion, students' pretest data in this study were normally distributed.

Table 7. Results of Postes Normality Test for Student of Control and Experimental Groups

One-Sample Kolmogorov-Smirnov Test

| | | PostesKK | PostesKE |
|----------------------------------|----------------|-------------------|-------------------|
| N | | 13 | 13 |
| Normal Parameters ^{a,b} | Mean | 81.54 | 91.54 |
| | Std. Deviation | 8.006 | 8.006 |
| Most Extreme Differences | Absolute | .345 | .239 |
| | Positive | .345 | .192 |
| | Negative | -.270 | -.239 |
| Test Statistic | | .345 | .239 |
| Asymp. Sig. (2-tailed) | | .148 ^c | .240 ^c |

- a. Test distribution is Normal.
- b. Calculated from data.
- c. Lilliefors Significance Correction.
- d. This is a lower bound of the true significance.

Table 7 shows that the normality test in the Control Group and Experimental Group had a significance value of 0.148 and 0.240, respectively. The values are far greater than the alpha value (α) = 0.05. In conclusion, students' posttest data in this study were normally distributed.

The data of homogeneity test results performed on the pretest and posttest scores of both groups are shown in tables 8 and 9.

Table 8. Pretest Homogeneity Test Results of Students in both groups ANOVA

| Experimental Group Pretest | | | | | |
|----------------------------|----------------|----|-------------|------|------|
| | Sum of Squares | df | Mean Square | F | Sig. |
| Between Groups | 350.000 | 5 | 70.000 | .316 | .888 |
| Within Groups | 1550.000 | 7 | 221.429 | | |
| Total | 1900.000 | 12 | | | |

Table 8 shows the results of the homogeneity test on the pretest scores of both groups is Fcount (0.316) <F-table (1.782) with significance of 0.888. This is far greater than the alpha value (α) = 0.05. In conclusion, the pretest data of students in the two groups in this study were homogeneous.

Table 9. Homogeneity of Postes Test Results for Students of Control and Experimental Groups ANOVA

| Experimental Group Pretest | | | | | |
|----------------------------|----------------|----|-------------|------|------|
| | Sum of Squares | Df | Mean Square | F | Sig. |
| Between Groups | 181.731 | 3 | 60.577 | .928 | .466 |
| Within Groups | 587.500 | 9 | 65.278 | | |
| Total | 769.231 | 12 | | | |

Table 9 shows the results of the homogeneity test on the posttest scores of the students of the two groups with F-count (0.928) <F-table (1.782) and significance of 0.466. This value is greater than alpha value (α) = 0.05. In conclusion, posttest data of students in both groups in this study were homogeneous. Students' posttest hypothesis test in both groups is shown in table 10.

Table 10. t Test Results

| | Test Value = 0 | | | | | |
|-----------------------------|----------------|----|-----------------|-----------------|---|-------|
| | t | Df | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference | |
| | | | | | Lower | Upper |
| Control Group Posttest | 36.719 | 12 | .000 | 81.538 | 76.70 | 86.38 |
| Experimental Group Posttest | 41.223 | 12 | .000 | 91.538 | 86.70 | 96.38 |

From the results of students' posttest data analysis in both groups the value of Sig. (2-tailed) was 0,000 with a significant level of 0.05. The value is 0,000 <0,05 means Ho is rejected and Ha is accepted.

The results of this study concluded that information technology-based game had a significant effect on students' critical thinking skills which empirically supported the results of Anggraini et al. (2016), Panggayudi et al. (2017), and Wulandari et al. (2017). Anggraini et al. (2016) concluded that students were more enthusiastic and more motivated to study with the use of

educational games. Approach with game in learning can stimulate emotions, intellectual, and psychomotor.

A research by Panggayudi et al. (2017) concluded that culture-based educational game media for learning to recognize numbers in early childhood was valid, practical, and effective with an average percentage of 88.23%. The contribution of the success of the use of educational game learning media to the trials was 90.44% small scale and the 85.19% for large scale. Wulandari et al. (2017) concluded that interactive multimedia loaded with educational games fitted to be used as learning media in schools. In conclusion, information technology-based game media have a

significant effect on the critical thinking skills of fifth grade elementary school students on social studies subjects with the theme of Indonesia's struggle for independence.

IV. CONCLUSIONS AND SUGGESTIONS

Information technology- based game media significantly affected students' critical thinking skill. This result is based on Normalized gain (N-gain) or Gain Score and t test. The results of the Gain score calculation for the experimental group showed an increase in students' critical thinking skills of 0.81 (High). T test analysis resulted in the Sig. (2-tailed) of 0,000 with a significant level of 0.05. In conclusion, information technology-based games had a significant effect on students' critical thinking ability. Based on the results of the research and conclusions, teachers are expected to use interesting learning media that students are motivated to take part in learning; for example using game media to improve students' learning outcomes and critical thinking skills. Future research can use the results of this study as a reference source for conducting further research on information technology-based game media.

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From formation to publication – Design of standards for Sinhala script

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Abstract-The international scope of computing, information interchange, and electronic publishing created a need for a worldwide character encoding scheme. In this paper, we examine some of the issues involved in the process of standardization of character codes primarily for the 8-bit machine and subsequently for the 16-bit code environments in the context of Sinhala language and scripts. We examined some of the major issues involved in machine representation of textual information in graphical and phonetic approach for Sinhala scripts. A comprehensive evaluation of some of the possible representation is also presented. The design philosophy of Sri Lanka Sinhala Standard Code for Information Interchange (SLASCII) based on ISO 646 has been considered along with the phonetic model of UCS/UNICODE and ISO 10646 philosophies. The character codes require fonts that provide visual images—glyphs—corresponding to the codes in both 8 bits and UCS/UNICODE, it should have appeared on the screen or paper in the language of Sinhala, Pali, and Sanskrit using this script with an acceptable and in a comprehensive manner. This paper discusses some of the design guidelines concerning standardization in detail at the character level. It is examined in the context of SLASCII and SLS 1134:1996 and philosophy behind the design of ISO 10646 proposals.

Index Terms- Sinhala Script, Unicode, Character Encoding,

I. INTRODUCTION

In the modern Information age, the exchange of information can happen only if we are able to communicate effectively in any language and script of the world. This in turn demands easy entry of **linguistic information into the computers**, easy way of **communicating with each other** through devices, easy way of **rendering language information** on different devices to suit to individual aesthetics, easy way of **adapting already existing software** where large investment has been made and also easy way of **adapting one standard to another** through solid theoretical manner. These require standardization at various levels.

The early language coding schemes of Sri Lanka [1] can be classified into the following two major categories:

(i) **Single language user category**: Here, it is considered the efficient way of inputting the text, representing the text internally for processing, and easy way of rendering it on various output devices. But, the preparation of multilingual

text is of not being concerned. Other than the control of escape sequence positions in the code table, the rest of the code positions will be used to assign the language scripts in the design. American Standard Code for Information Interchange (ASCII) and some of the national coding schemes such as Sri Lanka Standard Code for Information Interchange (SLASCII) [2] are examples for this class. For example, SLASCII caters the Sinhala scripts during the late-1980s and the aim was to develop an 8-bit code to fill the positions from A0 to FF in the single byte ISO 8859 similar code table based on the keyboard's character set.

(ii) **Multi-lingual user category**: Here an attempt is made to exploit common features of the language/scripts and the special needs are dealt with separately. The preparation of the multilingual document, multilingual dictionaries, and transliteration from one language to another are important aspects for consideration. SLS 1134:1996 phonetic model design for the Sinhala character code [3] has replaced the older typewriter metaphor concept from the previous SLASCII standard [4]. It could also be made universally applicable to all languages (UCS/UNICODE or International Standards Organization (ISO) 10646 come under the universal class).

In the multilingual user category, the 8-bit coding is divided into two pages based on the most significant bit (MSB) being 0 or 1. The first page (MSB=0) is left as the ASCII page, and the second page (MSB=1) is used to insert the Sinhala script code. This leaves us with six columns (96 symbols), and it is possible to give an explicit presentation to vowels, in addition to vowel signs and consonants. The first two columns of the second page are reserved for ASCII compatibility as per the recommendations of the ISO/IEC-8859-1.

Rare attempts have been made for standardizing the task of transliteration or translation. However, a good deal of effort has been made in standardizing character codes for different languages. The ISO has come up with a Universal Coded Character Set (UCS) encompassing all living scripts of the globe. On the other hand, UNICODE developed by Unicode Consortium uses a fixed two-byte code to represent all the world's normal text characters for electronic information processing.

II. BACKGROUND, OBJECTIVES AND LITERATURE SURVEY

A. Background

The initiative described in this paper was started in the late 1980s by the University of Colombo and subsequently, standardization activities started in early 1990s by the Council for Information Technology (CINTEC) and thereafter these activities continued by the Information and Communications Technology Agency (ICTA). Our objective was to ascertain why the usage of Sinhala was so low and to take steps to increase its use. There are a number of criticisms and questions raised by individuals and groups of persons in regards to the development of Sinhala under Unicode environment too.

The Unicode block for Sinhala simply lists the encoding symbols and gives no guidance on implementation. The representational model for encoding Indic scripts in Unicode is described in the Standard [5], with sections describing details for each of the individual scripts. The first section, covering the *Devanagari* script, provides a much greater level of detail than do subsequent sections and is provided as a template on which other scripts are based on. One problem with this arrangement is that the Indic scripts are not all the same; in fact, there are some very significant differences between scripts. Secondly, particular problems resulting from differences are that it is not clear how certain encoding formalisms specified are to be applied in other Indic scripts, and that there are common problems found in other scripts that are not addressed in the section on *Devanagari*. Thirdly, while listing the symbols may be sufficient for encodings in which each symbol is assigned a code, it is not possible to implement Sinhala in Unicode without additional information. Fourthly, the experience gained from 8-bit implementation active from 1989, addressed most of the scripts level problem did not consider at all for the formation of Sinhala in Unicode. As explained by Peter Constable [6], it is not correct to assume that Devanagari is representative of other Indic languages. The encoding of Sinhala in Unicode 12.1 was described just in two pages [5]; a casual reader gets the impression that the implementation of Sinhala Unicode is incomplete or not complicated. Further, it is not guided to sources of further information.

The Working Group formed by CINTEC in early 1990 published the working document and released this document to the public for comments [7] and subsequently modified document submitted to Sri Lankan Standard Institute (SLSI) [8] followed by sending to UNICODE consortium [9] for their consideration. As a result SLSI formed a first working group and developed specifications for encoding all valid constructs in the working document [10], is a revision to the SLS 1134:1996 standards [3], we believe that it is still not possible to represent not only contemporary Sinhala writing, but also classical writing including Pali and Sanskrit text written in Sinhala script. This paper describes the rendering and collating & sorting issues of the language scripts and thereafter, discusses some of the key issues concerning standardization at the character level.

B. Research Objectives

In this paper, after providing a brief background on Sinhala script, we describe the rendering and collating & sorting issues of the language scripts and thereafter, discuss some of the key

issues concerning standardization at the character level. In the context of SLASCII design, the philosophy behind the design of ISO/IEC 10646 compatible SLS 1134:1996 is examined and UNICODE proposals are also discussed in a theoretical manner in every stage of standardization.

Some of the major considerations in the design guideline principles of the character codes for internal representation are: storage requirement for font and data, unification and uniqueness of the code, completeness of code table, right collating sequence, ease of editing, direct and unambiguous transformation of keyboard symbols to the internal representation and the ease of composing the script on the output device.

C. Literature Survey

Sinhala script is used for writing the languages of Sinhala, Pali, and Sanskrit in Sri Lanka, which is said to be derivative of the ancient scripts Brahmi. Originally, the Sinhala scripts were a geometrical and straight line in shape, gradually scripts became rounded at the edges, with notable influence by the *Kadamba* and *Pallava Grantha* script of South India [11, 12]. The oldest palm leaf manuscripts in existence are from the 10th century onward and by about the 17th century, these manuscripts were written on varied subjects. These manuscripts with its thousands of characters and ligatures present a challenge to western type designers unaccustomed to varying shape character sets. For most of the past 500 years, Latin fonts were founded with character sets sufficient to compose text in one or a few European languages. Although some early fonts were designed with many variant characters and ligatures to emulate the rich variety of Asian scribal handwriting, the triumph of printing in Europe was partly due to the efficiency and economy of text composition from small sets of alphabetic characters.

Similarly, in Sri Lanka, during 1501-1658 Portuguese used Sinhala handwritten scripts in their “*tombo*” (list of records of villages to aid with tax collection), included a few of complex ligatures used in traditional “*ola*” leaf manuscripts. The founders’ typefaces, used in the first book of any size ever printed in Sinhala of 1736. In this book, Gabriel Schade uses vowels, consonants, ligatures, touching characters, numerals and punctuation marks (*Kundaliya*) containing some 64 characters and ligatures. Printing of law-and-order notifications for public awareness was the other type of important document printed at that time using the same founders’ types. K.K. Hof, Alphabet [13] of all races of the world of his comprehensive samples register, published in 1876, list 102 characters including 41 ligatures. However, many more important ligatures were not found in this 1876 list to reduce the cost of cutting, founding, composing, and distributing type.

The change from manual to mechanical composition technology at the end of the 19th century did not alter the average size of character sets, nor did the changes or improve the quality of the character set till the introduction of Sinhala Monotype composer [14] in the early 1960s. The Monotype matrix case contained 302 characters, 17 punctuation marks, and 10 numbers. The typewriter, a 19th-century invention that became available for Sinhala only in the mid 20th century, likewise offers small character sets. The *Wijesekara* Sinhala typewriter, popular around Sri Lanka, which has to be the government approved

official typewriter introduced in mid 1960s, provide 68 characters and 14 punctuation marks and 10 numbers.

Having looked at the manual and mechanical composition technology used for printing Sinhala scripts from the past to present, in the following section we examine the syllable structure which is being used to write modern Sinhala, Pali and Sanskrit languages, which is the general practice in the country.

III. SINHALA LANGUAGE AND EARLY SINHALA STANDARDS

A. Evaluation of frequency of occurrence of diacritical marks, vowels, consonant, and "medial" signs

At the time of the development of 8-bit coded character set for SLASCII, the occurrence of the diacritical marks, vowels, consonants, and "medial" signs were considered when storage requirements and the code point limitation as the ASCII pages are concerned. The frequency of occurrence of groups of symbols in Sinhala is given in Table 1-a to 1-c below based on the UCS/UNICODE compatible word list consists of 70142 distinct Sinhala words extracted from the UCSC/LTRL, Sinhala corpus beta version, April 2005. Sinhala characters in Table 1-a has been divided into 2 groups and they consist of 02 diacritical marks (D_n), 18 vowels (V_n), and Table 1-b consist of 41 consonants (C_n), and Table 1-c consist of 03 medial signs (C_n). Vowels (V_n) will appear only at the beginning of the words. The vowel signs (V_n) are used to change the inherent vowel and therefore, Vowel signs are ignored and not counted as vowels in this analysis.

According to the table 1-a given below, the occurrences of the vowels V₁₁ (ඞ) and V₁₂ (ඞඞ) are zero percent in present usage and are not found in any words or any dictionaries, but allow the vowel sign V₁₁ (ඞ) and V₁₂ (ඞ) to appear itself. The vowel V₁₀ (ඞඞ) also does not occur in present usage but its corresponding vowel sign V₁₀ (ඞඞ) is used. The occurrence of the consonant C₁₂ (ඞ) is also zero percent in modern usage and not found in any dictionary (see Table 1-b). According to the results in the Table 1-c below, the usage of consonants C₅ (ඞ) and C₁₀ (ඞ) also occurred zero percent in the general writing system, however, the consonant C₁₀ (ඞ) used to write *Pali* and *Sanskrit* in the language. Use of medial sign C₃ also not occurred in modern writing; however, it was used in contemporary writing. Medial signs C₁ and C₂ are essential though they are not a part of the Sinhala alphabet and used to write wherever they are needed.

This alphabet differs from all other Indo-Aryan languages and contained the special sound that has been unique to itself since the 8th century AD. For example, the presence of the set of five nasal sound known as "half nasal" C₆, C₁₂, C₁₉, C₂₅ and C₃₁ in modern writing system they have occurred only 0.80%, however they cannot be omitted except C₁₂ (which is not used at all) since these are essential for the writing system [15].

B. Cording in terms of 8-bit - SLASCII

According to the editors of an article published in the Communication ACM in 1963, S. Gorn, W. Bemer and J. Green [16], they have stated, while designing the 7-bit codes for internal representation, collating conventions and other

considerations and criteria are intended for the interchange of information among information processing and communication systems and associated equipment. Based upon, the following points have been considered when designing the SLASCII:

- 1) Automatic sorting has necessitated allocating reserved code position in the code table too. The sorting and collating are one of the most frequently required operations; assignment of code should maintain the collating sequence of the language. This is not very straight forward to achieve. Many a time there is a conflict between logical order of the diacritical marks in the character set and its placement at the code table.
- 2) The amount of storage required and a number of code positions in the code table were another important consideration. A total number of vowels reduced to 7 from 18 assuming the others can be composed using vowel signs. Therefore, vowel signs are also arranged according to the sorting order. Also, other unwanted consonants were removed from the standard too.
- 3) It should base itself on the ASCII standards adopted for the English language especially in terms of control characters and escape sequences. This enables the existing software and communication links to be totally compatible.
- 4) As far as possible there should be a direct correspondence to the existing Sinhala typewriter keyboard.

Table 1-a: Detailed analysis of occurrences of diacritical marks and vowels in modern Sinhala writing

| Sinhala Vowels and Vowel Signs in Alphabetical Order and Vowel Occurrences | | | | | | |
|--|--------------|-----------------|-------------------------------|--------------------|-------------|-------------|
| Diacritical Marks | | | | | Occurrences | % |
| 1 | <i>anus</i> | D ₁ | | ◌◌ | 2,469 | 0.737 |
| 2 | <i>visar</i> | D ₂ | | ◌ඃ | 7 | 0.002 |
| Vowels (V) | | | Corresponding Vowel Signs (V) | Vowels Occurrences | % | |
| 1 | <i>a</i> | V ₁ | අ | V ₁ (X) | ◌ඞ | 4,698 1.403 |
| 2 | <i>aa</i> | V ₂ | ආ | V ₂ | ◌ඞඞ | 1,138 0.340 |
| 3 | <i>ae</i> | V ₃ | ඇ | V ₃ | ◌ඞඞ | 1295 0.387 |
| 4 | <i>aae</i> | V ₄ | ඈ | V ₄ | ◌ඞඞඞ | 41 0.012 |
| 5 | <i>i</i> | V ₅ | ඉ | V ₅ | ◌ඞඞ | 1,194 0.357 |
| 6 | <i>ii</i> | V ₆ | ඊ | V ₆ | ◌ඞඞඞ | 92 0.027 |
| 7 | <i>u</i> | V ₇ | උ | V ₇ | ◌ඞඞ | 1,219 0.364 |
| 8 | <i>uu</i> | V ₈ | ඌ | V ₈ | ◌ඞඞඞ | 35 0.010 |
| 9 | <i>r</i> | V ₉ | ඞ | V ₉ | ◌ඞඞ | 19 0.006 |
| 10 | <i>rr</i> | V ₁₀ | ඞඞ | V ₁₀ | ◌ඞඞඞ | 0 0.000 |
| 11 | <i>!</i> | V ₁₁ | ඞ | V ₁₁ | ◌ඞඞ | 0 0.000 |
| 12 | <i>//</i> | V ₁₂ | ඞඞ | V ₁₂ | ◌ඞඞඞ | 0 0.000 |
| 13 | <i>e</i> | V ₁₃ | ඞ | V ₁₃ | ◌ඞඞ | 1,029 0.307 |

| | | | | | | | |
|----|-----------|-----------------|-----|-----------------|-----|-----|-------|
| 14 | <i>ee</i> | V ₁₄ | ඒ | V ₁₄ | ඒ | 190 | 0.057 |
| 15 | <i>ai</i> | V ₁₅ | ඒඒ | V ₁₅ | ඒඒ | 12 | 0.004 |
| 16 | <i>o</i> | V ₁₆ | ඔ | V ₁₆ | ඔ | 401 | 0.120 |
| 17 | <i>oo</i> | V ₁₇ | ඔඔ | V ₁₇ | ඔඔ | 146 | 0.044 |
| 18 | <i>au</i> | V ₁₈ | ඔඔඔ | V ₁₈ | ඔඔඔ | 11 | 0.003 |

Table 1-b: Detailed analysis of occurrences of consonants in modern Sinhala writing

| Sinhala Consonants in Alphabetical Order and Occurrences | | | | | |
|--|--------------|-----------------|-----|-------------|--------|
| Consonants | | | | Occurrences | % |
| 1 | <i>ka</i> | C ₁ | ක | 27,289 | 8.150 |
| 2 | <i>kha</i> | C ₂ | කඔ | 313 | 0.093 |
| 3 | <i>ga</i> | C ₃ | ග | 10,542 | 3.149 |
| 4 | <i>gha</i> | C ₄ | ගඔ | 206 | 0.062 |
| 5 | <i>nga</i> | C ₅ | ඞ | 0 | 0.000 |
| 6 | <i>nnga</i> | C ₆ | ඞඞ | 662 | 0.198 |
| 7 | <i>ca</i> | C ₇ | ච | 1,759 | 0.525 |
| 8 | <i>cha</i> | C ₈ | චඔ | 142 | 0.042 |
| 9 | <i>ja</i> | C ₉ | ඡ | 2,621 | 0.783 |
| 10 | <i>jha</i> | C ₁₀ | ඡඔ | 0 | 0.000 |
| 11 | <i>nya</i> | C ₁₁ | ඣ | 67 | 0.020 |
| 12 | <i>jnya</i> | C ₁₂ | ඡඣ | 0 | 0.000 |
| 13 | <i>nyja</i> | C ₁₃ | ඣඣ | 268 | 0.080 |
| 14 | <i>ṭta</i> | C ₁₄ | ට | 12,553 | 3.749 |
| 15 | <i>ṭtha</i> | C ₁₅ | ටඔ | 175 | 0.052 |
| 16 | <i>ḍda</i> | C ₁₆ | ඩ | 3,673 | 1.097 |
| 17 | <i>ḍdha</i> | C ₁₇ | ඩඔ | 23 | 0.007 |
| 18 | <i>ṇna</i> | C ₁₈ | ණ | 4,630 | 1.383 |
| 19 | <i>nndda</i> | C ₁₉ | ඞඞඞ | 171 | 0.051 |
| 20 | <i>ta</i> | C ₂₀ | ත | 19,929 | 5.952 |
| 21 | <i>tha</i> | C ₂₁ | ඨ | 786 | 0.235 |
| 22 | <i>da</i> | C ₂₂ | ද | 14,898 | 4.450 |
| 23 | <i>dha</i> | C ₂₃ | ධ | 2,231 | 0.666 |
| 24 | <i>na</i> | C ₂₄ | න | 35,634 | 10.643 |
| 25 | <i>nda</i> | C ₂₅ | ඳ | 1,237 | 0.369 |
| 26 | <i>pa</i> | C ₂₆ | ප | 14,173 | 4.233 |
| 27 | <i>pha</i> | C ₂₇ | ඵ | 71 | 0.021 |
| 28 | <i>ba</i> | C ₂₈ | බ | 5,432 | 1.622 |
| 29 | <i>bha</i> | C ₂₉ | භ | 1,269 | 0.379 |
| 30 | <i>ma</i> | C ₃₀ | ම | 20,848 | 6.227 |

| | | | | | |
|----|------------|-----------------|---|--------|-------|
| 31 | <i>mba</i> | C ₃₁ | ඹ | 595 | 0.178 |
| 32 | <i>ya</i> | C ₃₂ | ය | 27,943 | 8.346 |
| 33 | <i>ra</i> | C ₃₃ | ර | 25,087 | 7.493 |
| 34 | <i>la</i> | C ₃₄ | ල | 16,459 | 4.916 |
| 35 | <i>va</i> | C ₃₅ | ව | 29,230 | 8.730 |
| 36 | <i>sha</i> | C ₃₆ | ශ | 2,498 | 0.746 |
| 37 | <i>ssa</i> | C ₃₇ | ඡ | 2,186 | 0.653 |
| 38 | <i>sa</i> | C ₃₈ | ස | 17,154 | 5.123 |
| 39 | <i>ha</i> | C ₃₉ | හ | 8,883 | 2.653 |
| 40 | <i>la</i> | C ₄₀ | ළ | 3,107 | 0.928 |
| 41 | <i>fa</i> | C ₄₁ | ඞ | 415 | 0.124 |

Table 1-c: Detailed analysis of occurrences of medial signs in modern Sinhala writing

| Sinhala Scripts in Alphabetical Order and Occurrences | | | | | |
|---|--------------------|----------------|----|-------------|-------|
| Medial Signs | | | | Occurrences | % |
| 1 | <i>rakaransaya</i> | C ₁ | ඉ | 3,999 | 1.194 |
| 2 | <i>yansaya</i> | C ₂ | ඔඞ | 1,660 | 0.496 |
| 3 | <i>repaya</i> | C ₃ | ඞ | 0 | 0.000 |

C. *Phonetic model SLS 1134:1996*

The new, phonetic model design for the Sinhala characters code replaced the older typewriter metaphor concept from the previous SLASCII standard and Sinhala has been standardized under Unicode standard and this encoding uses the hexadecimal code in the range U+0Dxx to U+0Dxx. This process was based on the guideline principles for design character codes and going through an intensive interaction between the Sinhala experts in Sri Lanka. Nevertheless, designing of the codes for SLS 1134:1996, in the following points have been considered:

- 1) The character code set maintains the logical sequence of the alphabet. An effort has been made to preserve the alphabetical order of the Sinhala language to a greater extent.
- 2) As Sri Lanka has two official languages in the usage, namely Sinhala and Tamil, for the benefit of users who do transliteration from Tamil to Sinhala, some additional codes positions are reserved to accommodate Tamil.
- 3) In designing, this code set efforts were also made to retain the flexibility of the language to incorporate future development.

IV. DESIGNING METHODOLOGY FOR ISO/IEC 10646

A. *Designing character codes – Guideline principles*

According to the R.M.K. Sinha [17], some of the major considerations in designing the code for internal representation are one and only one code for semantically equivalent characters, uniqueness of coding, uniformity in assigning, usage of control

characters, etc. and based on the discussions we had in earlier sections in this paper, following guideline principles are envisaged in the designing of the codes for information interchange for Sinhala scripts of Brahmi origin.

- 1) **Completeness** - All characters should be represented in the code table.
- 2) **Unification** - There should be one and only one code for semantically equivalent characters.
- 3) **Uniqueness** - Two characters which differ in their meaning cannot be assigned to the same code.
- 4) **Memory economy** - The required amount of storage is another important consideration, especially for large information systems. Internal representation needing less space without some overhead of processing time is preferred over those which try to reduce processing time at the cost of storage.
- 5) **Compatibility** - The punctuation marks, numerals, and operators & other universal symbols are assigned the same code across the languages. No character other than the control characters is assigned the role of invoking an action or a role.
- 6) **Uniformity** - It should base itself on the present standards adapted for English computers especially in terms of control characters and escape sequences. This will enable the existing English software and communication links to be totally compatible.
- 7) **Separate code where necessary** - Diacritical marks should be assigned separate codes.
- 8) **Easiness of transliteration** - Transliteration from Sinhala to Tamil should be considered.
- 9) **Easiness of sorting** - Sorting and collating is one of the most frequently required operations, assignment of code which should maintain the collating sequence of the language. Therefore, acceptable and easiness of sorting and collating sequence should be considered.
- 10) **Easiness of rendering** - Special control code(s) should be introduced in Orthographic languages like Sinhala to join two or more consonants to form a single unit (conjunct consonants), alter the shape of preceding consonants (curviness of the consonant) and disjoin a single ligature into two or more units.
- 11) **Keyboard sequence compatibility** - As far as possible there should be the direct and unambiguous transformation of keyboard symbols to the internal representation.

Typical character sets of Sinhala language contained vowels (V), consonants (C), *virama* or *is-pilla* (X), vowel signs (V), diacritical marks (D), medial signs (C), punctuations (P), numerals (N), and sometimes special symbols. Sinhala has been standardized under Unicode standard and this encoding uses the hexadecimal code in the range U+0D80 to U+0DFF. This code chart comprises codes for the diacritical marks, vowels, vowel signs, consonants, punctuation mark, and numerals. The symbols used in the Sinhala language consist of consonants (C), vowels (V), *virama* or *is-pilla* (X), vowel signs (V), diacritical marks (D), medial signs (C) and punctuation mark (P) representation can be defined as follows:

$$\text{Sinhala Language} = \langle C, V, X, \underline{V}, D, \underline{C}, P \rangle; \text{ where} \\ \langle C \rangle := \text{consonants}; \quad (41)$$

$$\langle V \rangle := \text{vowels}; \quad (18)$$

$$\langle X \rangle := \text{is-pilla/virama}; \quad (01)$$

$$\langle \underline{V} \rangle := \text{vowel signs}; \quad (17)$$

$$\langle D \rangle := \text{diacritical Marks}; \quad (02)$$

$$\langle \underline{C} \rangle := \text{medial signs}; \quad (03)$$

$$\langle P \rangle := \text{punctuations Mark}; (01)$$

In addition to the above representation, code points for semantically equivalent graphical shapes for four vowel signs were included to the SLASCI and SLS 1134:1996 and they are defined as follows:

$$\langle \underline{Z} \rangle := \text{Alternative Graphical Signs}; (04)$$

The tables 2-a and 2-b below give the summary of the number of code points assigned for symbols of the language Sinhala in terms of the 8-bit SLASCI and 16-bit SLS 1134:1996 and UCS/UNICODE standards to compare the completeness of the implementation.

Table 2-a: Summary of the number of code points assigned for symbols of the language Sinhala in terms of the 8-bit SLASCI and 16-bit SLS 1134:1996 and UCS/UNICODE

| Row No. | Hex | 8-bit UNICOD | | |
|---------|-----|--------------|------|-----|--------------|------|-----|--------------|------|-----|--------------|------|-----|
| | | SLA SCII | SLS | UCS |
| | | 8x | 0D8x | | 9x | 0D9x | | Ax | 0DAx | | Bx | 0DBx | |
| 1 | 0 | | | | | ආ | | ආ | ආ | ආ | ආ | ආ | ආ |
| 2 | 1 | | | | | ආ | ආ | ආ | ආ | ආ | ආ | ආ | ආ |
| 3 | 2 | | ං | ං | | ආ | | ආ | ආ | ආ | ආ | ආ | ආ |
| 4 | 3 | | ආ | ආ | | ආ | ආ | ආ | ආ | ආ | ආ | ආ | ආ |
| 5 | 4 | | In | | | ආ | ආ | ආ | ආ | ආ | ආ | ආ | ආ |
| 6 | 5 | | ආ | ආ | | ආ | ආ | ආ | ආ | ආ | ආ | ආ | ආ |
| 7 | 6 | | ආ | | | ආ | ආ | ආ | ආ | ආ | ආ | ආ | ආ |
| 8 | 7 | | ආ | | | ආ | ආ | ආ | ආ | ආ | ආ | ආ | ආ |
| 9 | 8 | | ආ | | | ආ | ආ | ආ | ආ | ආ | ආ | ආ | ආ |
| 10 | 9 | | ආ | ආ | | | | ආ | ආ | ආ | ආ | ආ | ආ |
| 11 | A | | ආ | ආ | | ආ | ආ | ආ | ආ | ආ | ආ | ආ | ආ |
| 12 | B | | ආ | ආ | | ආ | ආ | ආ | ආ | ආ | ආ | ආ | ආ |
| 13 | C | | ආ | | | ආ | ආ | ආ | ආ | ආ | ආ | ආ | ආ |
| 14 | D | | ආ | ආ | | ආ | ආ | ආ | ආ | ආ | ආ | ආ | ආ |
| 15 | E | | ආ | | | ආ | ආ | ආ | ආ | ආ | ආ | ආ | ආ |
| 16 | F | | ආ | ආ | | ආ | ආ | ආ | ආ | ආ | ආ | ආ | ආ |

Table 2-b: Summary of the number of code points assigned for symbols of the language Sinhala in terms of the 8-bit SLASCI and 16-bit SLS 1134:1996 and UCS/UNICODE (Continued from previous Table 2-a)

| Row No. | Hex | 8-bit UNICOD | | |
|---------|-----|--------------|------|-----|--------------|------|-----|--------------|------|-----|--------------|------|-----|
| | | SLA SCII | SLS | UCS |
| | | Cx | 0DCx | | Dx | 0DDx | | Ex | 0DEx | | Fx | 0DFx | |
| 1 | 0 | ආ | ආ | ආ | ආ | ආ | ආ | ආ | ආ | ආ | ආ | ආ | ආ |

for E0, E9 and EA [X (ඌ), V7 (ඹ) and V8 (ඹ)] vowel signs however, assigned 3 code points in SLASCII standards.

- 8) Nine (09) combining vowels are created using corresponding vowel and appropriate vowel signs as follows:

$$\begin{aligned}
 V_2 &= V_1 + \underline{V}_2 & (\text{ආ} &= \text{අ} + \text{ා}) \\
 V_3 &= V_1 + \underline{V}_3 & (\text{ඈ} &= \text{අ} + \text{ෑ}) \\
 V_4 &= V_1 + \underline{V}_4 & (\text{ඉ} &= \text{අ} + \text{ි}) \\
 V_8 &= V_7 + \underline{V}_{11} & (\text{ඉ} &= \text{උ} + \text{ෆ}) \\
 V_{10} &= V_9 + \underline{V}_9 & (\text{සා} &= \text{ස} + \text{ා}) \\
 V_{14} &= V_{13} + X & (\text{ඵ} &= \text{ඵ} + \text{ඵ}) \\
 V_{15} &= \underline{V}_{13} + V_{13} & (\text{ඵ} &= \text{ඵ} + \text{ඵ}) \\
 V_{17} &= V_{16} + \underline{Z}_1 & (\text{ඹ} &= \text{ඹ} + \text{ඹ}) \\
 V_{18} &= V_{16} + \underline{V}_{11} & (\text{ඹ} &= \text{ඹ} + \text{ෆ})
 \end{aligned}$$

- 9) Five (05) composite vowel signs are entered as a sequence of two or more keys in SLASCII

$$\begin{aligned}
 \underline{V}_{14} &= \underline{V}_{13} + X & (\text{ඵ} &= \text{ඵ} + \text{ඵ}) \\
 V_{15} &= V_{13} + V_{13} & (\text{ඵ} &= \text{ඵ} + \text{ඵ}) \\
 \underline{V}_{16} &= \underline{V}_{13} + \underline{V}_2 & (\text{ඵ} &= \text{ඵ} + \text{ා}) \\
 \underline{V}_{17} &= \underline{V}_{13} + \underline{V}_2 + X & (\text{ඵ} &= \text{ඵ} + \text{ා} + \text{ඵ}) \\
 \underline{V}_{18} &= \underline{V}_{13} + \underline{V}_{11} & (\text{ඵ} &= \text{ඵ} + \text{ෆ})
 \end{aligned}$$

Ex. $\text{ඵ} = \text{ඵ} + \text{ක} + \text{ඵ}$
 $\text{ඵ} = \text{ඵ} + \text{ඵ} + \text{ක}$
 $\text{ඵ} = \text{ඵ} + \text{ක} + \text{ා}$
 $\text{ඵ} = \text{ඵ} + \text{ක} + \text{ා} + \text{ඵ}$
 $\text{ඵ} = \text{ඵ} + \text{ක} + \text{ෆ}$

This leaves us five columns (65 symbols), and now it is possible to give an explicit representation of vowels, in addition to the vowel modifier symbols, also allowed us to use 40 consonants except for C₁₂ (ඃ) consonants. In a total 79 symbols were able to use with this standard.

NOTES FOR SLS 1134:1996

- 1) Composite vowel signs are entered as a sequence of two or more keys in SLS:1134:1996 similar to SLASCII

$$\begin{aligned}
 \underline{V}_{14} &= \underline{V}_{13} + X & (\text{ඵ} &= \text{ඵ} + \text{ඵ}) \\
 V_{15} &= V_{13} + V_{13} & (\text{ඵ} &= \text{ඵ} + \text{ඵ}) \\
 \underline{V}_{16} &= \underline{V}_{13} + \underline{V}_2 & (\text{ඵ} &= \text{ඵ} + \text{ා}) \\
 \underline{V}_{17} &= \underline{V}_{13} + \underline{V}_2 + X & (\text{ඵ} &= \text{ඵ} + \text{ා} + \text{ඵ}) \\
 \underline{V}_{18} &= \underline{V}_{13} + \underline{V}_{11} & (\text{ඵ} &= \text{ඵ} + \text{ෆ})
 \end{aligned}$$

- 2) Positions 0DCA is assigned for virama (ඵ), 0D82 (ඵ) and 0D83 (ඵ) are assigned for diacritical marks. Positions 0DCF to 0DDF are assigned for 10 vowel signs (ඵ ඵ ඵ ඵ ඵ ඵ ඵ ඵ ඵ ඵ).
 3) 0DCE for Z₄ (ඵ)
 4) 0D84 for In, 0DCC, and 0DCD for Ln and Sh
 5) 0DF4 for P (ඵ)

NOTES FOR UCS/UNICODE

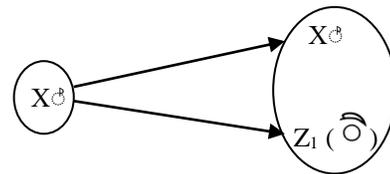
- 1) Single Coded 17 Vowel Sign for UCS/UNICODE

B. **Unification** - There should be one and only one code for semantically equivalent characters

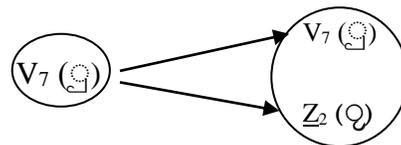
NOTES FOR SLASCII:

| | |
|-----------------|-----------------|
| C ₁₁ | C ₁₃ |
| nya | nyja |
| ඹ | ඹ |

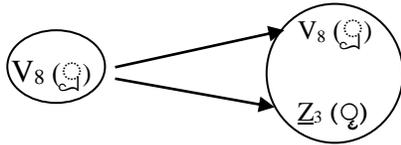
- 1) The letters C₁₁ (ඹ) (nya) and C₁₃ (ඹ) (nyja) are identical in sound only in the initial position of a word, for example, ඹඹ (nya+aa+na) and ඹඹ (nyja+aa+na). They are not identical in non-initial positions, where C₁₃ (ඹ) behaves like a combination of two consonant sounds, for example, ඵඹ (p+ra+k+nyja). Therefore, two codes are assigned for these two consonants.
 2) The following virama sign X (ඵ) has assigned two codes one for X (ඵ) and second for Z₁ (ඵ), although they are semantically equivalent vowel signs in the writing system.



- 3) The following vowel sign V₇ (ඹ) has assigned two codes as one for V₇ (ඹ) and second for Z₂ (ඵ) although they are semantically equivalent vowel signs in the writing system.



- 4) The following vowel sign V_8 (ඉ) has assigned two codes one for V_8 (ඉ) and second for Z_3 (ඉ) although they are semantically equivalent vowel signs in the writing system.



- C. **Uniqueness** - No two characters which differ in their meaning be assigned to the same code
- D. **Memory economy** – The required amount of storage is another important consideration, especially for large information systems. Internal representation needing less space without some overhead of processing time is preferred over those which try to reduce processing time at the cost of storage.
- E. **Compatibility** - The punctuation marks, numerals, and operators & other universal symbols are assigned the same code across the languages. No character other than the control characters is assigned the role of invoking an action or a role

| SLASCII | SLS 1134:1996 | UCS/UNICPDE |
|------------------|-----------------------------|-------------------------|
| used 8-bit ASCII | Used 16-bit UCS environment | UCS/UNICODE environment |

- F. **Uniformity** – It should base itself on the present standards adopted for English computers especially in terms of control characters and escape sequences. This will enable the existing English software and communication links to be totally compatible.

| SLASCII | SLS 1134:1996 | UCS/UNICODE |
|--|---|--|
| No additional Sinhala specific control characters. NBSP was used for SP characters | <i>In, Sh</i> and <i>Ln</i> were introduced | Replaced by ZWJ and ZWNJ inserted of <i>Ln</i> and <i>Sh</i> . In was missing. |

Codes are not provided in the code table in SLS:1134 and UCS/UNICODE for distinct formations in the language for the medial signs C_1 (*rakaransaya*), C_2 (*yansaya*), C_3 (*repaya*). However, these shapes could be generated by using relevant combinations given herein.

In SLASCII

$$C_1C_1 = C_1 + C_1 \quad (\text{ක} = \text{ක} + \text{ග}) \text{ (rakaransaya)}$$

$$C_1C_2 = C_1 + C_2 \quad (\text{කය} = \text{ක} + \text{ය}) \text{ (yansaya)}$$

C_3 (ඉ) (*repaya*) was not coded in this table.

In SLS 1134:1996

Provision for joint character is made through ‘*Ln*’ (stand for Link) and ‘*Sh*’ (stand for Short) keys; for example:

$$C_{24}C_{22} = C_{24} + X + Ln + C_{22} \quad (\text{ඤ} = \text{න} + \text{ඨ} + Ln + \text{ඳ})$$

$$C_1C_{37} = C_1 + X + Ln + C_{37} \quad (\text{කෂ} = \text{ක} + \text{ඨ} + Ln + \text{ඞ})$$

$$C_{20}C_{35} = C_{20} + X + Ln + C_{35} \quad (\text{කව} = \text{ක} + \text{ඨ} + Ln + \text{ව})$$

$$C_3 = C_{33} + X + Sh \quad (\text{ඉ} = \text{ඊ} + \text{ඨ} + Sh)$$

In UCS/UNICODE:

In this version ‘Link Key’ and ‘Link code’ (Ln), ‘Short Key’ and ‘Short code’ (Sh) and ‘Invisible Key’ and ‘Invisible code’ (In) are omitted as these keys are already included in the international standard, in a different page.

Inserted, the two special characters, U+200C ZERO WIDTH NON-JOINER (ZWNJ for short) and U+200D ZERO WIDTH JOINER (ZWJ for short), can be used as hints of which glyph shape is preferred in a particular situation. ZWNJ prevents the formation of a cursive connection or ligature in situations where one would normally happen, and ZWJ produces a ligature or cursive connection where one would otherwise not occur. These two characters can be used to override the default choice of glyphs. Join characters are made through ZWJ (U+200D) code, for example:

$$C_{24}C_{22} = C_{24} + X + ZWJ + C_{22}$$

$$(C_1C_{37} = C_1 + X + ZWJ + C_{37})$$

$$(C_{20}C_{35} = C_{20} + X + ZWJ + C_{35})$$

$$S_3 = C_{33} + X + ZWJ \quad (\text{ඉ} = \text{ඊ} + \text{ඨ} + ZWJ)$$

Non Join characters are made through ZWNJ (U+200C) code, for example:

$$C_{24}XC_{22} = C_{24} + X + ZWNJ + C_{22}$$

$$(C_1XC_{37} = C_1 + X + ZWNJ + C_{37})$$

$$(C_{20}XC_{35} = C_{20} + X + ZWNJ + C_{35})$$

However, the default case in Sinhala prevents the formation of a cursive connection or ligature in situations where one would normally happen.

- G. **Separate code where necessary** - Diacritical marks should be assigned separate codes

| SLASCII | SLS:1134 | UCS/UNICODE |
|---|---|---|
| D_1 (ඉ) D_2 (ඉ) | D_1 (ඉ) D_2 (ඉ) | D_1 (ඉ) D_2 (ඉ) |
| $V \rightarrow C \rightarrow X \rightarrow D \rightarrow \underline{V} \rightarrow S$ | $D \rightarrow V \rightarrow C \rightarrow \underline{V} \rightarrow P$ | $D \rightarrow V \rightarrow C \rightarrow \underline{V} \rightarrow P$ |
| Prevent by entering the wrong order. Sorting need additional code ordering tools. | Sorting makes easier. | Sorting makes easier. |

H. Easiness of transliteration - Transliteration from Sinhala to Tamil should be considered

| SLASCII | SLS:1134 | UCS/UNICPDE |
|----------------|--|--|
| Not considered | Considered | Considered |
| | The 0DB2, 0DBC, 0DBE and 0DBF Code positions are reserved for Tamil characters | The 0DB2, 0DBC, 0DBE and 0DBF Code positions are reserved for Tamil characters |

NOTE:

Special codes for Tamil characters could be utilized to transliterate scripts from Tamil to Sinhala. The character positions given in code tables both SLS:1134 and UCS/UNICODE for Tamil letters **௪** (*nna*), **௫** (*rri*), **௬** (*lla*) and **௭** (*lla*) could be represented 0DB2, 0DBC, 0DBE and 0DBF respectively. However, corresponding Sinhala characters are to be designed and implemented.

- I. **Easiness of sorting** – Sorting and collating is one of the most frequently required operations, assignment of code which should maintain the collating sequence of the language. Therefore, acceptable and easiness of sorting and collating sequence should be considered.

Collation is defined as the culturally expected ordering of linguistic characters in a particular language. This culturally expected ordering allows users to define the structure and find data in a way that is consistent for their particular language. This is not very straight forward to achieve. Many a time there is a conflict between logical order of the diacritical marks in the character set and its placement at the code table. Automatic sorting has necessitated allocating reserved code position in the code table too.

Each Sinhala letter is represented by a sequence of symbols in the code tables. A letter may be a vowel ($V_{13} = \text{ඵ}$), a consonant ($C_1 = \text{ක}$), a consonant followed by a *virama* ($C_1X = \text{ක්}$), consonant with a vowel sign ($C_1V_2 = \text{කා}$), consonant with a combined vowel sign ($C_1V_{16} = \text{කො}$), consonant with more than individual vowel sign as coded in SLASCII and after re-ordering process implies ($C_1V_{13}V_2X = \text{කෝ}$), a conjunct ligature used in UCS/UNICODE ($C_1X+ZWJ+C_{37} = \text{කෂ}$) or conjunct ligature used in SLS 1134 ($C_1X+Ln+C_{37} = \text{කෂ}$) or medial sign used in SLASCII ($C_1C_2 = \text{කු}$) and one of the above followed by a diacritical mark ($C_1V_2D_1 = \text{කාඨ}$).

Though the Sinhala language is based on a complex phonetic structure, the alphabetical order of the consonants ($C_1 \dots C_{41}$) are well defined as:

$$\text{Sort_key_1: } \{C_1 < C_2 < C_3 \dots C_{41}\}$$

The orders of the vowels (V) are arranged by tradition and contemporary. It can be defined as:

$$\text{Sort_key_2: } \{V_1 < V_2 < V_3 \dots V_{18}\}$$

In the case of vowel signs (\underline{V}), they are graphical signs which are always used in conjunction with consonants. It can be defined as:

$$\text{Sort_key_3: } \{\emptyset < \underline{V}_1 (X) < \underline{V}_2 < \underline{V}_3 \dots \underline{V}_{18}\}$$

In the case of *virama* (X) has no corresponding vowel syllable, but it will be used to remove the inherent sound /a/ from the consonant. Therefore, it will be treated as a special vowel sign within the language and defined as:

$$\text{Sort_key_4: } \{X\}$$

The Sinhala alphabet has two diacritical marks (D) and they used only in conjunction with vowels and consonants. They may appear only flowed by a vowel or consonant with an implicit or explicit vowel. Therefore, their lexicographical order defined as:

$$\text{Sort_key_5: } \{\emptyset < D_1 < D_2\}$$

Three special symbols known as Medial Signs (\underline{C}) order define as:

$$\text{Sort_key_6: } \{C_1 < C_2 < C_3\}$$

J. Easiness of rendering -

As shown in the table below, independent vowels combine with consonants in different ways. In single-byte or double bytes Sinhala text, the vowels that append to the left are written first followed by a consonant. The vowels that append to the right, above or below are written after the consonant. However, the logical order in both cases is the same, i.e. the consonant is followed by the vowel. Therefore, the legacy symbol, re-ordering will be required before string comparisons can be performed for sorting.

For example, Key-in sequence and code reordering for C, \underline{V} , \underline{C} , and D vowel signs combinations for SLASCII, SLS:1134:1996 and UCS:UNICODE as followed:

For SLASCII

Key-in sequence = Example 1: ක්‍රෝ = ක උ ආ ඵ

Example 2: ක්‍රෝ = (Not implemented)

After Re-ordering = Example 1: ක්‍රෝ = ක් උ ආ ඵ

Example 2: ක්‍රෝ = (Not implemented)

For SLS 1134:1996

Key-in sequence = Example 1: ක්‍රෝ = ක උ ආ ඵ

Example 2: ක්‍රෝ = ක Ln ඵ ඵ

After Re-ordering = Example 1: ක්‍රෝ = ක් උ ආ ඵ

Example 2: ක්‍රෝ = ක් Ln ඵ ඵ

For UCS/UNICODE

Key-in sequence = Example 1: ක්‍රෝ = ක උ ආ ඵ

Example 2: ක්‍රෝ = ක ් උ ් ආ ් ඵ ්

After Re-ordering = Example 1: ක්‍රෝ = ක් zwj ් උ ් ආ ් ඵ ්

Example 2: ක්‍රෝ = ක් zwj ් ඵ ්

NOTES:

SLASCII

- 1) Only 7 vowel letters are represented by single code point ($V_1, V_2, V_3, V_4, V_5, V_6,$ and V_7) and other vowels are represented by the vowel and corresponding vowel signs; $V_2 = V_1 + \underline{V}_2$ (ආ = අ + ආ).

- 2) Independent vowel letters V_{11} (භ) and V_{12} (භෞ) do not occur in present usage; therefore these two were not included in the code table.

- 3) Independent vowel letter V_{10} (ඹෂෂෂ) also does not occur in present usage, but its corresponding vowel sign \underline{V}_{10} (ෂෂෂ) is used, for example, C_{20} (ඹ) and it is represented by a combination of \underline{V}_9 (ෂෂ); for example $C_{20}\underline{V}_9\underline{V}_9 = \text{ඹෂෂෂ}$.
- 4) The consonant C_{12} (ඹ) does not occur in present usage; therefore this was not included in the code table.
- 5) Different graphical form \underline{Z}_2 (ඹ) corresponding with vowel sign \underline{V}_7 (ඹ) given separate code.
- 6) Different graphical form \underline{Z}_3 (ඹ) corresponding with vowel sign \underline{V}_8 (ඹ) given separate code.

SLS 1134:1996

- 1) Independent vowel letter V_{11} (ඹ) and V_{12} (ඹ) do not occur in present usage, but they are included in the code set for completeness of the order of the code table.
- 2) Corresponding vowel signs \underline{V}_{11} (ඹ) and \underline{V}_{12} (ඹ) for V_{11} (ඹ) and V_{12} (ඹ) are included in the code set for completeness of the code.
- 3) Independent vowel letter V_{10} (ඹෂෂෂ) also does not occur in present usage, but its corresponding vowel sign \underline{V}_{10} (ෂෂෂ) are used, for example, ඹෂෂෂෂෂෂ .

UCS/UNICODE

- 4) Complete consonant set considered and every consonant in the alphabet has its own codes.
- 1) Complete vowel set considered and every vowel in the alphabet has its own codes.
- 2) The *virama* X (ඹ) has a higher order of the vowel signs.
- 3) No alternative vowel signs and Before the vowels
- 4) There are five vowel signs (\underline{V}_{10} to \underline{V}_{14}) have glyph pieces which stand on both sides of the consonant; they follow the consonant in a logical order and should be handled as a unit for most processing.

K. Keyboard sequence compatibility - Most direct and unambiguous transformation of keyboard symbols to the internal representation is integral.

There have been a number of studies for standardization of Sinhala keyboard for use with electronic Devices. Sri Lanka Standard Institute has published ‘the standard keyboard’ in 1989. The standard keyboard layout had been designed in such a way that all characters that are to be used for interchanging Sinhala to be represented by 46 keys as given in Figure 1 below. The following principles were considered when designing the standard keyboard for Sinhala. These are as follows: 1. Every key on the keyboard is precious; 2. The keyboard should be easy to remember; 3. Punctuation marks and other editorial characters which are necessary for documenting Sinhala writing, but not given in the keyboard layout, may be to be used using common English plane; 4. Latin signs and symbols used in Sinhala and language should be identified and should have the same keyboard location as in English keyboard; and 5. Each key

represents two strokes, one at the normal position and the other at the shift lock position and few characters represent with shift lock with right alt key combination.

Figure 1. Standard Sinhala Keyboard Layout as defined by the SLS 1134:1996

I. CONCLUSION

We surveyed and compared the designing methodologies, rendering issues, implementations stages of Sinhala scripts and analyzed available OpenType fonts and their rendering schemes for use with modern Sinhala script. The study produced guidelines for designing UCS/IEC code scheme for *Brahmi* based Sinhala languages, which are not documented in international standards. With this design of UCS/IEC code scheme, one of the major opportunities of information interchange is the ability to transliterate from one script to another with little effort, and the other major utility of the unified standard code is to provide the ability to create mixed script documents. Therefore, it is important that there is uniformity in codes for control characters, numerals, and punctuations, mathematical and graphical symbols which are not discussed in this paper. All Sinhala fonts failed to display the variant glyphs with free variant selectors correctly, which were already standardized in Unicode 10646.

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Environmental impacts of the hydrocarbon spill caused by heavy rains. Case study in the bay of Cienfuegos, Cuba.

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Abstract- Hydrocarbon spills are events that cause a lot of impacts on fragile ecosystems, such as the marine environment, with fatal consequences, the short-term environmental impact can be serious and cause severe damage to the ecosystem and people who live in coastal areas, affecting their livelihoods, therefore, it is necessary to take measures to reduce, control or mitigate them, in order to recover the affected areas and generate preventive measures to prevent future spills. This document analyzes the environmental impact caused by the hydrocarbon spill in the Bay of Cienfuegos and proposes an environmental impact assessment to contribute to an adequate environmental management.

key words: Climate Change, Heavy Rain, Hydrocarbon Spill, Environmental Impact Assessment, Environmental Management and Environmental Impact.

I. INTRODUCTION

Among the most pressing environmental problems that characterize the XXI century is climate change, with great repercussion in countries with coasts and especially in those with characteristics of the islands, due to the rise in sea level and the effects on strongly interrelated ecosystems. The phenomenon of climate change has gained unusual relevance in the international arena. Its appearance has reactivated the environmental policy as a whole and, in particular, environmental education for sustainability, and is considered the main environmental problem facing contemporary society, from which significant impacts are expected with socio-economic, environmental and socio-cultural consequences. which is a knowledge gap that must be studied to estimate future scenarios that allow establishing, from the present, mitigation and adaptation measures in correspondence with the affectation.

Cuba is a coastal country because it is an island surrounded by the Caribbean Sea, due to its geographical location in the archipelago, it is exposed to the passage of meteorological phenomena such as cyclones and hurricanes, the cyclonic season extends from June 1 to November 30, being the period of the year in which there are more favorable conditions for the formation of these organisms.

Cuba, therefore, is not alien to this reality, climate change is of vital importance for the country, since it determines the greater development of its economic stability and, consequently, social stability. Special attention is paid to Cuban coastal areas that are directly affected by rising sea levels, as well as heavy rains and waves due to intense hurricanes that can cause coastal flooding and the destruction of natural and built heritage. Similarly, the gradual increase in sea level, the main threat, implies a slow decrease of the surface and the low places, causing, in turn, the salinization of the aquifers. Therefore, the Economic and Social Policy of Cuba reflects all these important issues for the nation, which can be seen in Guide 133 of the VI Congress of the Communist Party of Cuba since 2011 (PCC, 2011).

The prioritization of studies designed for this purpose stands out, hence the emergence of the National Science, Technology and Innovation Program on Climate Change (AMA, 2012), as well as the incorporation of the theme in the cycles of the National Environmental Strategy (2016 -2020). More recently, it emerged as the state Plan: The task of life (CITMA, 2017), in view of the urgency of having knowledge about the status and evolutionary trends of the Climate System, its impact on prioritized natural and socioeconomic environments.

The report of the Intergovernmental Panel on Climate Change (IPCC, 2001) states that this is a natural process accelerated by the ways in which society has been related to nature in recent centuries, so it is necessary to raise awareness among men of the imminent. The danger represented by this process is to look for alternatives for adaptation and, in turn, mitigate this effect to give continuity to life on the planet.

The tropical cyclone is considered the most destructive of meteorological systems, its main impact occurs in coastal areas as a result of strong winds and floods caused by heavy rains and storms, as well as by the action of strong waves. Considering the frequency of occurrence of hurricanes in the Caribbean area and the probable incidence of the effects of climate change, an increase in the intensity and quantity of these phenomena is expected (INSMET, 2008).

Climate change that influences climate variability is affecting many countries, especially those in subtropical and tropical areas.

For this reason, in Cuba there was a phenomenon of heavy rains (Subtropical Storm Alberto) in 2018 that caused a technological disaster in the oil refinery and, consequently, a spill of hydrocarbons to the bay of Cienfuegos.

The Bay of Cienfuegos is a well-studied ecosystem that includes studies on oil pollution, but to act in response to this disaster, more information is needed to carry out environmental management actions.

In view of this situation, insufficient information was identified to carry out the environmental management to mitigate the effects of the oil spill caused by the heavy rains in the Cienfuegos Bay, so in this document the following scientific question is proposed:

How to contribute to an adequate environmental management of the oil spill caused by heavy rains in the bay of Cienfuegos in 2018? Therefore, it is considered necessary to carry out an Environmental Impact Assessment (EIA) of this accident, considering that the EIA is one of the most powerful instruments to carry out an adequate environmental management, since it allows to analyze the impacts from the point of natural, socio-economic and sociocultural view and is used as an instrument to identify, predict and interpret environmental impact, as well as to prevent the negative consequences that certain actions can have on human health, the well-being of communities and the ecological balance.

According to Morgan, the emergence of environmental impact assessment (EIA) as a key component of environmental management in the last 40 years has coincided with the growing recognition of the nature, scale and implications of environmental change caused by human actions. During that time, the EIA has developed and changed, influenced by the changing needs of decision makers and the decision-making process, and by the experience of the practice (Morgan 1998).

II. PROPOSED CASE STUDY

The research study focuses on the bay of Cienfuegos, is a bay of stock that extends over an area of 88 km² and has 100 km of coastline, (León et al., 2018) with an average depth of 14 m, connected to the Caribbean Sea by a narrow channel of approximately 3 km Km long and a depth of 30 m. It has 5 associated hydrological basins that are: the basin of the Damují River, Arimao, Salado, Caonao and Arroyo Inglés. The topography of the bay is simple, but includes a low between Cayo Carenas and Punta de la Cueva. This wall submerged to a depth of approximately 1 m divides the bay into two well-defined hydrographic cells. The northern cell receives most of the impact of the urban waste discharges from the city of Cienfuegos, the industrial zone and the fluvial contribution of the Damují and Salado rivers that irrigate a large industrial zone. The south cell receives a less anthropic impact, which is contributed by the Caonao and Arimao rivers. Part of this southern area is a protected area that represents an important niche of migratory birds in the Caribbean region, as well as marine species in conservation status.



Fig. 1. Bay of Cienfuegos

Source: Stations Network State Program Environmental Quality of the Bay of Cienfuegos and areas analyzed by the ICA, 2018

The Bay of Cienfuegos, is the most important natural resource not only of the city, but also at the national and regional level, around which all the economic, social and cultural life of the territory revolves, which in turn combines with traditions, customs and legends dating from the 19th century, from the time of the city's founding, because according to Vázquez, the history of any island country is linked to water, both by the effect of the seas and rivers, on history, on food. (Vázquez, 2009) Therefore, the presence of the coast and strictly coastal activities (sport fishing, beach, diving, among others) are deeply rooted in the culture of Cienfuegos.

1. Cienfuegos has a bay of economic, social and cultural importance, not only for its territory, but also for the country and the region, which makes the difference with respect to others of its kind.
2. Cienfuegos has a historical background where you can see interesting attempts to find integrating alternatives and a concern of its inhabitants for the quality of its waters.
3. Cienfuegos already has a job based on concrete information on the application of the Integrated Coastal Zone Management (ICZM) approach that has served as the basis for the socialization processes carried out between 1997 and 2007. Therefore, this research proposes to know the environmental impacts in the short, medium and long term in the bay of Cienfuegos caused by the hydrocarbon spill.

III. CURRENT SITUATION

The bay of Cienfuegos, as a result of the intense rains that occurred in 2018, (Subtropical Storm Alberto) was affected by a discharge of hydrocarbons from the oil refinery because this meteorological event exceeded the extreme conditions of precaution and risk reduction, the Refinery has no conditions to face disasters of such magnitude, the amount of rain exceeded all forecasts, affecting 70% of the ecosystem.(CEAC, 2018)

Visible environmental impacts: loss of biodiversity (wildlife, biodiversity), loss of landscape (aesthetic degradation, oil spills).

Potential: deforestation and loss of vegetation cover, contamination of surface water, decrease in water quality. (physical-chemical, biological)

Other environmental impacts: food insecurity. (damage to crops)

The disappearance of the white shrimp in the northwestern zone (a species that was a symbol of the city and next to the pink shrimp was the main fishing resource of the bay)

Visible: Loss of landscape (sense of place)

Potential: loss of livelihoods.

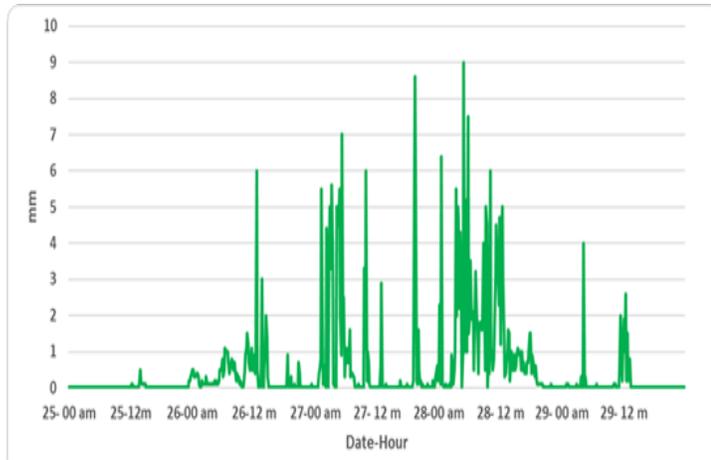


Fig. 2. Amount of rain fall. Subtropical Storm Alberto.
Source: Cienfuegos Meteorological Center, 2018, INSMET

IV. ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

The impact will be analyzed from the ecological, socio-economic and socio-cultural dimension.

Ecological dimension: the impact will be evaluated considering the physical-chemical quality indicators of the waters and their sediments (salinity and concentration of hydrocarbons in the sediments). The biodiversity indicator (behavior of phytoplankton, mangrove, macroalgae and molluscs) will also be evaluated.

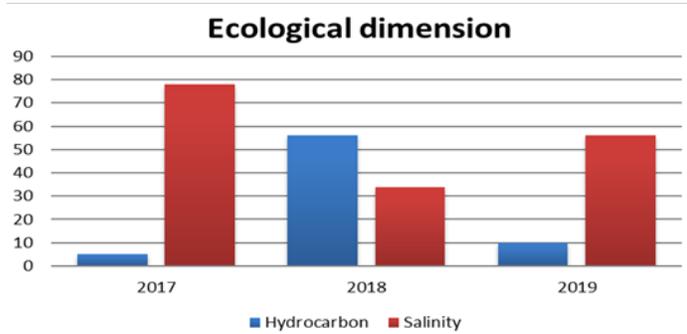


Fig 3. Behavior of the hydrocarbon and salinity indicators in the years 2017, 2018 and 2019.

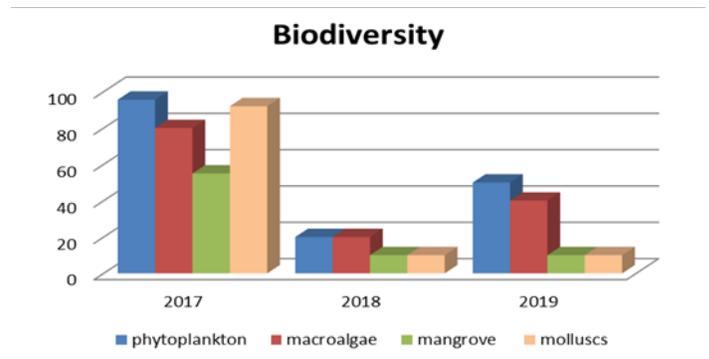


Fig. 4. Behavior of biodiversity in the years 2017, 2018 and 2019.

Socioeconomic dimension: the economic damage will be evaluated by the prohibition of the entrance of the cruise ships to the bay, which will affect tourism. In addition, the prohibition of entry of oil tankers to the refinery and its effect due to stop refining and the prohibition of the entry of transit vessels to receive the services of the Shipyard.

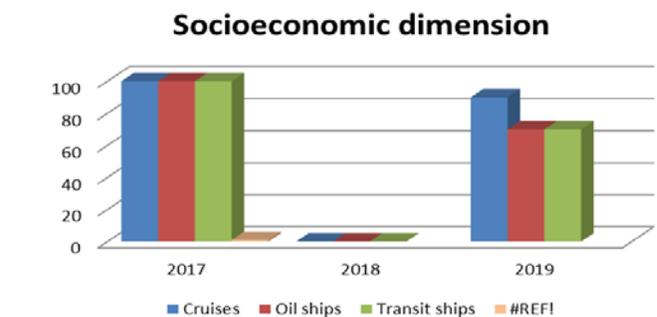


Fig.5. Behavior of the socioeconomic dimension according to the indicators of: Entrance of cruises to the bay, the entrance of oil tankers to refine oil and the entrance of transit ships to receive the service of the shipyard

Sociocultural dimension: the damage to the population will be assessed by the suspension of the use of its beaches, the prohibition of the practice of sport fishing, the prohibition of nautical sports and the change of the cultural landscape, taking into account the impact of the enjoyment of the boardwalk, sunset, among others.

These damages occurred in the short, medium and long term; for its evaluation, work will be done with the existing baseline.

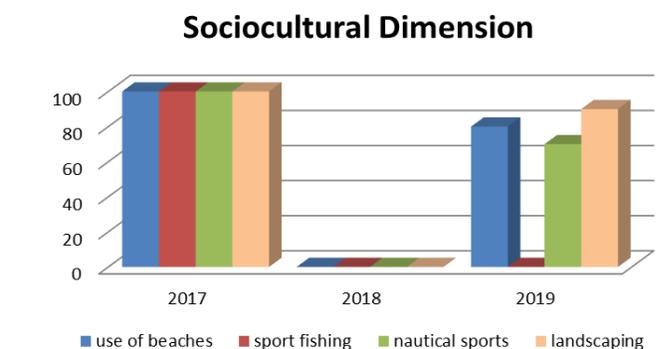


Fig. 6. Behavior of the sociocultural dimension according to the indicators of: Use of the beaches, nautical sports, sport fishing and landscaping.

Baseline

The Bay of Cienfuegos has been well studied, including studies on the pollution of hydrocarbons in this ecosystem; there is a baseline on the chemical quality of the water and sediments of the bay before discharge, which will allow comparing the phenomenon before and after the occurrence. There is also information on phytoplankton and other biological organisms that allow to evaluate the impact caused to the ecosystem.

Methodological guide for the evaluation of environmental impacts and damages in disaster situations.

The Guide for the evaluation of environmental impacts and damages of disaster situations is the result of the integration of three methodological documents, prepared by the Ministry of Science, Technology and the Environment and responds to the indications issued in the President's Directive No.1 of the National Defense Council for disaster reduction in 2010.

The considerations of the State Plan for the Confrontation of Climate Change (Life Task) and the Sendai Framework for Disaster Risk Reduction 2015-2030, of which Cuba is a signatory, have been taken into account.

Its objective is to methodologically guide the processes of identification, inclusion, discussion and homogenization of the impact and damage assessment of disaster situations.

Qualitative and quantitative data.

Quantitative and qualitative data will be collected, this will facilitate the better understanding of the phenomenon, they will also allow to triangulate, compare, relate and interpret the acquired information to better understand the phenomenon to be studied. From the first qualitative phase the researcher builds a second quantitative phase to test or generalize the initial results. Finally, how the quantitative results are interpreted make up the initial qualitative results.

Application of the software for the evaluation of the constructed matrix of cause-effect.

For the preliminary evaluation, the RIAM (Rapid Impact Assessment Matrix) methodology will be used, which allows a quick and clear evaluation of the impacts.

Environmental impact is understood as the direct or indirect consequence, of a beneficial or adverse nature, that occurs for man and the natural and socioeconomic systems on which his well-being depends, as a result of an environmental change caused by an action or set of actions of natural or human origin.

The evaluation system is feasible only when it is carried out by a multidisciplinary team. This allows the data of different components to be analyzed against common criteria, within the same matrix, offering a quick and clear evaluation of the impacts.

The evaluation criteria fall into two main groups:

A) Criteria related to the importance of the condition, which can individually change the score obtained.

B) Criteria that are of value for the situation, but that individually are not able to change the score obtained.

The sum of the group (B) is then multiplied by the result of the group (A) to provide the final result of the evaluation (ES) for each condition. The process can be expressed:

$$(a1) \times (a2) = aT$$

$$(b1) + (b2) + (b3) = bT$$

$$(aT) \times (bT) = ES$$

Where:

(a1) and (a2) are the individual scores of the criteria for the group (A)

(b1) to (b3) are the individual scores of the criteria for the group (B)

- aT is the result of the multiplication of all the scores of (A)
- bT is the result of the summation of all the scores of (B)
- ES is the Criterion Evaluation Score

Criteria of group A)

A1) Importance of the condition: a measure of the importance of the condition, which is evaluated against the spatial borders or human interests that affected it. The scales are defined:

4 = Important for national / international interests

3 = Important for regional / national interests

2 = Important for areas immediately outside the local condition

1 = Important only for the local condition

0 = Unimportant

A2) Magnitude of the change / effect: magnitude defined as a measure of the benefit / harm scale of an impact or condition.

+ 3 = Great benefit

+ 2 = Significant improvement of the status quo

+ 1 = Improvement of the status quo

0 = No change

-1 = Negative change in the status quo

-2 = Significant negative change

-3 = Great damage or change

Criteria of group B)

(B1) Permanence: defines if a condition is temporary or permanent, and should be seen only as a measure of the temporal status of the condition.

1 = No change / not applicable 2 = Temporary 3 = Permanent

(B2) Reversibility: this defines if the condition can be changed and is a measure of control over the effect of the condition. It should not be confused with permanence (eg, an accidental toxic spill in a river is a temporary condition (B1) but its effect (death of fish) is irreversible (B2), a job of sewage treatment in a village is a condition permanent (B1), the effect of its tributary can be changed (reversible condition) (B2).

1 = No change / not applicable 2 = Reversible 3 = Irreversible

(B3) Accumulation: this is a measure where it is evaluated whether the effect had a simple direct impact or if it will cause a cumulative effect over time or a synergistic effect with other conditions. The cumulative effect is a way of judging the sustainability of a condition, and should not be confused with a permanent / irreversible situation. For example, the death of an old animal is a permanent and irreversible, but not cumulative, because the animal is considered that no longer has reproductive capacity. The loss of shrimp in the post-larval stage, in its natural environment, is also permanent and irreversible, but in this cumulative case, as the subsequent generations of these larvae will also have been lost.

1 = No change / not applicable
 2 = No cumulative / simple
 3 = Cumulative / synergistic

The RIAM requires the specific evaluation of components that must be defined and are divided into four categories:

Physics-Chemistry (FC): covers all physical-chemical aspects of the environment, including non-biotic (finite) natural resources and the degradation of the physical environment by pollution.

Biological-Ecological (BE): covers all biological aspects of the environment, including renewable natural resources, conservation of biodiversity, interspecific interactions and contamination of the biosphere.

Socio-Cultural (SC): covers all human aspects of the environment, including social issues that affect individuals and communities, along with cultural aspects, including the conservation of cultural heritage and human development.

Economic-Operational (EO): qualitatively identifies the economic consequences of environmental changes, both temporary and permanent.

The evaluation criteria are formed on a scale of Liquer, which goes from a greater positive impact to a greater negative impact. It is important to note that a moderate negative impact is already very damaging.

Once the ES scores are placed in ranges bands, these can be shown individually or grouped according to the type of component and presented in graphic or numerical form. The complete EIA report will detail the criteria used, the components derived from the scope, the RIAM matrix and the presentation of the results of the RIAM method, together with primary information concerning the management alternatives applied.

The RIAM system has been described on a theoretical basis and has been computerized for its simple and fast use. The values obtained through the evaluation process are classified according to this method as shown in table 1.

| Band ranges Average (ES) | Range of values Alphabetical (RV) | Range of values Numeric (RV) | Evaluation criteria |
|--------------------------------|--|---------------------------------------|---|
| 108 a 72 | E | 5 | Greater positive impact |
| 71 a 36 | D | 4 | Significant positive impact |
| 35 a 19 | C | 3 | Moderate positive impact |
| 10 a 18 | B | 2 | Positive impact |
| 1 a 9 | A | 1 | Potentially insignificant impact |
| 0 | N | 0 | No change / status quo / not applicable |
| -1 a -9 | -A | -1 | Insignificant negative impact |
| -10 a -18 | -B | -2 | Negative impact |
| -19 a -35 | -C | -3 | Moderate negative impact |
| -36 a -71 | -D | -4 | Significant negative impact |
| -72 a -108 | -E | -5 | Greater negative impact |

Table 1. The values obtained through the evaluation process according to this method.

Technical report of the Preliminary Evaluation.

The preliminary report will be based on the qualitative and quantitative information available.

The economic valuation of the damages to the goods and services of the ecosystems will be carried out, working with the main ecosystems.

The damages will be expressed, explaining the immediate and expected effects in the short term. In addition, the affectations, alterations and modifications evidenced will be described.

The most significant aspects will be captured, briefly and directly, highlighting the main problems that require priority, to support the decision-making process, will be oriented towards prevention, not create new vulnerabilities and achieve more efficiency in the stages of the disaster risk cycle of reduction.

Specific and clear recommendations will be prepared, defining responsible persons and deadlines, and will be aimed at perfecting the stages of the disaster risk reduction cycle.

V. CONCLUSIONS

This paper presents the environmental impacts caused by the hydrocarbon spill in the Cienfuegos Bay, therefore, it is proposed to make an environmental impact assessment to know the short, medium and long term damages to the ecosystem, for this, it is proposed work from the existing baseline and compare the behavior of the previously analyzed parameters, as well as the use of the methodological guide for cases of environmental disasters and finally the application of the RIAM method, which will allow a clear and precise evaluation of the impacts. The potential of the Environmental Impact Assessment will allow the identification of the theoretical elements that will be taken into account to achieve an adequate environmental management in the ecosystem to be studied, as well as provide a complete diagnosis of the real situation or the situation of the ecosystem in terms of environmental, socio-economic and socio-cultural parameters as basic knowledge to make decisions at different levels for disaster risk management, in the same way that it will reduce the environmental risks generated by climate change.

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Antibacterial Activity of *Sargassum polycystum* and *Ulva reticulata* Methanol Extract Against Marine Fouling Bacteria

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ABSTRACT- Marine biofouling causes a lot of damage to the shipbuilding and aquaculture industry because of the increasing maintenance costs. The purposes of this research are to measure the effectiveness of seaweed to inhibit bacterial biofilms and determine their inhibitory concentrations. In this study, we used *Sargassum polycystum* and *Ulva reticulata* from Punaga coast, Takalar South Sulawesi, extracted with methanol to determine the potential of the extract as antifouling. There are 50 gr of *Sargassum polycystum* and *Ulva reticulata* was extracted with 300 ml of each solvent (1:6 w/v) for three times maceration. The highest antibacterial activity assay using agar diffusion method was indicated by *Sargassum polycystum* extract with inhibition zone range from 13.35 to 15.80 mm. Antifouling activities from brown algae make them very promising as candidates for eco-friendly antifouling.

Keyword: Seaweed. Methanol. Bacteria. Antifouling. Marine

I. INTRODUCTION

Solid substrate surface, when submerged in seawater, will experience changes formed by the results of attaching marine organisms (organism fouling), especially from microbes, diatoms, barnacles, tunicates, bryozoans and spores from seaweed. The implications of biofouling vary as the fisheries sector and shipping industry must face the consequences of biofouling (Plouguerné *et al.*, 2010). On ships, biofouling will increase ship weight, increase hydrodynamic drag and reduce ship maneuverability resulting in increased costs through increased use of labor, fuel, and docking time (Bazes *et al.*, 2009).

At first, controlling biofouling use chemicals in antifouling paint. The use of tributyltin (TBT) is the most successful way to eliminate biofouling. However, paint containing TBT harms non-target marine organisms. Efforts to prevent the attachment of fouling organisms to coastal buildings and ships are done by painting the building with paint containing heavy metals. Almost all paints used contain heavy metals with certain concentrations. The use of heavy metals as raw material for paint as one of the sources of heavy metal pollution which eventually accumulates in the sea. Pollution and decreasing environmental quality and environmental degradation are some of the impacts caused by the use of heavy metals (Bazes *et al.*, 2009).

Park *et al.* (2012) evaluated the ecological risk that *Gomphina veneriformis* growth was significantly delayed, the gonad index decreased and the changed sex balance (imposex) and intersex gonad in females increased significantly. In Maceio Coast, Brazil, *Thais rustica* has the imposex syndrome that makes male animals become females because of an impaired endocrine system (Camillo, *et al.*, 2004).

In Indonesia, several studies have also been carried out regarding the dangers of using paint mixtures which are harmful to the lives of non-target organisms. Mamonto *et al.*, (2017) conducted research in Bitung, North Sulawesi using *Thais aculeata*, *Monodonta labio*, and *Nerita exuvia*. As a result, imposex in the region is quite high at around 58.5% - 80.67%.

This impact apparently does not only occur in shellfish but also occurs in *Kappaphycus alvarezii* algae. Because of these impacts, the International Maritime Organization on January 1, 2008, banned the use of paint from TBT throughout the world.

The application of biotechnology to produce natural material products from marine organisms generally does not cause effects and naturally biodegradable. The alternative prevents the presence of attachment biota by utilizing the active ingredients derived from nature, especially the sea. Efforts to combat attachment biota using bioactive compounds. It is more efficient and environmentally friendly alternative (Sumarno, 2017). One of the best ways to replace antifouling paint from TBT with natural compounds from marine organisms that have the potential to be antifouling. Seaweed is one of the many organisms reported as potentially antifouling.

Previous studies have been conducted to see the potential of seaweed as an antifouling. Some types of seaweed used are *Sargassum duplicatum* (Santi, *et al.*, 2014), *Delisea pulchra* (Steinberg, *et al.*, 1998), *Styopodium zonale*, *Dictyota menstrualis* and *Laurencia obtusa* (Da Gama, *et al.*, 2002), and *Bifurcaria bifurcata* (Maréchal *et al.*, 2004) has been reported to show significant antifouling activity. This study focuses on preventing biofouling at the stage of primary biofilm formation by bacteria and evaluates it by looking at its effects at the next stage of fouling. This research aims to know the potential of *Sargassum polycystum* and *Ulva reticulata* extract as natural antifouling.

II. MATERIALS AND METHODS

Collection of Seaweed Samples

Samples of *Sargassum polycystum* and *Ulva reticulata* were collected from Punaga coast, Takalar, Indonesia. The algae were washed with cleaned sea water and put into plastic bags before kept in a cool box to prevent photolysis and thermal degradation during transportation.

Sample Preparation

The samples were washed with sea and fresh water and sterile aquadest. After the washing process is complete the sample is drained until it is completely drained by the method of drying at room temperature for 4-6 days. Dry seaweed samples are made simplicia powder for the extraction process. The extraction process is done using methanol as a solvent. The extraction procedure was carried out by weighing 50 g of *Sargassum polycystum* seaweed powder in an Erlenmeyer flask and added 200 mL of methanol for 24 hours at room temperature. The solution was passed through Whatman No. 1 filter paper. The samples were dried using a rotary evaporator at a temperature of 45-50°C and low pressure (500-700 mmHg vacuum). Seaweed extract is prepared for use in the antimicrofouling test.

Isolation of Marine Fouling Bacteria

Isolation of biofilm bacteria was carried out using a modified method of Sabdono, *et al.*, (2007). A 15 x 10 cm wood is attached to the substrate of water at a depth of 50 cm below sea level at the lowest low tide. The panel is taken after 2 weeks of immersion and put into the cool box and brought to the laboratory for the isolation of biofilm bacteria. The panel is sprayed with sterile seawater, then swabbing the panel surface with a sterile cotton swab to Tryptic Soy Broth (TSB).

Antibacterial Activity Test

Antibacterial activity test carried out between *Sargassum polycystum* and *Ulva reticulata* crude extract on biofilm bacteria using standard disc diffusion. The agar diffusion method was used for assessment of antibacterial activity (Zainuddin, *et al.*, 2019). 1 ml bacteria was inoculated in 20 ml of Tryptic Soy Agar (TSA). The warm agar containing bacteria then poured into Petri disc (9 cm in diameter) to cool down in laminar air flow at room temperature.

The crude extract of each seaweed (*Sargassum polycystum* and *Ulva reticulata*) was added a 50 µL at 2 mg concentration into a sterile paper disc (6 mm in diameter) (Zainuddin *et al.*, 2019). The paper disc was evaporated until dry then the disc

placed on the agar surface with bacteria and incubated for 24 hours at 37 °C. The negative controls are solvent which used during extraction (methanol). As a comparison, 4% of antifouling paint is used as a positive control. The antibacterial activity of *Sargassum polycystum* and *Ulva reticulata* extracts against marine fouling bacteria were assessed by measuring the diameter of the inhibition zone (clear zone). All treatments replication two times and every time with three replicates.

III. RESULT AND DISCUSSION

Seaweed that has been taken from Punaga coast is cleaned and washed to remove organisms, mud or sand. After being washed, the seaweed is then weighed as wet weight, as shown in **Figure 1**. Seaweed is dried in a shaded place and protected from direct sunlight for 4-6 days and weighed as dry weight. The wet weight of *Ulva reticulata* is 3250 gram and *Sargassum polycystum* is 3750 gram. Each seaweed was weight 50 gram to solve in 300 mL of methanol. Percent of dry biomass is 27.73% for *Sargassum polycystum* and 25.85% for *Ulva reticulata*, and percent of rendement for *Sargassum polycystum* is 2.21% and 2.05% for *Ulva reticulata*. The highest percent of the crude extract is shown by *Sargassum polycystum* with methanol extract (**Table 1**).



Figure 1. Fresh seaweed from Punaga coast, Takalar. *Ulva reticulata* (left) *Sargassum polycystum* (right)

Methanol solvent was also carried out as a comparison with the previous method. The percentage of crude extract from this method is the most among the others 2.21% for *Sargassum polycystum* and 2.05% for *Ulva reticulata*. This is related to solvent polarity. The inhibitory test results showed that methanol extract with this method also showed good results.

Table 1. Wet Weight and Dry Weight of Algae Biomass and Percentage of Crude Extracts Obtained from 50 g of Dry Weight Biomass in 300 mL Organic Solvent

| No. | Species | Class | Wet-weight (ww)(g) | Dry Weight (dw)(g) | Percent of dw/ww | Solvent | Crude Extract (mg) | Crude Extract (%) |
|-----|-----------------------------|-------------|--------------------|--------------------|------------------|----------|--------------------|-------------------|
| 1. | <i>Sargassum polycystum</i> | Phaeophyta | 3750 | 1040 | 27.73 | Methanol | 1.10 | 2.21 |
| 2. | <i>Ulva reticulata</i> | Chlorophyta | 3250 | 840 | 25.85 | Methanol | 1.03 | 2.05 |

Antibacterial activity test using the calipers is done three times. All treatments were a replication of two times and every time with three replicates. Visual observations can be seen in Figure 1. The average diameter of *Sargassum polycystum* extract is 14.50 mm and 14.13 mm while *Ulva reticulata* extract is 13.18 mm and 12.44 mm. This is very good if compared with positive controls of 15.35 mm and 15.02 mm. The negative control is negative control does not provide a clear zone, it means that the solvent (methanol) does not have an effect on the inhibition of extract. The difference in inhibition of the

growth of biofilm bacteria by extracts produced by the bioactive composition available in each extract is different. Accordingly, it causes the ability to extract as antifouling differently.

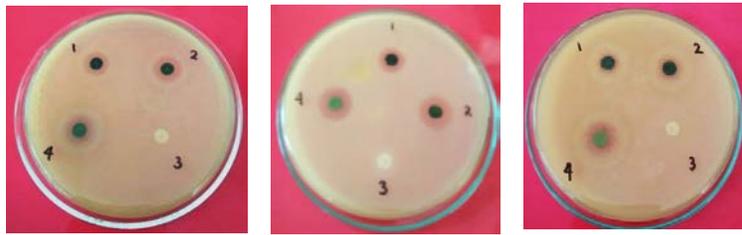


Figure 2. Result of antibacterial activity : (1) *Ulva reticulata*, (2) *Sargassum polycystum* (3) Negative control, (4) Positive control. High antibacterial activity was shown by *Sargassum polycystum* with methanol solvent.

The best seaweed extracts against marine fouling bacteria were shown by *Sargassum polycystum* extract. Which can inhibit the most biofilm bacteria with a range of inhibition zone diameters from 11.10 to 18.30 mm. This shows that methanol extract has a broad spectrum as antimicrofouling which can inhibit various types of biofilm bacteria (**Figure 2**). Methanol extract has the potential as an antifouling because it can inhibit various types of biofilm bacteria that are the cause of microfouling.

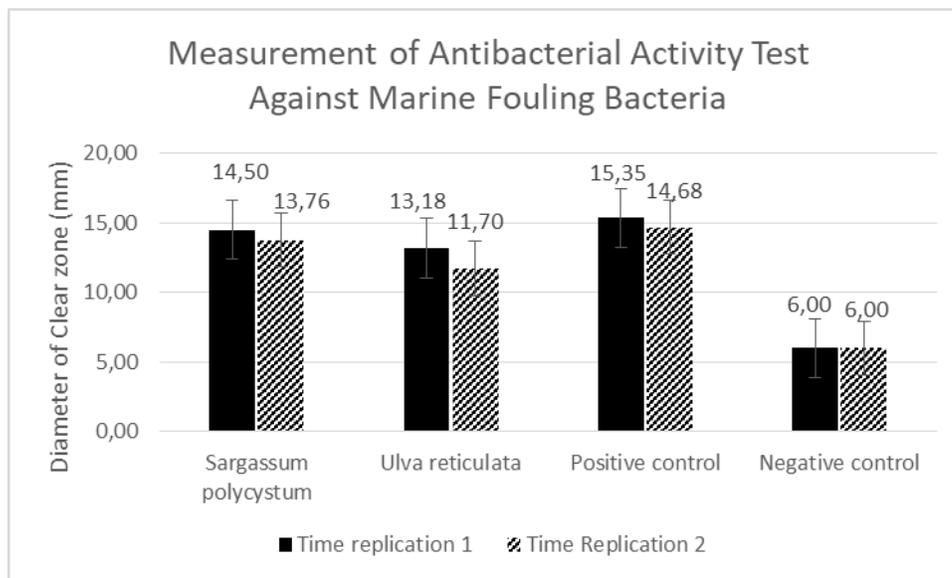


Figure 3. Mean of clear zone measurement in antibacterial activity test. Extract of seaweed with different solvent against marine fouling bacteria. A number of replicates are 6 per treatment.

*Inhibition zones include the disc diameter of 6 mm; the activity is categorized according to the diameter of the inhibition zone around the disc, ≥ 20 mm =highest, $< 20 \geq 15$ mm = high, $< 15 \geq 10$ mm = moderate, $< 10 \text{ mm} \rightarrow 6$ mm = low, 6 mm = no activity (Elmi *et al.*, 2019)

The first step for controlling biofouling is by inhibiting the occurrence of the process of attaching larvae from invertebrate or spores from algae (microfouling). If at the initial stage the formation of biofilm bacteria (microfouling) can be inhibited it is thought that it can also inhibit the attachment of macrofouling so that biofouling can be controlled. *S. duplicatum* crude extract has the potential as an environmentally friendly antifouling because the control of biofouling comes from the secondary metabolites of marine organisms.

This secondary metabolism inhibits biofilm formation so that biofilm growth can be inhibited. The methanol extract of *Sargassum polycystum* contains alkaloid compounds, saponins, quinones, phenolics, steroids, and flavonoids. Whereas, *S.*

duplicatum ethyl acetate extract contains alkaloid compounds, saponins, steroids and flavonoids (Santi *et al.*, 2014). According to Da Gama *et al.* (2002), phenols and quinones are often found in the form of glycosides, which are present in cell vacuoles and are easily soluble in polar compounds (methanol). Alkaloids are found in extracts methanol. Alkaloids have nitrogen bases in their cyclic chains and contain a variety of substituents which vary as amine groups, amides, phenols, and methoxy so that alkaloids are semipolar. Alkaloids have antimicrobial activity against gram positive and negative bacteria (Putranti, 2013). This secondary metabolite is thought to interfere with biofilm formation so that the growth of biofilm bacteria.

IV. CONCLUSION

Seaweed extract is proven to be a candidate for natural antifouling which can inhibit marine fouling bacteria growth. The strong antifouling activity makes them promising candidates for new antifouling additives.

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Effect of *Ulva reticulata* Extract in Increasing Hemocyte Count and Phagocytosis Activity in Tiger Shrimp (*Penaeus monodon*)

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Abstract- Tiger shrimp is one of Indonesia's foreign export commodities. Tiger shrimp has decreased production due to various diseases. *Ulva reticulata* seaweed is known to have polysaccharide sulfate and secondary metabolites that can enhance immunity in shrimp. This study was conducted to analyze the potential of *Ulva reticulata* extract in increasing the immune response in tiger shrimp. The study design used a Completely Randomized Design (CRD) with 4 treatments with 3 replications. As a treatment, mixing *Ulva reticulata* extract on commercial feed with a dose of 0, 0.5, 1.0 and 1.5 g kg⁻¹ feed for 14 days. The observation parameters consisted of hemocyte counts and phagocytic activity. The results showed the highest hemocytes and the highest phagocytic activity was shown in the treatment of 1.5 g kg⁻¹ with total hemocytes of 3.0 x 10⁵ cells/ml and the percentage of phagocytic activity was 77%.

Index Terms- *Ulva reticulata*, hemocyte count, phagocytosis activity, tiger shrimp

I. INTRODUCTION

Tiger shrimp is one of Indonesia's foreign export commodities. The disease is one of the main causes of the failure of tiger shrimp production. The shrimp immune system depends on non-specific defense processes as a defense against infection (Lee et al., 2004). The first defense against disease in shrimp was carried out by hemocytes through phagocytosis, encapsulation and nodule formation. The activity of phagocytosis can be increased by activating the contradictory oxidase (Pro-PO) system in a semigranular and granular hemocytes (Selvin et al., 2004). One effort to prevent shrimp disease is through enhancing the body's defense system using immunostimulants, vitamins, and hormones (Johny et al., 2005).

Immunostimulants are chemical compounds, drugs or other ingredients that can improve specific and non-specific response mechanisms of fish (Anderson, 1992). The administration of immunostimulants is carried out with the intention of activating non-specific immune systems such as macrophages invertebrates and hemocytes in invertebrates (Dugger and Jory, 1999). One of the natural ingredients that can be used for immunostimulants is seaweed. (Ridlo, 2009).

Seaweed is a multicellular alga that contains immunologically active substances. The utilization of seaweed so far is still limited to carrageenan products and agar. The potential for seaweed in the field of disease control is still not widely explored and exploited. Some studies show that seaweed has a prospect that is still open to its development in the field of disease control. Seaweed extract has been known to have acted as an antitumor, increase the activity of chemotaxis macrophage, stimulate oxygen radical secretion activity and phagocytosis peritoneal and splenic murine macrophage (Castro et al., 2004). Secondary metabolites from *Halimeda macroloba* have anti-fungal bioactive compounds (Widiastuti, 2003). Seaweed *Ulva* sp., *Dendrilla* sp., *Spirulina* sp., *Enteromorpha* sp., *Dictyota* sp., And *Porphira* sp. has been shown to increase shrimp immunostimulatory activity (Castro et al., 2004; Selvin et al., 2004).

Ulva reticulata is one type of seaweed that includes green algae. *Ulva reticulata* has natural bioactive compounds which contain the sulfate polysaccharides (Abd El-Baky et al., 2008). Selvin et al., (2004) found that the active compound in the *Ulva fasciata* could enhance the immunostimulant activity of shrimp. This was indicated by the enhancement of the Total Haemocyte Count (THC) when the *Ulva fasciata* extract was administered. In addition, Selvin et al. (2011) also reported that the extract of the *Ulva fasciata* could increase the survival rate of tiger prawn against the vibrio infection and the THC. Some studies were also revealed that the composition of polysaccharide from the *Ulva*'s extract could increase the macrophage cell, phagocytic cell, and respiratory burst (RB) of shrimp through the immersion (Castro et al., 2006; Tabarsa et al., 2012).

Hemocytes are a very important factor in the cellular defense system that is non-specific. Increased shrimp body resistance can be seen from the increased phagocytic activity of hemocyte cells. Phagocytosis is a non-specific defense mechanism that can generally protect against pathogenic attacks (Fontaine and Lightner, 1974).

This study was to analyze the potential of *Ulva reticulata* extract in increasing the total number of hemocytes and phagocytic activity in tiger shrimp.

II. THE RESEARCH METHOD

Collection Sample

Samples of *Ulva reticulata* were collected during the low tide along the Punaga coast, Takalar, South Sulawesi Indonesia on 13 December 2018. The algae were washed with cleaned sea water and put into plastic bags before kept in a cool box to prevent photolysis and thermal degradation during transportation.

Sample Preparation

Seaweed samples that have been taken are put into plastic then put into the coolbox and taken to the laboratory for the extraction process. The samples were washed with sea water and sterile freshwater and aquadest. Wet algae were then cleaned from sediments and associated organisms. After the washing process, the sample is drained until it is completely drained and weighed as wet weight. Seaweed samples were sun-dried carefully under shade for 4-6 days. Dry samples of seaweed made powder to increase extraction effectiveness for the extraction process were then weighed again as dry weight.

Extraction of Algae

Extraction of algal materials was conducted as described previously (Kursia., 2013). 100 g of finely powdered algal material was extracted with 200 mL ethanol in a 1 L capacity round bottom flask (1:2, w/v). The extraction was run for 24 h under room temperature. The extracts were filtered through a Whatman no. 1 filter paper then evaporated until 5-10 mL volume.

Experimental animals and acclimation period

The test organisms used in this study were tiger shrimp obtained from the Politeknik Pertanian Negeri Pangkep. The tiger shrimp used was 9 ± 3.3 with 20 shrimp/aquarium. Firstly, tiger shrimp are adapted for three days and maintained in controlled conditions. Shrimp are fed three times a day with a feeding rate (FR) of 4-5% of biomass/day. Water, containers, and maintenance equipment are disinfected first.

Preparation of medicated feeds

Ulva reticulata extract was weighed first based on the dose and dissolved in 100 mL of water. *Ulva reticulata* extract solution is mixed into commercial shrimp feed, then coated with 2.5% egg white and dried again at room temperature, in an open room, protected from direct sunlight (Nurdiansah, 2013). The prepared food is put in a plastic container and stored in the refrigerator until used.

Treatment Schedule

The method used in this study was a completely randomized design (CRD) method with 4 treatments and 3 replications. The treatment given is based on the Declarador., et al. Method. (2014) black tiger shrimp fed with a mixture of *Ulva reticulata* extract of K: 0 g kg⁻¹, (A) 0.5 g kg⁻¹, (B) 1.0 g kg⁻¹ and (C) 1.5 g kg⁻¹ feed shrimp, all treatments and controls were fed three times a day with FR of 4-5% biomass/day. The provision of treatment lasts for 14 days. Measurement of hemocytes and phagocytosis activity was carried out on the 15th day after treatment.

Total Hemocyte Count

The shrimps' hemolymph was conducted at the pleopod at the abdominal segment near the genital hole by using syringe 1 mL (Xian et al., 2009). Before the hemolymph collection, the syringe was loaded with 0.1 mL of Na-citrate 10% used as an anticoagulant (Vargas-Albores et al., 1993). The calculation of the total quantity of hemocyte (THC) was conducted by using hemocytometer (Abdollahi-Arpanahi et al., 2018).

Phagocytosis Activity

Black shrimp hemolymph is added as much as 0.1 mL into Eppendorf and mixed evenly with 25 µL *Staphylococcus* sp bacteria and incubated for 20 minutes. Then as many as 5 µL were crushed on a glass object and made a screw preparation. Then fixed with 100% methanol for 5 minutes, then stained with Giemsa (10%) for 15 minutes Preparations are rinsed with running water and dried. Phagocytosis activity is measured based on the percentage of phagocytic cells that show the process of phagocytosis (Anderson dan Siwicki, 1993). The phagocytic activity is calculated by a formula :

$$AP = \frac{\text{the quantity of phagocyte cell}}{\text{the quantity of observed phagocyte cell}} \times 100$$

Data analysis

Analysis of Total Haemocyte Count (THC) data and Phagocytosis Activity on shrimp were analyzed by ANOVA, and if there were differences between treatments followed by the Tuckey Test.

III. RESULTS

The body defense system of tiger shrimp (*Penaeus monodon*) on the administration of seaweed extract *Ulva reticulata* is indicated by the number of hemocytes and on the phagocytic activity. Hemocytes are one form of cellular defense. Hemocytes play a role in the process of phagocytosis, encapsulation, degranulation, and nodular aggregation of foreign pathogens and particles as well as the production and release of prophenoloxidase (proPO) in the immune system of crustaceans (Sahoo et al., 2008). The hemocytes counts in crustaceans are very important in maintaining resistance to pathogens. Immunoreactive factors such as peroxinectin, antibacterial peptides, and clotting components are stored in the hemocytes, so an increase in the number of hemocytes is a measure of the ability of a substance to stimulate the body's defense system of shrimp.

The results showed that the number of hemocytes given *Ulva reticulata* extract gave higher results than control. The results of the variance analysis and further testing of total hemocytes differed significantly ($P < 0.05$) between treatments and controls.

The administration of *Ulva reticulata* Extract 1.5 g kg⁻¹ showed a higher total hemocyte value compared to other Johansson et al. (2000), shrimp hemocytes play an important role in immune responses including recognition, phagocytosis, melanization, cytotoxicity, and inter-cell communication. The results of the above research are in accordance with the research of Selvin et al. (2004) which states that *Ulva* sp extract can

increase the total hemocytes of tiger shrimp. Similar research that has been done shows that the shrimp immune response can be improved by the application of sulfate polysaccharides contained in *Ulva* sp. Sakai (1999) Sakai (1999) states that the ability of immunostimulants to enhance the immune response and develop protection against pathogenic infections is influenced by the dose of the application. Giving immunostimulants at concentrations below the minimum value for the occurrence of an immune response does not have an effect on increasing the number of hemocytes.

Brown (2000), states that increasing immunity can be known from the increase in phagocyte cell activity from hemocytes, namely the ability of immune response cells to phagocytosis of disease agents that enter the body.

The results showed that the phagocytosis activity given *Ulva reticulata* extract gave higher results than controls. The results of the variance analysis showed that the addition of *Ulva reticulata* extract had a significant effect ($P < 0.05$) on the phagocytosis activity of tiger shrimp.

The administration of *Ulva reticulata* extract in feed at a dose of 1.5 g kg^{-1} showed the best results with a phagocytosis activity of 77% compared to other treatments.

Increasing the phagocytosis activity can be indicated that the addition of *Ulva reticulata* extract in feed can stimulate or enhance the immune system in shrimp. According to Suleman et al (2018) stated that the content of sulfate polysaccharides contained in extracts from *Ulva* sp was able to increase the phagocytic activity by 53% in vannamei shrimp.

Table 1. Total Haemocytes Count of Tiger Shrimp After Feeding Treatment with *Ulva reticulata* Extract

| Treatment | Mean ($\times 10^5 \text{ sel/ml}$) \pm SD |
|-------------------------------|--|
| K (0 g kg^{-1}) | 1,3 \pm 0,15 ^a |
| A ($0,5 \text{ g kg}^{-1}$) | 1,9 \pm 0,82 ^a |
| B ($1,0 \text{ g kg}^{-1}$) | 2,0 \pm 0,57 ^a |
| C ($1,5 \text{ g kg}^{-1}$) | 3,0 \pm 0,75 ^b |

Data (mean \pm SD) at the same time of observation with different letters show significant differences in results ($p < 0.05$)

Table 2. Percentage of phagocytosis Activity of Wind Shrimp After Treatment of Feeding with *Ulva Reticulata* Extract

| Treatment | Mean(%) \pm SD |
|-------------------------------|----------------------------|
| K (0 g kg^{-1}) | 43 \pm 8,1 ^a |
| A ($0,5 \text{ g kg}^{-1}$) | 48 \pm 10,7 ^a |
| B ($1,0 \text{ g kg}^{-1}$) | 70 \pm 8,5 ^b |
| C ($1,5 \text{ g kg}^{-1}$) | 77 \pm 6,0 ^b |

Data (mean \pm SD) at the same time of observation with different letters show significant differences in results ($p < 0.05$)

Phagocytosis activity is a very important way of controlling and destroying foreign particles. The defense process through phagocytosis is divided into several processes, chemotaxis, recognition, and internalization (Bachere, 1995). According to Smith et al. (2003), hemocytes perform an Inflammatory-type reaction such as phagocytes, hemocyte clumping, production of oxygen-reactive metabolites and microbicidal release of proteins.

The process of phagocytosis begins with attachment (ingestion) and ingestion (ingestion) of microbial particles into phagocytic cells. Phagocytes cells then form digestive vacuole (digestive vacuole) called phagosomes. Lysosomes (granules in phagocyte cytoplasm) then fuse with phagosomes to form phagolysosomes. Subsequent microorganisms are destroyed and microbial debris is excreted from the cell through the egestion process Destruction of phagocytic microbial particles involves the release of enzymes into phagosomes and the production of ROI

(reactive oxygen intermediate) now called respiratory burst (Rodriguez and Le Moullac, 2000 in Manoppo, 2011

Dugger and Jory (1999) said phagocytes of hemocytes are one of the nonimmune systems specific to shrimp. These cells recognize stimulants depending on the type of surface of the molecules and carbohydrates found on the surface of pathogens and how these molecular types differ from the surface of the host cell. Cell recognition itself includes a number of complex structures on the surface of the host cell where the hemocytes can recognize and interpret.

IV. CONCLUSION

Based on the results of research feeding with the addition of *Ulva reticulata* extract, the cellular immune response increased in the form of total hemocytes and phagocytosis activity in tiger shrimp. The best results for the number of hemocytes and

phagocytosis indices are indicated by the addition of *Ulva reticulata* extract at a dose of 1.5 g kg⁻¹ feed.

V. SUGGESTION

Further research to obtain a pure extract of *Ulva reticulata* as immunostimulants in shrimp farming.

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X Band Doppler Radar

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Abstract- Like most radars, Doppler radar detects an object by sending out a series of pulses of electromagnetic radiation in the radio or microwave region of the spectrum. In this research, Doppler radar is used to find out the time period of a moving pendulum for different lengths, to measure the rotation rate in rpm, to determine the Doppler frequency of moving object and to know the less vibration measurement. This radar contains parabolic reflector and Monolithic Microwave ICs (MMICs) transceiver. Observation and measurements are taken from zelscope software. This software extracts the information of amplitude, time, frequency, FFT etc and this information can be used to device various configurations of the radar.

Index Terms- Doppler frequency, pendulum, radar, zelscope

I. INTRODUCTION

Doppler effect is a shift in the frequency of a wave caused by the relative motion of the transmitting source, the reflecting object or the receiving system. If the energy source and the reflecting object are moving toward each other, the reflected frequency will be higher. If the energy source and the reflecting object are moving away from each other, the reflected frequency will be lower. If an object is moving, its velocity, relative to the radar, can be detected by comparing the transmitter frequency with the echo frequency. The difference frequency called the Doppler frequency (f_d) is related to object velocity. Doppler effect can be described mathematically in the case of Doppler radar by the following equation [1].

$$f_d = (2u/\lambda) \cos(\theta) \quad (1)$$

where f_d is the change in frequency, u is the velocity of the relative motion, λ is the wavelength of the transmitted waves, and θ is the angle between the source and the direction of motion.

In this design, the wavelength corresponds to free space wavelength of the 10.525 GHz CW signal generated by the radar.

Since
Speed of light = frequency \times wavelength (2)

Hence
 $3 \times 10^8 \text{ m/s} = 10.525 \times 10^9 \times \text{wavelength}$ (3)

Wavelength = $2.85 \times 10^{-2} \text{ m}$ (4)

So
 $f_d = 2 \times u / 2.85 \times 10^{-2} \text{ Hz}$ where u is in m/s (5)

$f_d = 70.17 \times u \text{ Hz}$ (6)

which means that a relative velocity of 1m/s produces a Doppler shift of 70.17 Hz for a carrier frequency of 10.525 GHz.

II. SYSTEM BLOCK DIAGRAM

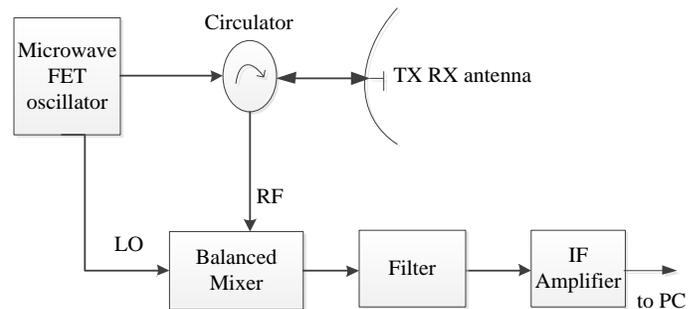


Figure 1: Overall Block Diagram

CW Doppler radar contains a dielectric resonator stabilized microwave FET oscillator, providing a frequency and amplitude stable signal at the operating frequency. The power from this oscillator is filtered to remove harmonic and spurious signals and is then split into two approximately equal amplitude signals. One of these signals is further filtered and feeds the transmit antennas, illuminating the target. The other signal is routed to the local oscillator input of a balanced mixer providing the reference signal against which the Doppler return signal is compared. The Doppler return signal, reflected from the target is collected by the received antennas and coupled to the RF input of the balanced mixer where it is compared with the transmitted signal. The Doppler received signal is extracted and is available at the IF output for signal processing [3].

III. HARDWARE COMPONENTS

Since some of the more complex functions in the generic transceiver block diagram can be fabricated by using MMIC technology, the components that can be realized through the use of this technology can be employed to create system architectures that are difficult if not impossible to design with other, less integrated technologies. The MMIC design approach utilizes active and passive devices that have been manufactured by using a single process. Active and passive circuit elements are formed on a semi-insulating semiconductor substrate, GaAs, through various deposition schemes. The monolithic approach to circuit design inherently offers several advantages [2].

A. Doppler Antenna

An antenna is used to transmit and receive the radio frequency signal, which is 10.525 GHz (X Band) in this system. It is a parabolic reflector located at the front of the feed module, and has a fairly narrow beam width for pointing accuracy. The antenna mount uses adjustable feed point for the best gain of antenna. The focal point of the reflector antenna coincides with the phase center of the feed horn for maximum gain. Antenna gives a gain of around 10dB under optimum conditions.

Circulator is used as a type of duplexer to route signals from the transmitter to the antenna and from the antenna to the receiver, without allowing signals to pass directly from transmitter to receiver [6].

B. Oscillator

The microwave FET based oscillator requires $5V \pm 0.25V$ applied to the +5V terminal of the device. If the oscillator is powered continuously in CW mode, the current consumption is typically 50mA. The peak value of the pulse voltage lays between 4.75 and 5.25 V and the flatter the pulse top the better the detection capability of the Doppler will be. Under these conditions pulse chirp will be less than 1MHz.

C. Balanced Mixer

The mixer in this system compares the frequency of the transmitted signal with the signals reflected back from targets in the coverage area. A portion of the oscillator signal is fed to the LO port of the mixer, and the return signal intercepted by the receive antenna is fed to the RF input. The magnitude of the IF output signal is proportional to the magnitude of the signal received at the RF input, and the frequency is proportional to the relative velocity of the target reflecting the received signal [3].

D. Radio Frequency Module

The Doppler module supplies the transmitted RF signal to the antenna and it also performs a mixing operation on the received signal. Typically three frequencies are in a mixer: the RF, the local oscillator frequency, and the difference frequency. The difference between the LO and RF is the Doppler shift causes and this is the output from the mixer

In CW mode, the total transmitted power is less than 15mW. This power is distributed within the coverage pattern of the unit, and the maximum power density is $1\text{mW}/\text{cm}^2$ at a distance of 5mm from the front face of the radar.

E. Amplifier

Amplifier is used to amplify the signal so that a good magnitude of signal could be achieved on display (either PC or any CRO) for further analysis of this signal. In this system, Amplifier provides a gain of around 40dB as the signal received from the radar is a few micro volts only.

F. Filter

Filter circuit is used to filter the noise in the Doppler echo signal [2]. It is a low pass filter.

IV. SIGNAL PROCESSING

The processing unit amplifies the baseband signal f_d and filters any DC components. The processor makes use the sound card of the PC for baseband processing. A fast A/D converter converts the incoming analog IF signal to digital signal with an accuracy of 16 bits and a sampling rate of 44100 samples per second.

Zelscope is Windows software that converts your PC into a dual-trace storage oscilloscope and spectrum analyzer. It uses your computer's sound card as analog-to-digital converter, presenting a real-time waveform or spectrum of the signal which can be music, speech, or output from an electronic circuit. Zelscope features the interface of a traditional oscilloscope, with conventional gain, offset, time base, and trigger controls. As a real-time spectrum analyzer, Zelscope can display the amplitude and phase components of the spectrum. Sampling rate is 11 kHz to 44 kHz. Available bandwidth is between 10Hz and 20 kHz. On screen measurement, by setting two cursors left and right, voltage and time difference and direct frequency can be readout. Raw data can export as WAV file [4].

V. TEST AND RESULTS

X band Doppler radar is shown in Fig.2. The feed phase center in this radar is placed at the focus of the parabolic dish for best gain from antenna. The very small wavelength of signal is used for transmission and reception, adjustment becomes very important aspect in order to achieve better sensitivity. To get accurate measurement, target will be in the range of 1m in front of radar in its line of sight.



Figure 2: X band Doppler Radar

A. Determination the velocity of the object

When target is moved slowly from right to left or left to right, corresponding Doppler frequency can be observed and measured on test point f_d . From this frequency we can calculate the velocity of target by using equation (1). In Fig.3, Doppler frequency is 6 kHz and it means that target is moving with the velocity of 9ms^{-1} in radial motion. Aspect angle is zero degree and distance is at 1m from the Doppler radar. In Fig.4, the distance of target is decreased and we can see that the signal level increase.

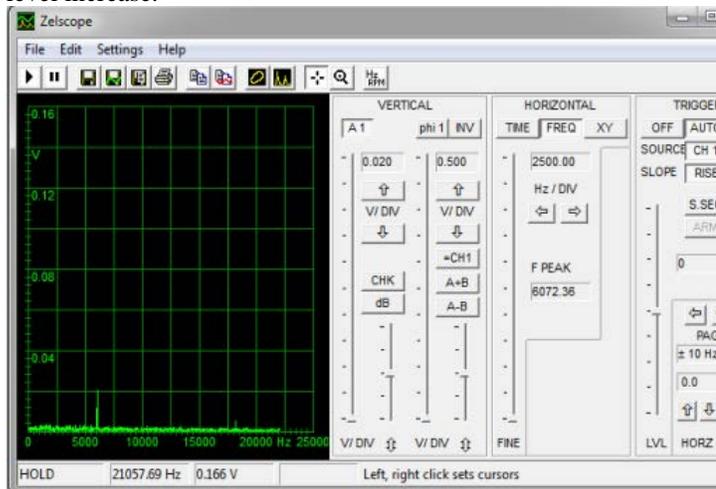


Figure 3: Target Signal Captured by Radar at 1m

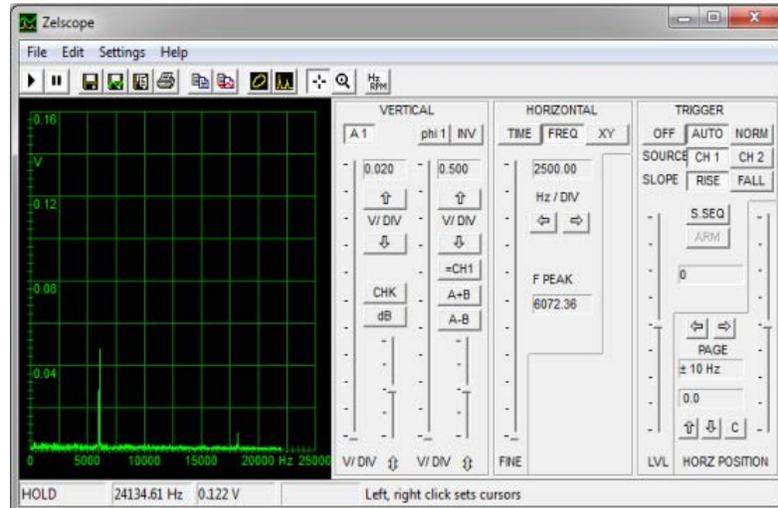


Figure 4: Target Signal Captured by Radar at 0.5m

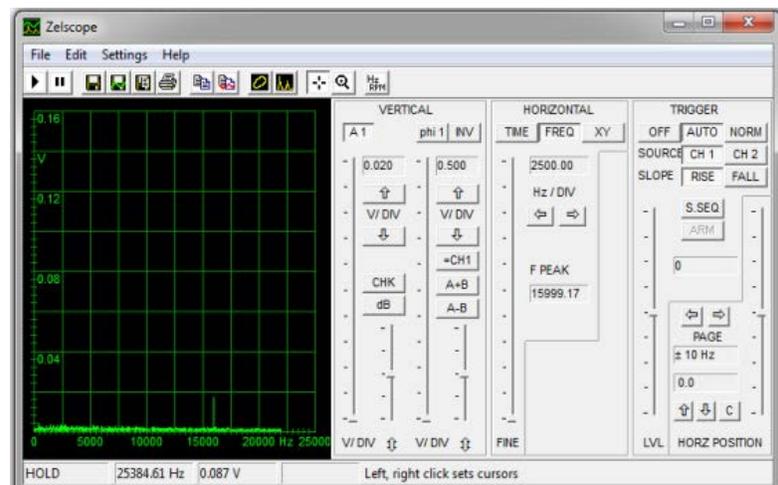


Figure 5: 16 kHz Target Signal Captured by Radar at 1m

B. Time and frequency measurement of moving pendulum

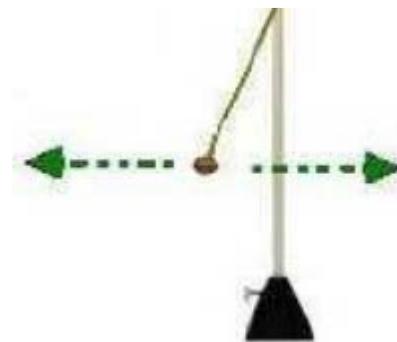


Figure 6: Hanging Pendulum on Stand

Theoretically the time period T of pendulum in Fig.6 is given by

$$T = 2\pi\sqrt{l/g} \quad (7)$$

where l is length of pendulum and g is constant 9.8ms^{-2} .
 Time period of pendulum is independent of amplitude of oscillations. When bob of pendulum moves to and fro, it will reflect the incoming microwave signal.

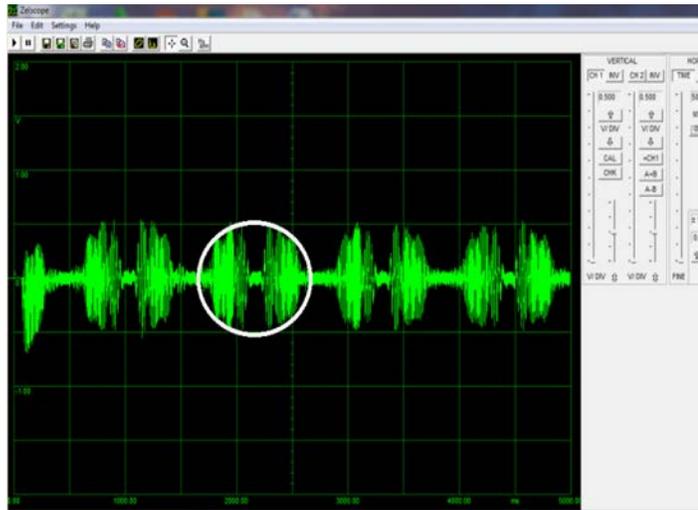


Figure 7: Pendulum Signature Captured by Doppler Radar

In Fig.7, captured signal on display can be observed that when pendulum is moving to and fro then Doppler radar draws the signal twice, so the time period can be measured between any peaks of the signal. Since the radar responds to both to and fro movements the time taken for oscillation is two graticule (1000 ms). The length of pendulum is 25cm. The theoretical time period is 1.0 second. Results can be changed by changing the length. It means radar can detect for very small objects, with the accurate results. Fig.8 shows the time period of 10cm length pendulum.

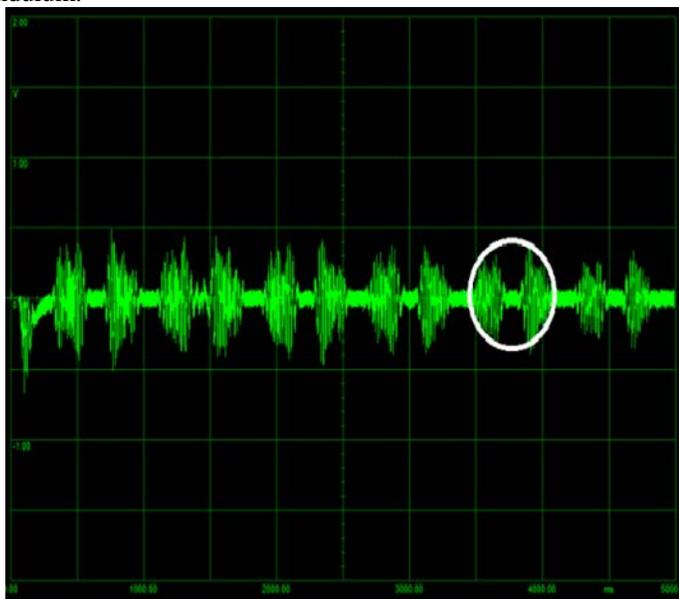


Figure 8: Pendulum Signature for 10 cm in length

C. Detection of vibration of tuning fork

For generating the vibrations, stroke any tuning fork and bring it in front of the radar antenna. The Doppler frequency is generated because of vibrations of tuning fork as approximately frequency written on it.



Figure 9: 256 Hz tuning fork

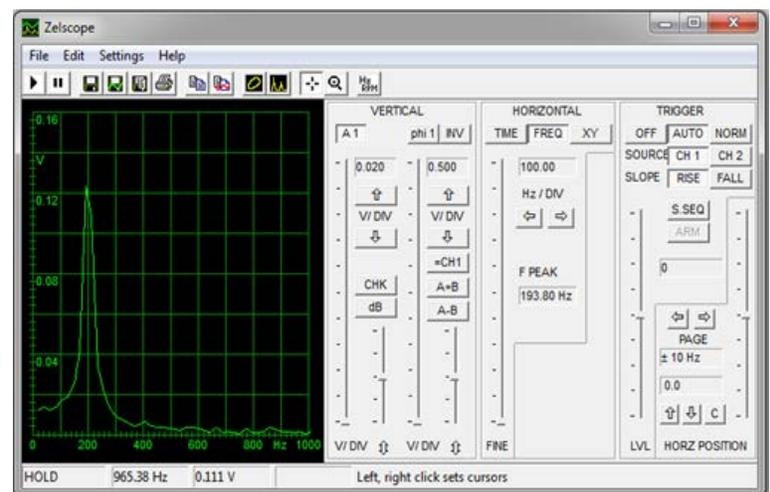


Figure 10: Signal from the Vibrating Tuning Fork

There is a small difference between the frequency of tuning fork and the Doppler frequency on PC due to the manufacturing tolerances. Radar measures the frequency, RPM, velocities accurately. Tuning fork provides the standard frequency source, which can be read off from the PC for calibration.

D. Rotation per minute (RPM) measurement of Fan

A fan at full speed is placed in front of radar at a suitable distance from antenna to get the proper deflection in the form of Doppler frequency.



Figure 11: A Fan for RPM Measurement

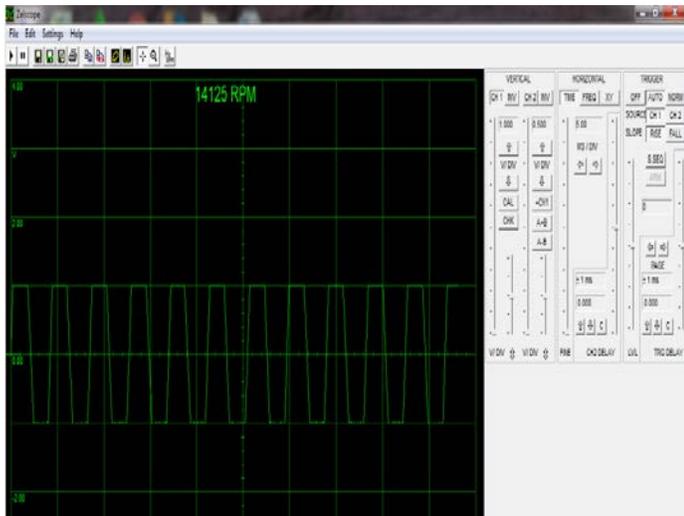


Figure 12: Signal from the Rotating Fan

The rpm of fan is measured as indicated on the radar software. To get the actual speed of fan, count the number of blades and divide the rpm of the fan indicated by software. The CPU fan has very curved blades, which provide adequate radar signature when looked at axially as compared to a ceiling fan.

VI. CONCLUSION

This system is a complete Doppler radar training system for teaching and learning in the laboratory. The CW Doppler Radar can be used to measure the speed of automobiles, shells, guided missiles etc. It can be used to detect movement of troops, vehicles even in dark and in the bad weather. Unlike pulsed radar, CW Radar is able to detect an aircraft in spite of fixed objects. However practical application of CW Radar is limited by the fact that several targets at a given bearing tend to cause confusion. Also range discrimination may be achieved only by very costly circuit complexity. Further it is the maximum power

it transmits and this places a limit on its maximum range. Also it is not capable of indicating the range of the target and can show only its velocity. CW Doppler Radar has other advantages like it uses low transmitting power, low power consumption, and small size.

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Switch Controller Design and H_∞ Performance Achievement

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Abstract- This paper treats the problem of switching controller design which includes several linear time-invariant (LTI) controllers-all of them capable of stabilizing a specific LTI plant-in such a way that the H_∞ control performance of the closed-loop system is guaranteed for any switching sequence. It is demonstrated that there is a possibility to find realizations for these controller transfer matrices so that the closed-loop system remains H_∞ control performance under arbitrary switching.

Index Terms- H_∞ performance achievement, Switching control, Random switching, Realization theory.,

I. INTRODUCTION

Recently, we find an increasing interest from the scientific community in the study of linear switching system, which comprises a collection of subsystems described by linear dynamics (differential/difference equations), together with a switching rule that specifies the switching between the subsystems; see the survey papers [1-3], the recent book [4, 5] and the references cited therein [6-12]. With its strong engineering backgrounds, such systems can be used to construct a controller for a wide range of physical and engineering plants in practice. When the switching law has no given mode (or is arbitrary), one way to investigate analysis and synthesis problems of stability or L_2 gain performance is to find a common Lyapunov function for all the switching models (c.f. [13]-[20]). Even though these conditions tend to be strong due to the existence of a common Lyapunov function that guarantees the stability or control performance of a system under all possible switching, those based on quadratic functions have been successful because of the development of efficient tools based on LMIs [21, 22].

For dealing with the control of complex systems where conflicting requirements make a single LTI controller unsuitable, reference [23] has provided a switching control strategy to achieve global stability under arbitrary switching. It has been proven that, given a single linear plant and a family of linear stabilizing compensators, there always exist (possibly non-minimal) realizations for all of them which assure global stability, no matter how we switch among the controller. This result is based on the Youla-Kucera parameterization [25],[26] of all stabilizing compensators. In a recent paper [24], given any arbitrary family of compensators, each of which is stabilizing the corresponding LTI plant, there exist suitable realizations for each of these compensators which assure stability of the closed-loop system under arbitrary switching.

On the other hand, the regular H_∞ problem could be solved by the famous Riccati equation based algorithm [27]. Meanwhile, it also provides a parameterization of all possible stabilizing controllers guaranteeing a bound of H_∞ performance of the closed-loop system [27]. In dealing with switching controllers design, a fundamental issue is how to guarantee the control performance under arbitrary switching. Our basic question is the following: given a strictly proper plant, under which conditions there exists a switching compensator which guarantees some H_∞ performance under arbitrary switching? Till now, to the author's knowledge, switching between H_∞ performance controllers regardless the switching signal has not been explored fully yet.

The main idea of the present paper is to design a switching controller that includes several LTI controllers designed beforehand and independently-all of them capable of stabilizing a specific LTI plant-in such a way that H_∞ control performance of the closed-loop system is guaranteed for any switching sequence. That is, the switching signal is assumed to be arbitrary while a set of H_∞ controllers are implemented for the plant. The important step of the controller design is to select realizations for these individual parameters so that switching between them results in a stable time-varying system with a specific H_∞ performance criterion. Compared with previous results, there are two main contributions. First, given a switching system including a set of LTI systems guaranteeing corresponding H_∞ performances, it provides state space realizations of these LTI systems which guarantee that the switching system assures the H_∞ performance, whose bound is the maximum of H_∞ performance values of these LTI systems.

Second, given an LTI plant and a family of LTI controllers guaranteeing corresponding H~ performances for the LTI plant, respectively, state space realizations for these LTI controllers will be given, which assure not only an H~ performance of the overall closed-loop system under arbitrary switching but also the corresponding H~ performance of local closed-loop system at each switching point.

II. DEFINITION AND PROBLEM STATEMENT

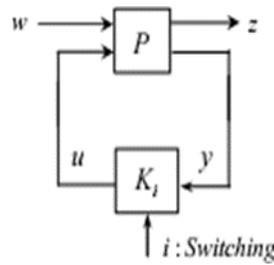


Fig.1 switching control

The state space realization of P is taken to be a simplified form as:

$$\begin{aligned} \dot{x} &= Ax + B_{1w} + B_{2u} \\ z &= C_{1x} + D_{12u} \\ y &= C_{2x} + D_{21w} \end{aligned} \tag{1}$$

With (A, B_1) controllable, (A, B_2) Stabilizable, (C_1, A) observable and (C_2, A) detectable, where $x \in \mathfrak{R}^n$ is the state. Where $w \in \mathfrak{R}^{m1}$ is the disturbance, $u \in \mathfrak{R}^{m2}$ is the control input, $z \in \mathfrak{R}^{p1}$ is the controlled output, $y \in \mathfrak{R}^{p2}$ is the state, respectively. Suppose further that the following regularity assumption hold:

$$D_{12}^T [C_1 \ D_{12}] = [0 \ I], D_{21} [B_1^T \ D_{21}^T] = [0 \ I]$$

According to the concept of dual (see e.g. [29] for details), we define the dual of P as

$$P^* := \begin{cases} \dot{x} = A^T x + C_1^T w + C_2^T u \\ z = B_1^T x + D_{21}^T u \\ y = B_2^T x + D_{12}^T w \end{cases}$$

It is also assumed that there exists a family of linear switching controller transfer matrices $K_i(s)$, designed beforehand and independently for the plant (1) with corresponding H~ control performances γ_i . A state space realization of these switching controllers K_i are given as

$$K_i := \left[\begin{array}{c|c} A_{k,i} & B_{k,i} \\ \hline C_{k,i} & D_{k,i} \end{array} \right] \tag{2}$$

and meanwhile we assume the controller can switch arbitrarily, precisely that

$$i = i(t) \in \tau = \{1, 2, \dots, r\} \tag{3}$$

That is, the method presented here to implement the switching controller guarantees an H_∞ control performance regardless of the algorithm used to command the switching between the controllers. Just as introduced in [24], the following assumptions will be considered.

Assumption 1: Non-Zenoness: The number of switching instants is finite on every finite interval.

Assumption 2: Zero Delay: There is no delay in the communication between the plant and the controller, which, at time t , knows the current $y(t)$ and configuration $i(t)$. Assumption 1 is not an essential restriction and avoids well-posedness issues. Conversely, Assumption 2, may be a restriction in practice, but fairly acceptable in most plants. The closed-loop system matrix achieved from (1) and (2) in

$$A_i^{cl} = \begin{bmatrix} A + B_2 D_{k,i} C_2 & B_2 C_{k,i} \\ B_{k,i} C_2 & A_{k,i} \end{bmatrix}, \quad B_i^{cl} = \begin{bmatrix} B_1 + B_2 D_{k,i} D_{21} \\ B_{k,i} D_{21} \end{bmatrix} \tag{4}$$

$$C_i^{cl} = \begin{bmatrix} C_1 + D_{12} D_{k,i} C_2 & D_{12} C_{k,i} \end{bmatrix}, \quad D_i^{cl} = D_{12} D_{k,i} D_{21} \tag{5}$$

Lemma 1: the following two properties are equivalent:

- (i) Each of the closed-loop system in Fig.1 has H_∞ performance with a bound γ_i for fixed $i(t)$;
- (ii) There exists a positive-definite Lyapunov matrix for system (4)-(5) satisfies

$$\begin{bmatrix} X_i A_i^{cl} + (A_i^{cl})^T X_i & X_i B_i^{cl} & (C_i^{cl})^T \\ * & -\gamma_i I & (D_i^{cl})^T \\ * & * & -\gamma_i I \end{bmatrix} < 0. \tag{6}$$

$$\begin{bmatrix} A_i^{cl} Y_i + Y_i (A_i^{cl})^T & B_i^{cl} & Y_i (C_i^{cl})^T \\ * & -\gamma_i I & (D_i^{cl})^T \\ * & * & -\gamma_i I \end{bmatrix} < 0. \tag{7}$$

The main problem is addressed in this paper as

Problem: Given LTI plant (1) and a family of transfer functions $K_i(s)$ assuring that the closed-loop system (4)-(5) is guaranteed H_∞ control performance γ_i for fixed i , does there exist realizations for the $K_i(s)$ such that the overall closed-loop system is guaranteed the H_∞ performance $\gamma := \max(\gamma_i)$ among arbitrary switching, and meanwhile, the corresponding H_∞ performance γ_i of each local closed-loop system is also maintained by each local controller $K_i(s)$ for fixed

3 PRELIMINARY

In this section, some useful properties among two Riccati equations and correspondent controller constructions for the standard H_∞ control problem will be overviewed as follows.

To simplify notation, we define some equations as

$$\psi(X) = A^T X + XA + X(\gamma^{-2} B_1 B_1^T - B_2 B_2^T)X + C_1^T C_1 \tag{8}$$

$$\psi(Y) = A_{mp} Y + Y A_{mp}^T + Y(\gamma^{-2} X B_2 B_2^T X - C_2^T C_2)Y + B_1 B_1^T \tag{9}$$

Where $A_{mp} = A + \gamma^{-2} B_1 B_1^T X$.

Lemma 2: There exists an admissible γ -suboptimal controller if and only if the two conditions below hold

- (i) There exists a symmetric nonnegative stabilizing solution X to the Riccati equation $\psi(X) = 0$.
- (ii) For the X given in (i), there exists a symmetric nonnegative stabilizing solution Y to Riccati equation $\psi(Y) = 0$.

Moreover, when two conditions hold, one such controller is

$$K_{sub1} = \left[\begin{array}{c|c} \hat{A} + \hat{B}_2 F + L C_2 & -L \\ \hline F & 0 \end{array} \right] \tag{10}$$

Where $\hat{A} = A + \gamma^{-2} B_1 B_1^T X + \gamma^{-2} Y X B_2 B_2^T X$, $\hat{B}_2 = B_2 + \gamma^{-2} Y X B_2$, $L = -Y C_2^T$ and $F = -B_2^T X$

Lemma 3: If conditions (i) and (ii) of lemma (2) are satisfied, the set of all admissible controllers such that $\|T_{zw}\|_\infty < \gamma$ equals the set of all transfer matrices from y to u as

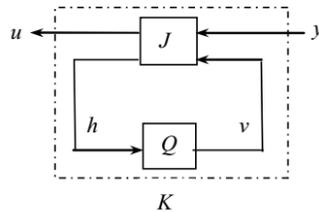


Fig.2. parameterization of γ -suboptimal controller with Q .

Where $Q \in H_\infty$ and $\|Q\|_\infty < \gamma$

$$J := \left[\begin{array}{c|cc} \hat{A} + \hat{B}_2 F + L C_2 & -L & \hat{B}_2 \\ \hline F & 0 & I \\ -C_2 & I & 0 \end{array} \right] \tag{11}$$

It is a very useful construction, since the free parameter Q increase adjustable parameter for control systems.

Remark: Any stabilizing controller $K(S)$ is expressed with a quadratically stable Q_0 as $K = F_l(J, Q_0)$. Considering a function

$Q_0 = F_l(\hat{J}, K)$, where

$$\hat{J} := \left[\begin{array}{c|cc} \hat{A} & Y C_2^T & \hat{B}_2 \\ \hline B_2^T X & 0 & I \\ C_2 & I & 0 \end{array} \right] = \left[\begin{array}{c|cc} \hat{A} & -L & \hat{B}_2 \\ \hline -F & 0 & I \\ C_2 & I & 0 \end{array} \right] \tag{12}$$

$$F_l(J, Q_0) = F_l(J, F_l(\hat{J}, K)) = F_l(J_{mp}, K), \tag{13}$$

Where J_{mp} can be obtained by using the state space star product formula

$$J_{imp} = \begin{bmatrix} 0 & I \\ I & 0 \end{bmatrix}$$

Hence $F_l(J, Q_0) = F_l(J_{imp}, K) = K$

In this setup, the following lemma (similar to [27, lemma 16.8]) is utilized in the sequel

Lemma 4: Assume conditions (i) and (ii) of lemma (2) are satisfied. Then the controller $K(s)$ is admissible for $P(s)$ and $\|F_l(P, K)\|_\infty < \gamma$.

According to the lemma above, we can choose a proper parameter $Q = F_l(\hat{J}, K)$, whose state space realization could be

$$K := \left[\begin{array}{c|c} A_k & B_k \\ \hline C_k & D_k \end{array} \right]$$

derived with the controller

$$Q := \left[\begin{array}{c|c} A_Q & B_Q \\ \hline C_Q & D_Q \end{array} \right] = \left[\begin{array}{cc|c} \hat{A} + \hat{B}_2 D_k C_2 & \hat{B}_2 C_k & \hat{B}_2 D_k - L \\ B_k C_2 & K_k & B_k \\ \hline D_k C_2 - F & C_k & D_k \end{array} \right] \tag{14}$$

4 MAIN RESULTS

In this section, the proposed control structure and the free parameter Q_0 are shown in Fig.4. According to lemma 3, the free parameter composed of the controllers K_i and \hat{J} is proper stable transfer function that has an H_∞ control performance.

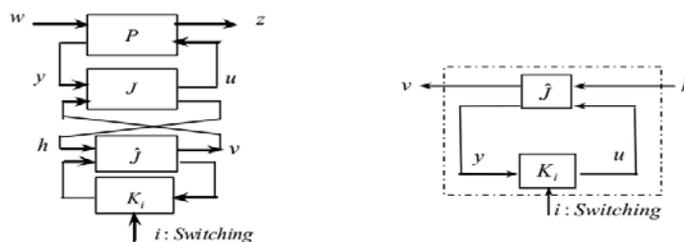


Fig.3. The proposed control structure and $Q_0 = F_l(\hat{J}, K_i)$

First, H_∞ performance realization of the switching system with transfer function expression will be considered here. Similar with the results presented in [24] for the case of linear switching plant, the free parameter Q_0 must be properly realized.

$$Q_{0,i} = \left[\begin{array}{c|c} A_{Q_{0,i}} & B_{Q_{0,i}} \\ \hline C_{Q_{0,i}} & D_{Q_{0,i}} \end{array} \right]$$

Theorem 1: As long as each system of the linear switching system Q_0 has H~ performance with a bound γ_i for fixed i , there always exists H~ performance realization with a bound

$$\gamma := \max(\gamma_i), i = i(t) \in \tau = \{1, 2, \dots, r\}$$

for the switching system Q_0 .

Proof: To prove that there exists a realization that remains an H. performance for the switching system Q_0 , since each system $Q_{0,i}$ has H. performance with a bound γ_i for fixed i , the performance criterion could be chosen as $\gamma := \max(\gamma_i)$. According to lemma 1, there always exist r linear matrix inequalities for the performance criterion γ as

$$\begin{bmatrix} X_i A_{Q_{0,i}} + (A_{Q_{0,i}})^T X_i & X_i B_{Q_{0,i}} & (C_{Q_{0,i}})^T \\ * & -\gamma I & (D_{Q_{0,i}})^T \\ * & * & -\gamma I \end{bmatrix} < 0 \tag{15}$$

If we multiply (15) by $T_i = \begin{bmatrix} R_i^{-T} & 0 & 0 \\ 0 & I & 0 \\ 0 & 0 & I \end{bmatrix}$ on the left and T_i^T on the right, where R_i is an upper triangular matrix

(Cholesky's decomposition) of $X_i = R_i^T R_i$ since T is full row rank, we can get

$$\begin{bmatrix} [\tilde{A}_{Q_{0,i}} + (\tilde{A}_{Q_{0,i}})^T] & \tilde{B}_{Q_{0,i}} & (\tilde{C}_{Q_{0,i}})^T \\ * & -\gamma I & (\tilde{D}_{Q_{0,i}})^T \\ * & * & -\gamma I \end{bmatrix} < 0 \tag{16}$$

Where $\tilde{A}_{Q_{0,i}} = R_i A_{Q_{0,i}} R_i^{-1}$, $\tilde{B}_{Q_{0,i}} = R_i B_{Q_{0,i}}$, $\tilde{C}_{Q_{0,i}} = C_{Q_{0,i}} R_i^T$, and $\tilde{D}_{Q_{0,i}} = D_{Q_{0,i}}$.

Since $Q_{0,i}(s) = \tilde{C}_{Q_{0,i}} [sI - \tilde{A}_{Q_{0,i}}]^{-1} \tilde{B}_{Q_{0,i}} + \tilde{D}_{Q_{0,i}} = C_{Q_{0,i}} [sI - A_{Q_{0,i}}]^{-1} B_{Q_{0,i}} + D_{Q_{0,i}}$, $i = i(t) \in \tau = \{1, 2, \dots, r\}$ and there exists identity matrix, it means the state space realization $\{\tilde{A}_{Q_{0,i}}, \tilde{B}_{Q_{0,i}}, \tilde{C}_{Q_{0,i}}, \tilde{D}_{Q_{0,i}}\}$ has H~ performance with the bound γ for any $i = i(t) \in \tau = \{1, 2, \dots, r\}$

The following procedure provides the H~performance realization with the bound γ for the switching system Q_0 .

Procedure:

- 1) Take any realization $\{A_{Q_{0,i}}, B_{Q_{0,i}}, C_{Q_{0,i}}, D_{Q_{0,i}}\}$ of each system $Q_{0,i}$, so that $Q_{0,i}(s) = C_{Q_{0,i}} [sI - A_{Q_{0,i}}]^{-1} A_{Q_{0,i}} + D_{Q_{0,i}}$ which is H~ performance with a bound γ_i
- 2) Compute the positive-definite solution X_i of the following inequalities as

$$\begin{bmatrix} X_i A_{Q_{0,i}} + A_{Q_{0,i}}^T X_i & X_i B_{Q_{0,i}} & C_{Q_{0,i}}^T \\ * & -\gamma I & D_{Q_{0,i}}^T \\ * & * & -\gamma I \end{bmatrix} \prec 0, \tag{17}$$

Where $\gamma := \max(\gamma_i)$

3) Factorize X_i as $X_i = R_i^T$ where R is an upper matrix triangular matrix (Cholesky's decomposition).

4) Realize the given function as

$$\begin{aligned} \dot{Z}(t) &= \tilde{A}_{Q_{0,i}} Z(t) + \tilde{B}_{Q_{0,i}} v(t) \\ h(t) &= \tilde{C}_{Q_{0,i}} z(t) + \tilde{D}_{Q_{0,i}} v(t) \end{aligned} \tag{18}$$

Where $\tilde{A}_{Q_{0,i}} = R_i A_{Q_{0,i}} R_i^{-1}$, $\tilde{B}_{Q_{0,i}} = R_i B_{Q_{0,i}}$, $\tilde{C}_{Q_{0,i}} = C_{Q_{0,i}} R_i^{-1}$, and $\tilde{D}_{Q_{0,i}} = D_{Q_{0,i}}$

Henceforth, two Riccati equations (8) and (9) of the standard H_∞ control problem always have symmetric nonnegative stabilizing solutions for $\gamma := \max(\gamma_i)$. The main result of this subsection is stated as follows.

Theorem 2: Given LTI plant (1) and a family of transfer functions $K_i(s)$, $i = i(t) \in \tau = \{1, 2, \dots, r\}$, each stabilizing plant (1) with corresponding H_∞ performance γ_i , and then Riccati equations (8) and (9) of the standard H_∞ control problem have symmetric nonnegative stabilizing solutions X and Y for the criterion $\gamma := \max(\gamma_i)$, there exists non-minimal realizations of these switching transfer functions.

$K_i(s)$ shown in Fig.4 that guarantees H_∞ performance of the closed-loop system for every i , and a set of state space realizations of $K_i(s)$ are given as

$$A_{k,i} = \begin{bmatrix} \hat{A} + \hat{B}_2 F + L C_2 - \hat{B}_2 D_{k,i} C_2 & \hat{B}_2 \tilde{C}_{Q_{0,i}} \\ -\tilde{B}_{Q_{0,i}} C_2 & \tilde{A}_{Q_{0,i}} \end{bmatrix}, \tag{19}$$

$$B_{k,i} = \begin{bmatrix} \hat{B}_2 D_{k,i} - L \\ \tilde{B}_{Q_{0,i}} \end{bmatrix},$$

$$C_{k,i} = \begin{bmatrix} F - D_{k,i} & \tilde{C}_{Q_{0,i}} \end{bmatrix}, \quad D_{k,i} = D_{k,i} \tag{20}$$

Where $\hat{A} = A + \gamma^{-2} B_1 B_1^T X + \gamma^{-2} Y X B_2 B_2^T X$, and $\hat{B}_2 = B_2 + \gamma^{-2} Y X B_2$, $L = -Y C_2^T$, $F = -B_2^T X$

$$\left[\begin{array}{c|c} \tilde{A}_{Q_{0,i}} & \tilde{B}_{Q_{0,i}} \\ \hline \tilde{C}_{Q_{0,i}} & \tilde{D}_{Q_{0,i}} \end{array} \right] = \left[\begin{array}{c|c} R_i A_{Q_{0,i}} R_i^{-1} & R_i B_{Q_{0,i}} \\ \hline C_{Q_{0,i}} R_i^{-1} & D_{Q_{0,i}} \end{array} \right] \tag{21}$$

With $\left[\begin{array}{c|c} A_{Q_{0,i}} & B_{Q_{0,i}} \\ \hline C_{Q_{0,i}} & D_{Q_{0,i}} \end{array} \right] = \left[\begin{array}{c|c|c} \hat{A} + \hat{B}_2 D_{k,i} C_2 & \hat{B}_2 C_{k,i} & \hat{B}_2 D_{k,i} - L \\ \hline B_{k,i} C_2 & A_{k,i} & B_{k,i} \\ \hline D_{k,i} C_2 - F & C_{k,i} & D_{k,i} \end{array} \right]$ and R_i is a derived from $X_i = R_i^T R_i$ according to (17)

Proof:

According to lemma 4, the H~ performance $\|F_1(G, K)\|_\infty$ is equivalent with $\|F_1(\hat{J}, K)\|_\infty$ by the controller K . That is, when the controller $K = F_1(J, Q_0)$ is chosen, we have $\|F_1(\hat{J}, F_1(J, Q_0))\|_\infty = \|Q_0\|_\infty$. That is the H~ performance of the closed-loop system is equivalent with the system Q_0 . Thus, we can construct the switching system Q_0 combined with $Q_{0,i}$, which has H~ performance realization with the bound γ .

If each switching system of Q_0 is chosen as

$$Q_{0,i} = F_1(\hat{J}, K_i), \text{ where } \hat{J} := \left[\begin{array}{c|cc} \hat{A} & -L & \hat{B}_2 \\ \hline -F & 0 & I \\ \hline C_2 & I & 0 \end{array} \right] \text{ is shown in Fig.3, the state space realization of } Q_{0,i} \text{ could be obtainable as}$$

$$Q_{0,i} = \left[\begin{array}{c|c} A_{Q_{0,i}} & B_{Q_{0,i}} \\ \hline C_{Q_{0,i}} & D_{Q_{0,i}} \end{array} \right] = \left[\begin{array}{c|c|c} \hat{A} + \hat{B} D_{k,i} C_2 & \hat{B}_2 C_{k,i} & \hat{B}_2 D_{k,i} - L \\ \hline B_{k,i} C_2 & A_{k,i} & B_{k,i} \\ \hline D_{k,i} C_2 - F & C_{k,i} & D_{k,i} \end{array} \right]$$

Since each of $K_i(s)$ is stabilizing the plant (1) with H~ performance γ_i , we have $\|Q_{0,i}\|_\infty \leq \gamma_i \leq \gamma$, with $\gamma := \max(\gamma_i)$.

According to theorem 1, an H~ performance realization with the bound γ of $Q_{0,i}$ could be written as

$$\left[\begin{array}{c|c} \tilde{A}_{Q_{0,i}} & \tilde{B}_{Q_{0,i}} \\ \hline \tilde{C}_{Q_{0,i}} & \tilde{D}_{Q_{0,i}} \end{array} \right] = \left[\begin{array}{c|c} R_i A_{Q_{0,i}} R_i^{-1} & R_i B_{Q_{0,i}} \\ \hline C_{Q_{0,i}} R_i^{-1} & D_{Q_{0,i}} \end{array} \right],$$

Where R_i is derived from $X_i = R_i^T R_i$ with (17). Even though state space realizations of $Q_{0,i}$ may be different, transfer function expression of each system $Q_{0,i}$ is the same. Finally, when the realization of $Q_{0,i}$ is substituted into $K_i = F_1(J, Q_{0,i})$, a set of state space realizations of $K_i(s)$ could be obtainable as (19)-(20).

Remark: The theorem above gives the answer to the problem presented in section II. Each system $Q_{0,i}$ can be selected in such a way shown as Fig.4 that the resulting controller transfer function is the desired one $K_i(s)$. The only problem concerned with Q_0 is its realization, which cannot be arbitrary. Here, an H~ realization method of Q_0 is given as (21).

5 NUMERICAL EXAMPLE

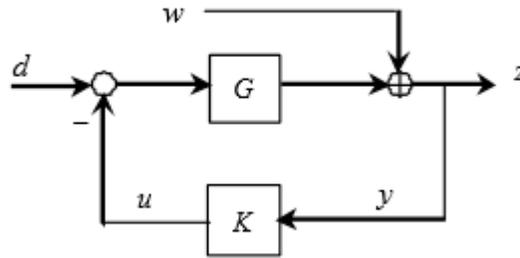


Fig. 4. Mixed sensitivity function minimization problem

We consider the practical example of Hespanha and Morse (2002) in [23] corresponding to the control of the roll angle of an aircraft. The model is defined by the transfer function

$$G(s) = \frac{-1000}{s(s + 0.875)(s + 50)}$$

Two controllers are considered to guarantee different H_∞ performance for mixed sensitivity function minimization problem, the first one is designed for good noise rejection properties, whereas the second is a little fast but sensitive to measurement noise. Furthermore, both of controllers are considering the properties of not only the output of controlled plant but also the output of the controller.

The controlled input vector is defined in Fig. 4 as follows:

$$\begin{bmatrix} z \\ u \end{bmatrix} = \begin{bmatrix} (I + GK)^{-1}G & (I + GK)^{-1} \\ K(I + GK)^{-1}G & (I + GK)^{-1}K \end{bmatrix} \begin{bmatrix} d \\ w \end{bmatrix}, \tag{22}$$

Where d is the input disturbance and w is the measurement noise. In this case, the state space presentation of the generalized plant is

$$P := \left[\begin{array}{c|cc} A & [B & 0] & -B \\ \hline [C] & [0 & I] & [0] \\ [0] & [0 & 0] & [-1] \\ C & [0 & 1] & 0 \end{array} \right] \tag{23}$$

Since D_{11} of above generalized plant is not zero matrix, it does not satisfy the assumption of by the solution of traditional Riccati equations. We utilize the elimination procedure of D_{11} and scaling transformation introduced in [29]. The generalized plant satisfying all assumptions is obtained as follows.

$$\tilde{G} = \left[\begin{array}{c|cc} A & B_1 & B_2 \\ \hline C_1 & 0 & D_{12} \\ C_2 & D_{21} & 0 \end{array} \right] = \left[\begin{array}{c|cc} A & [B & 0] & -B \\ \hline p(1-\gamma^{-2})^{(1/2)}C & [0 & 0] & [0] \\ (1-\gamma^{-2})^{(-1/2)}C & [0 & 0] & [-1] \\ [0 & -1] & 0 \end{array} \right] \tag{24}$$

where the weighting function ρ is chosen as a positive number. And the positive number γ is a prescribed H- performance criterion. The H infinite controller for (23) can be obtained as

$$K = \sqrt{1 - \gamma^{-2} \tilde{K}} \tag{25}$$

where \tilde{K} is the H- controller for (24), which could be solved by the traditional method of Riccati equations. It is easily found that the generalized plant above satisfies all assumptions. Here ρ is chosen equal to 100 and 300 for K_1 and K_2 , respectively. This choices of ρ result in K_2 exhibiting a faster response than K_1 with performance criterions $\gamma_1 = 107.7$ and $\gamma_2 = 313.2$, respectively as

$$K_1 = \frac{-6.7e4s^2 - 3.5e6s - 7.7e6}{s^3 + 729.7s^2 + 7.3e4s + 3.1e6},$$

$$K_2 = \frac{-3.035e5s^2 - 1.585e7s - 3.362e7}{s^3 + 1208s^2 + 1.694e5s + 1.101e7}$$

In this case, to construct LFT formulation of controller for $K_i = F_l(J, Q_{0,i})$ in Fig.3, K_i is chosen to be the central solution, where symmetric nonnegative stabilizing matrices X and Y of two H- like Riccati equations are solved as

$$X = \begin{bmatrix} 57.9 & 4.6e^3 & 1.0e^5 \\ 4.6e^3 & 4.1e^5 & 1.1e^7 \\ 1.0e^5 & 1.1e^7 & 4.6e^8 \end{bmatrix} \quad \text{and} \quad Y = \begin{bmatrix} 9.7e^{-3} & 8.1e^{-5} & -2.6e^{-5} \\ 8.1e^{-5} & 1.3e^{-4} & 3.4e^{-5} \\ -2.6e^{-5} & 3.4e^{-5} & 2.2e^{-5} \end{bmatrix}$$

We can obtain

$$J := \left[\begin{array}{ccc|cc} -108.7 & -4.6e^3 & -9.9e^4 & 6.0e^{-1} & -9.9e^{-1} \\ 1.0 & 0 & -1.0e^3 & -1.0 & -9.3e^{-3} \\ 0 & 1 & -6.2e^2 & -6.2e^{-1} & -5.7e^{-3} \\ \hline 57.8 & 4.6e^3 & 1.0e^5 & 0 & 1 \\ 0 & 0 & 1.0e^3 & 1 & 0 \end{array} \right]$$

To design the multi-controller for $K := \{K_1, K_2\}$, we have

$$Q_{0,i} = F_l(\hat{J}, K_i), \quad \text{where} \quad \hat{J} = \left[\begin{array}{c|cc} \hat{A} & -L & \hat{B}_2 \\ \hline -F & 0 & I \\ C_2 & I & 0 \end{array} \right] \quad \text{is shown in Fig.4}$$

The corresponding transfer matrices $\{Q_{0,1}, Q_{0,2}\}$ are then computed using (21). Since K_1 is chosen to be the central solution, we have $Q_{0,1} = 0$. The state space realization of $Q_{0,2}$ can be obtainable as

$$Q_{0,2} = \left[\begin{array}{cccccc|c} -51.2 & -68.6 & -5.4e^{-2} & -57.5 & -4.6e^3 & -9.9e^4 & 0.6 \\ 1.5 & 4.3 & 9.3e^2 & -5.4e^{-1} & -4.3e^1 & -9.3e^2 & -1.0 \\ 3.3e^{-3} & 2.7 & 5.7e^2 & -3.3e^{-1} & -2.6e^1 & -5.7e^2 & -0.6 \\ 0 & 0 & -6.0e^2 & -1.1e^2 & -4.6e^3 & -9.9e^4 & 0.6 \\ 0 & 0 & 1.0e^3 & 1.0 & 0 & -1.0e^3 & -1.0 \\ 0 & 0 & 6.2e^2 & 0 & 1.0 & -6.2e^2 & -0.6 \\ \hline -57.9 & -4.6e^3 & -1.0e^5 & 57.9 & 4.6e^3 & 1.0e^5 & 0 \end{array} \right]$$

The fact that $Q_{0,1} = 0$ is a consequence of having used $K = K_1$. We then pick a minimal realization $\{\tilde{A}_{Q_{0,2}}, \tilde{B}_{Q_{0,2}}, \tilde{C}_{Q_{0,2}}\}$ for $Q_{0,2}$ and the trivial realization $\{\tilde{A}_{Q_{0,1}}, 0, \tilde{C}_{Q_{0,1}}\}$ for $Q_{0,1}$. Since both realizations share the same stable \tilde{A}_{Q_2} matrix. As mentioned before, it would have been possible to choose realization for $Q_{0,1}$ and $Q_{0,2}$ with this property even if $Q_{0,1}$ is nontrivial. The desired controller realizations are then given by (19)–(20). This guarantees H_∞ performance: $\gamma := \max(\gamma_1, \gamma_2) = 352.5$ of the switched closed-loop system. When external disturbance $d(t)$ is injected into the system for $t \in [18, 40]$ as Fig.5,

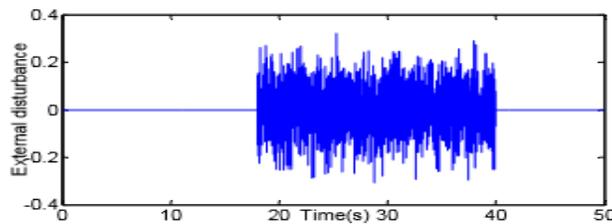


Fig.5. External disturbance $d(t)$

The outputs of controller plant and the controller are illustrated as Fig.6 and Fig.7, respectively.

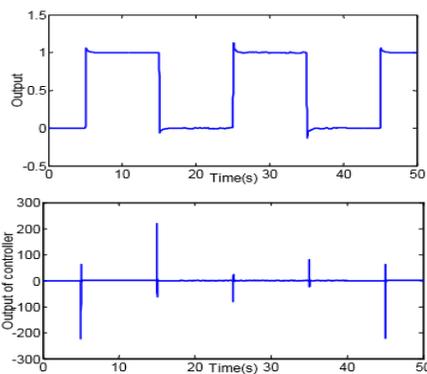


Fig.6. The switching control with H_∞ performance

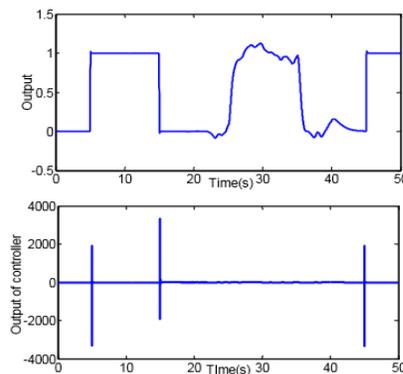


Fig.7. The switching strategy between stabilizing controllers

The paper presented here is to guarantee H_∞ -performance of the closed-loop system, when switching between H_∞ -performance controllers regardless the switching signal. Since the mixed sensitivity function minimization problem considered here guarantees the properties of not only the output of controlled plant but also the output of the controller. Comparing Fig. 6 and Fig. 7 we notice that the magnitude of the control signal in our method is much lower than that proposed in [23]. This makes clear the validity of the proposed technique.

6 CONCLUSIONS

To deal with the control of complex systems where conflicting requirements make a single LTI controller unsuitable, the paper provides a switching strategy between H_∞ -performance controllers of mixed sensitivity control problem for a specific LTI plant. It is shown that it is possible to find proper realizations for the given family of H_∞ -performance controllers so that the closed-loop system remains the H_∞ - control performance, no matter how we switch among the controller.

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Clinical and Neurocognitive recovery from Mild and Moderate Head Injury: A Study from a Tertiary care Hospital in Eastern India

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Abstract- INTRODUCTION- Traumatic Brain Injury (TBI) is a major cause of mortality & morbidity afflicting millions of people worldwide¹ and in India². The World Health Organization suggests traumatic brain injury (TBI) will be a leading cause of death and disability by 2020, with about 10 million people affected each year. A patient with TBI is a person who has had a traumatically induced physiological disruption of brain function, which is manifested by at least one of the following: 1. any period of loss of consciousness, 2. any loss of memory for events immediately before or after the accident, 3. any alteration in mental state at the time of the accident (e.g. feeling dazed, disoriented, or confused), or 4. focal neurological deficit(s) that may or may not be transient³. This study is designed to look for clinical outcome by GCS and neurocognitive outcome by PGI-BBD in mild to moderate head injury patients at 3 and 6 months after discharge of patient.

AIM OF THE STUDY- To assess the neurocognitive outcome in mild and moderate traumatic head injury patients.

MATERIALS AND METHODS - this study was carried out in Department of Neurosurgery, in association with Department of Neurogenetics, Neuromedicine and Psychiatry at Institute of Post-Graduate Medical Research & Education and Bangur Institute of Neurosciences, Kolkata. We have included all the cases of mild and moderate Head Injury (as per Glasgow Coma Scale mild= 13-15, moderate= 9-12) from January 2017 to June 2018, in a single unit. We had planned minimum 102 patients to be included in the study. It is a non-randomized, prospective, double blind study.

RESULTS - The mean dysfunction score (mean \pm s.d.) of the patients was 19.01 \pm 2.35 with range 17 – 27 and the median was 18. Most of the patients (83.3%) had dysfunction score \leq 20 which was significantly higher ($Z=9.44$; $p<0.0001$). However, 16.7% of the patients had dysfunction score $>$ 20.

CONCLUSION- The current study has shown clinical and neurocognitive outcomes in patients with mild and moderate TBI correlate with the severity of Head injury.

Index Terms- Traumatic Brain Injury (TBI), Neurocognitive Outcome, Mild to moderate head injury

INTRODUCTION - Traumatic Brain Injury (TBI) is a major cause of mortality & morbidity afflicting millions of people worldwide¹ and in India². The World Health Organization suggests traumatic brain injury (TBI) will be a leading cause of death and disability by 2020, with about 10 million people affected each year.

A patient with TBI is a person who has had a traumatically induced physiological disruption of brain function, which is manifested by at least one of the following: 1. any period of loss of consciousness, 2. any loss of memory for events immediately before or after the accident, 3. any alteration in mental state at the time of the accident (e.g. feeling dazed, disoriented, or confused), or 4. focal neurological deficit(s) that may or may not be transient³.

This definition of TBI includes the head being struck, the head striking an object, and the brain undergoing an acceleration/deceleration movement (i.e. whiplash) without direct external trauma to the head.

This study is designed to look for clinical outcome by GCS and neurocognitive outcome by PGI-BBD in mild to moderate head injury patients at 3 and 6 months after discharge of patient.

AIM OF THE STUDY-

To assess the neurocognitive outcome in mild and moderate traumatic head injury patients.

MATERIALS AND METHODS-

After obtaining clearance from the ethical committee of the institute, this study was carried out in Department of Neurosurgery, in association with Department of Neurogenetics, Neuromedicine and Psychiatry at Institute of Post-Graduate Medical Research & Education and Bangur Institute of Neurosciences, Kolkata. We have included all the cases of mild and moderate Head Injury (as per Glasgow Coma Scale mild= 13-15, moderate= 9-12) from January 2017 to June 2018, in a single unit. We had planned minimum 50 patients to be included in the study. It is a non-randomized, prospective, double blind study.

Inclusion Criteria

1. All patients of mild to moderate head injury GCS \geq 9(classified according to Glasgow Coma Scale).
2. Age more than 18 years

Exclusion Criteria-

- A. GCS<9 (Severe head Injury)
- B. Age < 18 years
- C. Associated chest, abdomen & limb injury
- D. Penetrating brain injury
- E. Patient with pre existing psychomotor impairment

Study tools –

1. General- Age, sex, contact information, educational status, occupation, marital status, date and time of admission
2. History of event- Mode of injury, date and time of injury, route of referral
3. Initial examination including GCS
4. Neuroimaging data and operative notes if any surgical procedure is done
5. Date of discharge or death and GCS at the time of discharge
6. Glasgow Outcome Score at 3 month& 6 month interval
7. Neurocognitive outcome at 3 month& 6 month interval

GLASGOW OUTCOME SCALE

GOS 1 Good recovery

GOS 2 Moderate disability (disabled but independent), no assistance with activities of daily living

GOS 3 Severe disability (conscious but disabled), needing assistance with activities of daily living

GOS 4 Persistent vegetative state

GOS 5 Death

GOS = Glasgow outcome scale

PGI-Battery of Brain Dysfunction (PGI-BBD)

The components of the PGI-BBD are as follows:

- PGI Memory Scale (PGIMS)
- Revised Bhatia Short Battery of Performance Tests of Intelligence (BSR-R)
- Verbal Adult Intelligence Scale (VAIS)
- Nahar–Benson test
- Bender visual motor Gestalt test (Bender–Gestalt test).

Study Technique-

Patients of head injury were admitted in emergency ward and after evaluation started on standard treatment protocol as per clinical and neuroimaging findings. If necessary they underwent emergency surgery for head injury. All discharged patients were followed up at 3 & 6 months. They were allocated to one of the categories of Glasgow Outcome Scale by means of structured interview. Neurological assessment using PGI BBD Neuropsychological battery was done at 3 & 6 months.

Data thus generated was analyzed with the help of Microsoft excel 2007 and SPSS version 22nd software. Appropriate tables and graphs were generated. Chi-square test and other appropriate statistics as applicable was incorporated in the study for statistical inferences.

Results-

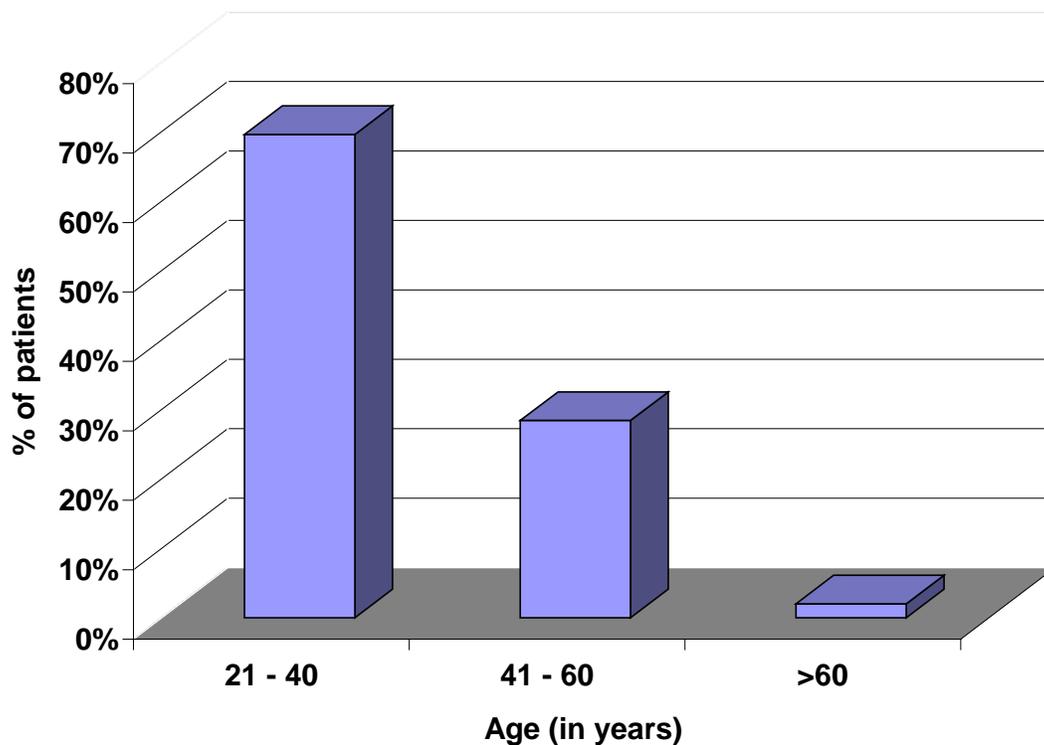
We have recruited total 102 patients in our study. Baseline data regarding age, sex and clinical presentation of the subjects was collected.

Table-1: Distribution of age of the patients

| Age (in years) | Number | % |
|--------------------|-------------|--------|
| 21 – 40 | 71 | 69.6% |
| 41 – 60 | 29 | 28.4% |
| >60 | 2 | 2.0% |
| Total | 102 | 100.0% |
| Mean ± s.d. | 37.71±12.01 | |
| Median | 36 | |
| Range | 21 – 64 | |

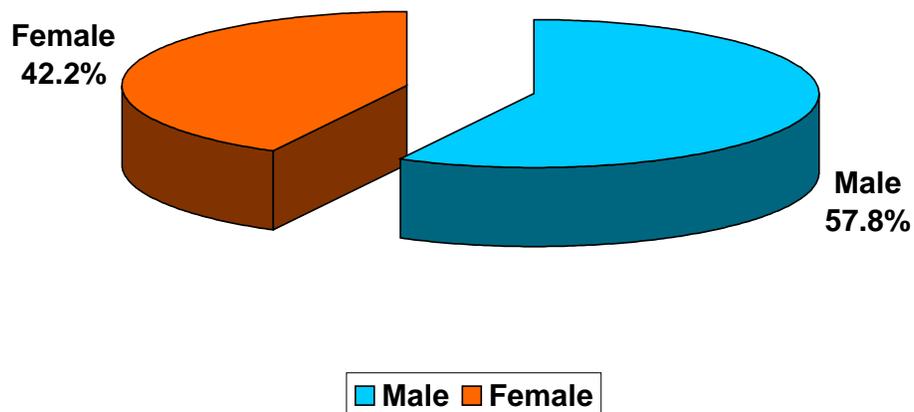
Most of the patients (59.6%) were with age between 21 – 40 years (69.6%) which was significantly higher than the patient with age >40 years ($Z=4.56; p<0.0001$).

Thus traumatic head injuries were mostly prevalent among the patients with age between 11 – 40 years.



Sex-wise Distribution of Head Injury patients

Table-2: Distribution of gender of the patients



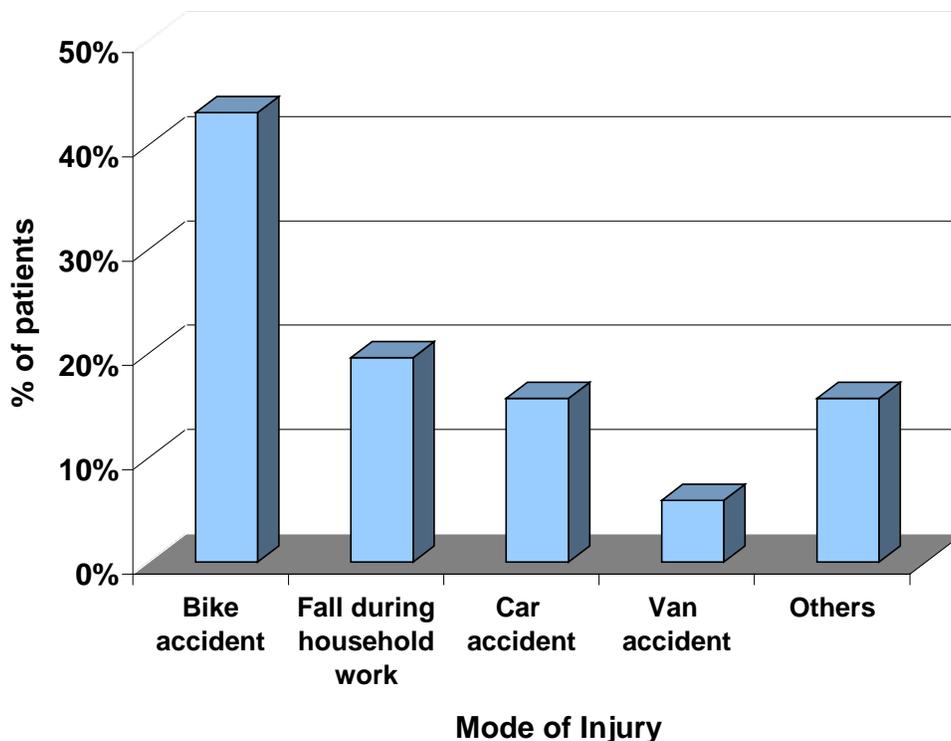
| Gender | Number | % |
|--------------------|----------------|---------------|
| Male | 59 | 57.8% |
| Female | 43 | 42.2% |
| Total | 102 | 100.0% |
| Male:Female | 1.4:1.0 | |

The ratio of male and female (Male:Female) was 1.4:1.0. Test of proportion showed that proportion of males (57.8%) was significantly higher than that of females (42.2%) ($Z= 2.26$; $p=0.023$).

Thus males were in significantly higher risk of having traumatic head injury than females.

Etiology of Head Injury

Table-3: Distribution of mode of Injury of the patients



| Mode of Injury | Number | % |
|----------------------------|--------|-------|
| Bike accident | 44 | 43.1% |
| Fall during household work | 20 | 19.6% |
| Car accident | 16 | 15.7% |
| Van accident | 6 | 5.9% |
| Physical Assault | 2 | 2.0% |
| Bicycle accident | 2 | 2.0% |
| Bus accident | 1 | 1.0% |
| Electrocution | 1 | 1.0% |
| Fall from Tractor | 1 | 1.0% |
| Fall from Bike | 1 | 1.0% |
| Fall from train (Railways) | 1 | 1.0% |
| Fall from Tree | 1 | 1.0% |
| Hit by Cricket Ball | 1 | 1.0% |
| Hit by Truck | 1 | 1.0% |
| Fall from Rickshaw | 1 | 1.0% |
| Road Traffic Accident | 2 | 2.0% |
| Unknown | 1 | 1.0% |

| | | |
|--------------|-----|--------|
| Total | 102 | 100.0% |
|--------------|-----|--------|

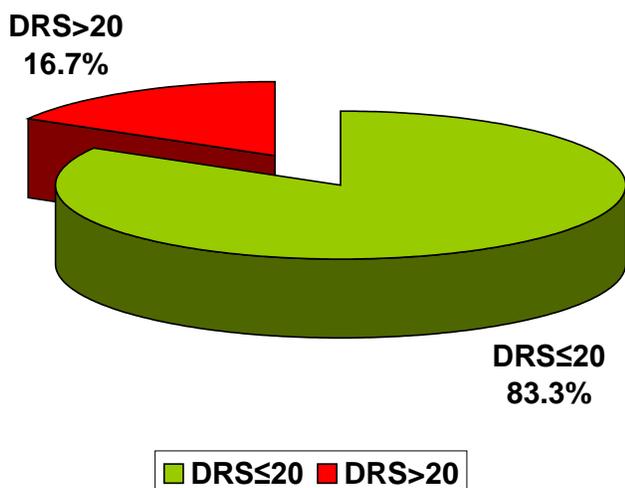
Bike accident was the most cause of the traumatic head injury (43.1%) which was significantly higher ($Z=3.58;p<0.0001$).

Table-4: Distribution of Dysfunction rating scores (Neuro-cognitive Outcome)of the patients

| Dysfunction rating scores (Neuro-cognitive Outcome) | Number | % |
|--|------------------|----------|
| ≤ 20 | 85 | 83.3% |
| >20 | 17 | 16.7% |
| Total | 102 | 100.0% |
| Mean \pm s.d. | 19.01 \pm 2.35 | |
| Median | 18 | |
| Range | 17 - 27 | |

The mean dysfunction score (mean \pm s.d.) of the patients was 19.01 \pm 2.35 with range 17 – 27 and the median was 18.

Most of the patients (83.3%) had dysfunction score ≤ 20 which was significantly higher ($Z=9.44;p<0.0001$). However, 16.7% of the patients had dysfunction score >20 .



DISCUSSION-

We have analysed distribution of TBI in various age groups, sex & mode of injury; its clinical outcome and neurocognitive outcome in relation to severity of brain injury.

One of the striking findings from this review is that despite the relatively large volume of studies addressing functional outcomes and recovery following pediatric TBI, there are remarkably few studies with well defined and discrete severity groups, time points post injury, and age bands at the time of injury. This, in addition to the necessity for having descriptive statistical data to conduct a meta-analytic review, substantially reduced the number of studies that could be summarized. Nonetheless, data from available studies that met inclusion criteria were systematically summarized and reviewed in this paper, yielding empirically and clinically useful information regarding injury outcomes by neurocognitive domain at various defined time points post injury (cross-sectional studies), as well as the time course of recovery (longitudinal studies).

Studies of mild TBI included in the analyses showed few, if any, impairments in the neurocognitive domains reviewed at any time point, including postacute outcomes. This is consistent with previous literature (Bijur, Haslum, & Golding, 1990⁴; Satz et al., 1997⁵). Of note, however, there were some studies reporting substantial impairments in the mild TBI group, even at Time 3. For example, data from one study of a relatively younger TBI sample (2-7 years at injury and 5 years post injury) contributed effect sizes in the moderate to large range (with one exception) on four different paper and pencil measures of attention (Catroppa, Anderson, Morse, Haritou, & Rosenfeld, 2007⁶). Conversely, a study of comparatively older children (6-15 years at injury and 3 years post injury) resulted in no notable differences between cases and controls (Fay et al., 1994⁷). Further, a large British cohort of mild head injury in children found no differences between cases and healthy controls or other nonhead injury orthopedic controls in any aspect of neurocognitive ability or behavioral functioning (Bijur et al., 1990⁴). Although most studies found no statistically significant effects of mild TBI on neurocognitive functioning as a group, some suggested that there may be a subset of children with mild TBI who show adverse outcomes in some domains. The inconsistencies across studies in the outcomes of mild TBI may be due to several factors.

CONCLUSION

The current study has shown clinical and neurocognitive outcomes in patients with mild and moderate TBI correlate with the severity of Head injury.

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Spatial Autoregressive Models with Heteroskedasticity Disturbance using Generalized Method of Moments

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Abstract- Spatial regression is one of the statistical methods that has problems of spatial dependency and heteroskedasticity. Spatial autoregressive regression (SAR) concerns only to the dependence on lag. The estimation of SAR parameters containing heteroskedasticity using the maximum likelihood estimation (MLE) method gives biased and inconsistent. The alternative method is generalized method of moments (GMM). GMM uses a combination of linear and quadratic moment functions simultaneously, so that the computation is easier than that of MLE. This study is to develop SAR model with heteroskedasticity disturbances using the GMM. The model is evaluated based on residual variance and pseudo R^2 . Furthermore, this method is applied to the Java's Gross Regional Domestic Product (GRDP) data on 2017. The results showed that the district minimum wage and local revenue were significantly influence to the Java's GRDP data in 2017. This model provides pseudo R^2 value of 75.3% which means it is good enough to illustrate the diversity of Java's GRDP in 2017.

Index Terms: Heteroskedasticity, spatial autoregressive, maximum likelihood, generalized method of moments.

I. INTRODUCTION

The spatial dependence and spatial heteroskedasticity are problems in spatial data [1]. Lesage [2] stated that spatial dependence can be described in regression models, such as autoregressive response, error, predictor, or combination the variable. Models with dependencies in response are called spatial autoregressive models (SAR). Fotheringham [3] stated that spatial heteroskedasticity can be described using geographically weighted regression (GWR).

Ord [4] considered the maximum likelihood (ML) for the estimation of the regression model. Kelejian and Prucha [5] extended that the MLE estimator is inconsistent in heteroskedasticity disturbances. Anselin [1] introduced the two-stage least squares (S2SLS) method. Kelejian and Prucha [6] introduced the generalized method of moments (GMM). GMM does not require a distribution assumption of the disturbance and computationally easier than the ML [7].

The results of Kelejian and Prucha's research [5] showed that the estimation method is valid if the assumption of errors is stochastic and identical normal. However, heteroscedacity can occur in aggregation data. In this case heteroskedacity originates from a data averaging process with many different observations at the

time of aggregation [6]. Kelejian and Prucha [7] develop the GMM method into robust form that has been proven to be consistent if there is heteroskedacity. Combination of linear and quadratic in moment functions are simultaneously assumed by GMM.

In general, spatial regression modeling only considers one of the spatial effects and uses the ML estimation method. Gross regional domestic product (GRDP) data using the SAR model has been conducted by Hikmah [8] and Yulita [9] has heteroskedasticity using the GWR model. GRDP data is economic data that reflects the economic development of a region. Bivand [10] suggested that economic data always showed spatial patterns. In addition, GRDP publications in Indonesia published by the BPS in 2014 showed that Java had a high level of GDP distribution compared to outside Java. This study would handle heteroscedastic problems in the SAR model using GMM. The purpose of this study is modelling the Java 2017 GRDP data using GMM.

II. MATERIALS AND METHODS

2.1 SAR Model with GMM Approach

In this study, the following SAR model specification is considered $\mathbf{y} = \rho \mathbf{W} \mathbf{y} + \mathbf{X} \boldsymbol{\beta} + \boldsymbol{\varepsilon}$ where $\boldsymbol{\varepsilon} \sim N(\mathbf{0}, \sigma^2 \mathbf{I})$, \mathbf{y} is the $n \times 1$ vector of dependent variable, \mathbf{X} is the $n \times k$ matrix predictor, $\boldsymbol{\beta}$ is the $k \times 1$ vector of regression coefficient parameter, \mathbf{W} is the $n \times n$ spatial weight matrix, $\boldsymbol{\varepsilon}$ is the $n \times 1$ vector of disturbances (or innovations), and ρ is the coefficient autoregressive spatial lag [1].

Kelejian and Prucha [7] motivated to control spatial autocorrelations in the model at a tractable level also implies that the model and then reduced form of the model becomes feasible as $\mathbf{W} \mathbf{y} = \mathbf{W} \mathbf{S}^{-1} \mathbf{X} \boldsymbol{\beta} + \mathbf{W} \mathbf{S}^{-1} \boldsymbol{\varepsilon}$ where $\mathbf{S} = (\mathbf{I} - \rho \mathbf{W})$ and the variable $\mathbf{W} \mathbf{y}$ is known as the spatial lag of the dependent variable. Lee and Liu [11] define for \mathbf{Q} a matrix built from functions \mathbf{W} and \mathbf{X} . So, $\mathbf{G} = \mathbf{W} \mathbf{S}^{-1}$ and then $\mathbf{Q} = (\mathbf{G} \mathbf{X} \boldsymbol{\beta}, \mathbf{X})$ is a non-stochastic part that forms a population moment function $\mathbf{Q}' \boldsymbol{\varepsilon}$. Let \mathbf{P} be a $n \times n$ matrix with $\text{tr}(\mathbf{P}) = \text{tr}(\mathbf{G} - \text{Diag}(\mathbf{G})) = 0$. $\boldsymbol{\varepsilon}' \mathbf{P}_j \boldsymbol{\varepsilon}$ from orthogonal forms is obtained the moment function as follows:

$$E(\mathbf{Q}' \boldsymbol{\varepsilon}) = \mathbf{Q}' E(\boldsymbol{\varepsilon}) = \mathbf{0}_{(k+1) \times 1} \quad (1)$$

$$\begin{aligned} E(\boldsymbol{\varepsilon}' \mathbf{P}_j \boldsymbol{\varepsilon}) &= E(\text{tr}(\boldsymbol{\varepsilon}' \mathbf{P}_j \boldsymbol{\varepsilon})) = E(\text{tr}(\mathbf{P}_j \boldsymbol{\varepsilon} \boldsymbol{\varepsilon}')) \\ &= \text{tr}(\mathbf{P}_j E(\boldsymbol{\varepsilon} \boldsymbol{\varepsilon}')) = \text{tr}(\mathbf{P}_j \boldsymbol{\Sigma}) = 0 \end{aligned} \quad (2)$$

\mathbf{Q} is linear and \mathbf{P}_j is quadratic in $\boldsymbol{\varepsilon}$ as the moment function. Matrix quadratic moments \mathbf{P}_j asymptotically efficient as GMM estimator [11]. The parameter moment function of the spatial model simultaneously is the combination of linear and quadratics moment functions as follows:

$$\mathbf{g}_n(\boldsymbol{\theta}) = \begin{pmatrix} \mathbf{Q}'\boldsymbol{\varepsilon}(\boldsymbol{\theta}) \\ \boldsymbol{\varepsilon}(\boldsymbol{\theta})' \mathbf{P}_j \boldsymbol{\varepsilon}(\boldsymbol{\theta}) \end{pmatrix} = \begin{pmatrix} (\mathbf{G}\mathbf{X}\boldsymbol{\beta}, \mathbf{X})' \boldsymbol{\varepsilon}(\boldsymbol{\theta}) \\ \boldsymbol{\varepsilon}(\boldsymbol{\theta})' (\mathbf{G} - \text{Diag}(\mathbf{G})) \boldsymbol{\varepsilon}(\boldsymbol{\theta}) \end{pmatrix} \quad (3)$$

Suppose that $\boldsymbol{\Omega}$ is a matrix of moment functions. $\boldsymbol{\Omega}$ consist variance and covariance that are linear and quadratic¹⁾ in $\boldsymbol{\varepsilon}$.

$$\boldsymbol{\Omega} = E[\mathbf{g}_n(\boldsymbol{\theta}_0)\mathbf{g}_n'(\boldsymbol{\theta}_0)] = \begin{pmatrix} \text{tr}(\boldsymbol{\Sigma}\mathbf{P}^*(\mathbf{P}^*\boldsymbol{\Sigma} + \boldsymbol{\Sigma}\mathbf{P}^*)) & \mathbf{0}_{1 \times (k+1)} \\ \mathbf{0}_{1 \times (k+1)} & \mathbf{Q}'\boldsymbol{\Sigma}\mathbf{Q} \end{pmatrix} \quad (4)$$

²⁾ $\boldsymbol{\Sigma} = \text{diag}(\sigma_1^2, \dots, \sigma_n^2)$ and $\mathbf{P}^* = (\mathbf{G} - \text{Diag}(\mathbf{G}))$, the parameters of the spatial model are simultaneously suspected by the formula of a combination of linear and quadratic in moment functions by GMM approach. GMM robust estimator specification is considered:

$$\hat{\boldsymbol{\theta}} = \begin{pmatrix} \hat{\boldsymbol{\beta}} \\ \hat{\boldsymbol{\rho}} \end{pmatrix} = \underset{\boldsymbol{\theta} \in \Theta}{\text{argmin}} \mathbf{g}_n'(\boldsymbol{\theta}) \hat{\boldsymbol{\Omega}}^{-1} \mathbf{g}_n(\boldsymbol{\theta}) \quad (5)$$

Where $\hat{\boldsymbol{\Omega}}$ is a consistent estimator for $\boldsymbol{\Omega}$.

2.2 Data

The data used is secondary data from the Indonesian Central Bureau of Statistics. The data is data based on the constant price of 2010 as the response variable. The response and independent variable are presented in table 1.

Table 1: The variables used this the study

| Variables | Unit |
|---|-----------------|
| GRDP at the constant price based on year 2010 (Y) | Trillion Rupiah |
| Amount of Labor (X ₁) | Thousand Souls |
| District minimum wage (X ₂) | Million Rupiah |
| Locally generated revenue (X ₃) | Million Rupiah |
| Human development index (X ₄) | Percent |

2.3 Data Analysis Procedure

Data Analysis used software R Studio 3.5.2 for Java GRDP data on 2017. The steps of analysis will be by the following:

1. Exploring GRDP data in Java in 2017.
2. Testing heteroscedastic variance errors using the Pagan Breusch (BP) test statistic [1].
3. Calculating the Moran's Index to spatial dependence [1].
4. Identify of spatial models with LM test includes spatial influence test on lag (SAR), error (SEM), GSM, robust LM_{lag} and robust LM_{error}[1].
5. Estimating model parameters by GMM approach.

¹⁾ Appendix 1 can be used to derive $\boldsymbol{\Omega}$ matrices in this section

²⁾ Appendix 2

III. RESULTS

3.1 Exploring GRDP data in Java in 2017

Gross regional domestic product (GRDP) is the amount of gross domestic product (GDP) of a region. Economic growth can be used as a macroeconomic parameter, both on a national scale and regional scale that reflects the economic condition of a country or region. GRDP can describe the ability of a region to manage natural resources. The average GRDP in each province in Java on 2017 is presented in Figure 1.

The distribution of GRDP-values in Java is presented in Figure 2. Figure 2 describe GRDP-values based on grouping by quartile. They are 3.91-17.8, 17.8-30, 30-59.5, and 59.5-591. Districts / cities with high GRDP-values (> 59.5 trillion rupiahs) are cities in DKI Jakarta, Bekasi, and Surabaya provinces. Districts / cities that have a low GRDP-value (<3.91 trillion rupiah) including Banjar, Blitar, and others. The pattern of the distribution of GRDP-values in districts / cities in Java is presented in Figure 2 without scale.

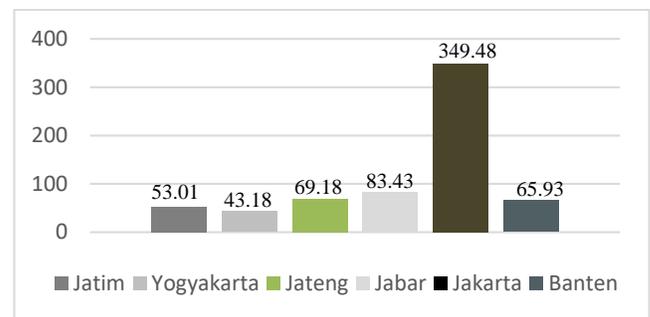


Figure 1: The average Java's GRDP in each province in 2017

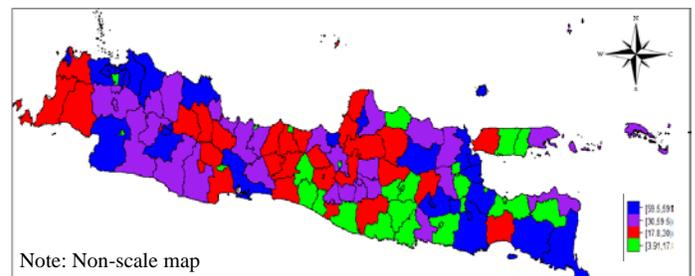


Figure 2: Map of the distribution of the Java's GRDP in 2017

GDP produced by a region, population, as well as social conditions, the surrounding area, and the welfare of the people that differ between regencies / cities, geographical condition of an area can cause the difference of GRDP. The regions are the center of government and economic centers tend to produce high GRDP-values such as cities in DKI Jakarta, Surabaya, and Bandung. The Moran scatter plot is used to detect a location that is outlier in other locations.

In Figure 3 quadrant I (top right) shows districts/cities with positive autocorrelation, because the java's GDRP values of districts/cities and surrounded by surrounding areas are high, such as Sidoarjo, Gresik and Surabaya. Quadrant II (top left) shows districts/cities with negative autocorrelation, because the Java's GDRP values of districts/cities is low and surrounded areas are high, such as South Jakarta City.

Quadrant III (lower left) shows districts/cities with positive autocorrelation, because the Java's GDRP values of districts/cities and surrounded by surrounding areas are low, such as in Depok Regency, Bogor Regency, and Bogor City. Quadrant IV shows districts/cities with negative autocorrelation, because the Java's GDRP values of districts/cities is high and surrounded areas are low, such as Kediri City, Bekasi Regency, Sukabumi Regency, East Jakarta City and West Jakarta City are the outlier.

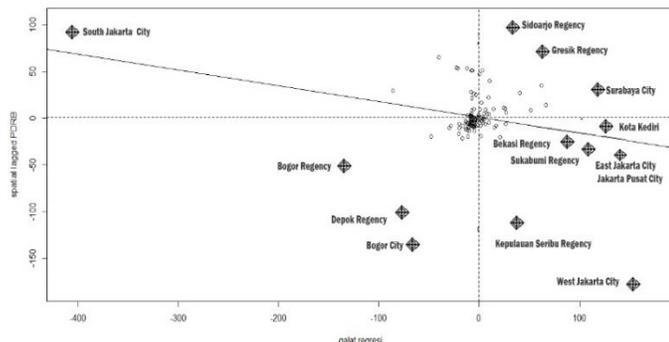


Figure 3: Moran scatter plot

Correlation between regional original income and district minimum wages is 0.63. Correlation human development index and number of workers is negative correlation. Chatterjee [12] stated the value of the variance inflation factor (VIF) greater than 10 indicates that the data has a multicollinearity problem. Table 2 shows that variable independent has not a VIF value of more than 10.

Table 2: VIF values for each independent variable

| Variables | VIF |
|-----------|------|
| x1 | 1.35 |
| x2 | 1.86 |
| x3 | 2.02 |
| x4 | 1.38 |

3.2 Spatial Effect Test

BP test produces a BP-value of 35.79 with a p-value of 3.32×10^{-6} . This shows that the homogeneity of spatial diversity is not fulfilled or there is a problem with heteroskedasticity in the data. The Moran's index is 0.395 with a p-value of 5.05×10^{-7} which indicates that there is a positive spatial autocorrelation ($I > 0$) between GRDP in each neighboring district / city at the 5% level and expectation value from the Moran's index is -0.00847 or $I < E(I)$ then a random pattern.

3.3 Testing Heteroskedasticity Variance Errors

The Lagrange Multiplier (LM) test is conducted to test the effect of spatial dependence in response. Table 3 shows the results of the spatial comparison test with the LM test. LM test obtained the spatial dependence value on the response (SAR) of 6.678 with a p-value of 0.0097. Thus, it can be concluded that there is a spatial dependence on the response with significant at level of 0.01. In addition, the value of dependence in spatial error model (SEM) and in the response and error (GSM) results are less than 0.05, so that it can also be modeled with the SEM or GSM model.

Table 3: The results of Lagrange Multiplier (LM) test

| Model | Statistics LM test | P-value |
|----------------|--------------------|----------|
| LM lag (SAR) | 6.6777 | 0.0097** |
| LM error (SEM) | 3.9592 | 0.0466* |
| SARMA (GSM) | 6.7488 | 0.0342* |

*significant at 5% level

**significant at 1% level

3.4 Parameter Estimation SAR Model by GMM Approach

The parameter estimates in the SAR model are presented in Table 4. The independent variable that has a significant influence on GDP in Java in 2017 is the district minimum (X_2) and local income (X_3). The estimated parameters, residual variance, pseudo R^2 SAR models use the GMM estimation presented in Table 4.

Table 4: Estimated parameters, residual variance, pseudo R^2

| Coefficient | Parameter | Estimates |
|-------------------|-----------|-----------|
| Rho | ρ | -0.14 |
| x1 | β_1 | 0.01 |
| x2 | β_2 | 19.86* |
| x3 | β_3 | 0.07** |
| x4 | β_4 | -0.74 |
| Residual variance | | 53.89 |
| Pseudo R^2 | | 0.75 |

*significant at 5% level

**significant at 1% level

Based on Table 4, increasing one unit of district minimum wages will cause increasing 19.86 of GRDP and increasing one unit of regional original income will cause increasing 0.07 of GRDP. Thus, heteroskedasticity handling produces a model that is simpler than the model with GWR.

IV. CONCLUSION

GMM can be used to analyze data containing heteroskedasticity in SAR modeling. The application of GMM methods in GRDP data in Java on 2017 provide to significant variable that influence GRDP. Those are district minimum wage (X_2) and regional original income (X_3) with pseudo R^2 is 0.753 and residual variance of 53.89.

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APPENDIX

1. Suppose that Ω is a matrix of moment functions consisting of variance and covariance that are linear and quadratic in ϵ . For a \mathbf{G} quadrilateral matrix, set $\text{Diag}(\mathbf{G}) = (g_{11}, \dots, g_{nn})'$ is a vector of diagonal matrix elements \mathbf{G} .

$$\begin{aligned} \Omega &= \text{var}(\mathbf{g}_n(\theta_0)) \\ &= E[\mathbf{g}_n^2(\theta_0)] - (E[\mathbf{g}_n(\theta_0)])^2 \\ &= E[\mathbf{g}_n(\theta_0)\mathbf{g}_n'(\theta_0)] - 0 \end{aligned}$$

$$= E[\mathbf{g}_n(\boldsymbol{\theta}_0)\mathbf{g}_n'(\boldsymbol{\theta}_0)]$$

2. Let \mathbf{X}_n , \mathbf{Y}_n and \mathbf{Z}_n be $n \times n$ matrices. \mathbf{X}_n and \mathbf{Y}_n have zero diagonal elements, and \mathbf{Z}_n has uniformly bounded row and column sums in absolute value. Assume $\boldsymbol{\Sigma} = \text{diag}(\sigma_1^2, \dots, \sigma_n^2)$.

$$\begin{aligned} \text{a. } E(\boldsymbol{\varepsilon}'_n \mathbf{X}_n \boldsymbol{\varepsilon}'_n \boldsymbol{\varepsilon}'_n \mathbf{Y}_n \boldsymbol{\varepsilon}'_n) &= \sum_{i=1}^n \sum_{j=1}^n \mathbf{x}_{n,ij}(\mathbf{y}_{n,ij} + \mathbf{x}_{n,ji}) \boldsymbol{\sigma}_{ni}^2 \boldsymbol{\sigma}_{nj}^2 \\ &= \text{tr}(\boldsymbol{\Sigma}_n \mathbf{X}_n (\mathbf{Y}'_n \boldsymbol{\Sigma}_n + \mathbf{Y}_n \boldsymbol{\Sigma}_n)) \end{aligned}$$

$$\begin{aligned} \text{b. } E(\boldsymbol{\varepsilon}_n \boldsymbol{\Sigma}_n \boldsymbol{\varepsilon})^2 &= \sum_{i=1}^n \mathbf{z}_{n,ii}^2 [E(\boldsymbol{\varepsilon}_{ni}^2) - 3 \boldsymbol{\sigma}_{ni}^4] + (\sum_{i=1}^n \mathbf{z}_{n,ii}^2 \boldsymbol{\sigma}_{ni}^2) \\ &+ \sum_{i=1}^n \sum_{j=1}^n \mathbf{z}_{n,ij}^2 (\mathbf{z}_{n,ij} \mathbf{z}_{n,ji}) \boldsymbol{\sigma}_{ni}^2 \boldsymbol{\sigma}_{nj}^2 \\ &= \sum_{i=1}^n \mathbf{z}_{n,ii}^2 [E(\boldsymbol{\varepsilon}_{ni}^4) - 3 \boldsymbol{\sigma}_{ni}^4] + \text{tr}^2(\boldsymbol{\Sigma}_n \mathbf{Z}_n) \\ &+ \text{tr}(\boldsymbol{\Sigma}_n \mathbf{Z}_n \mathbf{Z}'_n \boldsymbol{\Sigma}_n + \boldsymbol{\Sigma}_n \mathbf{Z}_n \boldsymbol{\Sigma}_n \mathbf{Z}_n) \end{aligned}$$

$$\begin{aligned} \text{c. } \text{Var}(\boldsymbol{\varepsilon}_n \mathbf{Z}_n \boldsymbol{\varepsilon}) &= \sum_{i=1}^n \mathbf{z}_{n,ii}^2 [E(\boldsymbol{\varepsilon}_{ni}^4) - 3 \boldsymbol{\sigma}_{ni}^4] \\ &+ \sum_{i=1}^n \sum_{j=1}^n \mathbf{z}_{n,ij} (\mathbf{z}_{n,ij} \mathbf{z}_{n,ji}) \boldsymbol{\sigma}_{ni}^2 \boldsymbol{\sigma}_{nj}^2 \\ &= \sum_{i=1}^n \mathbf{z}_{n,ii}^2 [E(\boldsymbol{\varepsilon}_{ni}^4) - 3 \boldsymbol{\sigma}_{ni}^4] \\ &+ \text{tr}(\boldsymbol{\Sigma}_n \mathbf{Z}_n \mathbf{Z}'_n \boldsymbol{\Sigma}_n + \boldsymbol{\Sigma}_n \mathbf{Z}_n \boldsymbol{\Sigma}_n \mathbf{Z}_n) \end{aligned}$$

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Determination of General Circulation Model Grid Resolution to Improve Accuracy of Rainfall Prediction in West Java

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Abstract- The statistical downscaling technique is used to predict rainfall using general circulation model (GCM) data. One important factor to improve prediction accuracy is selection of GCM grid resolution. The purpose of this study is to determine the best GCM grid resolution to predict rainfall. The data used was GCM data from CFSRv2 with grid resolutions of $0.312^{\circ} \times 0.312^{\circ}$; $0.5^{\circ} \times 0.5^{\circ}$; $2.5^{\circ} \times 2.5^{\circ}$ and local rainfall data in West Java. The determination of best grid resolution began with determining the GCM domain in each rainfall observation station based on minimum correlation value of 0.3 between GCM data and local rainfall data. The domains were evaluated by LASSO regression based on the smallest RMSEP and the largest correlation. The results showed that the best grid resolution is $2.5^{\circ} \times 2.5^{\circ}$.

Index Terms- GCM grid resolution, Statistical downscaling, LASSO regression.

I. INTRODUCTION

Rainfall as one of the climate elements has a serious impact especially on the agricultural sector [1]. Increasing rainfall above the normal average potentially cause flood [2], whereas decreasing rainfall below-normal can cause drought [3]. Floods and droughts also harm the area of harvest and production [4].

The negative impact of high rainfall and low rainfall is felt in West Java. Indramayu Regency as the biggest rice producer area in West Java was hit by floods that soak ten thousand hectares of rice fields [12]. Meanwhile, Dewi (2019) revealed that West Java had no rain more than 61 days which had the potential to cause drought. This will cause significant impacts on food production. Based on this description, rainfall information is needed to minimize these negative impacts and maximize production results.

General Circulation Model (GCM) data were often used in climate studies, such as precipitation [5]. GCM is a numerical model that produces a number of data on various climate parameters such as precipitation, temperature, and humidity [6]. The data generated from the model are the climate parameter values on the GCM grids. GCM data are available at various grid resolutions, including $0.312^{\circ} \times 0.312^{\circ}$; $0.5^{\circ} \times 0.5^{\circ}$; and $2.5^{\circ} \times 2.5^{\circ}$ in the form of the Climate Forecast System Reanalysis (CFSR) model. The grid resolution includes a rough resolution due to $1^{\circ} \times 1^{\circ} \approx 100 \times 100 \text{ km}^2$. The precipitation value in the grid cannot be used directly to predict rainfall in local scale areas that have a smaller grid

resolution [7]. Therefore, rainfall estimating requires statistical downscaling (SDS) techniques to bridge global scale data with local scale data.

Rainfall prediction using the SDS technique requires a GCM area called the GCM domain. The selection of the GCM domain is an important factor in the SDS technique and will determine the predicting results [8]. The grid resolution is considered to improve the rainfall prediction accuracy.

This study aims to determine the best GCM grid resolution and to improve the rainfall prediction accuracy. The grid resolution determination began with determination of GCM domain using concept of a minimum correlation of 0.3 [14] between the GCM grid data (predictors) and the local rainfall data (response) for the grid in the four compass directions. This is supported by Busuic *et al.* (2001) which states that one of the conditions in the SDS technique is the close relationship between response and predictors.

II. METHOD

A. Data

In this study, two types of data were used. The first data, as predictor variables, were monthly precipitation data of the GCM output in 1981 to 2009 (348 months). The GCM data was issued by the National Centers for Environmental Prediction (NCEP) in the form of CFSR model and could be downloaded on the website <https://rda.ucar.edu/>. CFSR is a model that describes a global interaction between land, sea, and earth air that is measured every 6 hours or 4 times a day. The GCM data were in grids above the territory of Indonesia, located at 12°N to -15°S latitude and 90°E to 150°E longitude. The grid resolutions in this study were $0.312^{\circ} \times 0.312^{\circ}$; $0.5^{\circ} \times 0.5^{\circ}$; and $2.5^{\circ} \times 2.5^{\circ}$. The second data, as a response variable, were monthly rainfall data (mm/month) of 27 local rainfall stations located at -7.78°S to -6.28°S latitude and 108.40°E to 107.87°E longitude in West Java Province. The rainfall data obtained from the Meteorological, Climatological, and Geophysical Agency (BMKG).

B. Procedure of Analysis

The procedure used R 3.5.2 software with the following steps:

1. Preparing and exploring data
 - a. Extracting CFSR data from **netCDF** format into R dataframe format using packages **ncdf4**.

- b. Combining predictor variables (CFSR data) with response variables (local rainfall data).
 - c. Cleaning the missing data so that the data had a different length of data at each station, but in general, this data had length of 348 months.
 - d. The data was divided into two parts, named modeling data and validation data. Modeling data was the entire monthly data except validation data. While the validation data was monthly rainfall data that had been cleaned in item (1.c) in the last 12 months period.
 - e. Exploring data using patterns of local rainfall distribution.
2. Determining the best grid resolution.

These processes were carried out on three local rainfall stations, namely Leles station (lowland 0-200 metres above sea level (masl)), Lengkong station (medium land 200-500 masl), and Sangiang station (plateau > 500 masl) [10].

The processes were as follows:

- a. Determining the GCM grid that would be used as a reference. The grid was the closest coordinates to the local rainfall station.
- b. Calculating correlation between the local rainfall station and GCM grid precipitation on four compass directions with the reference grid as the center [7].
- c. Selecting grids from step (2b) with correlation value at least 0.3.
- d. Forming a square / rectangular domain that includes the grids in point (2.c). The process illustration of determining the GCM domain is shown in Figure 1.

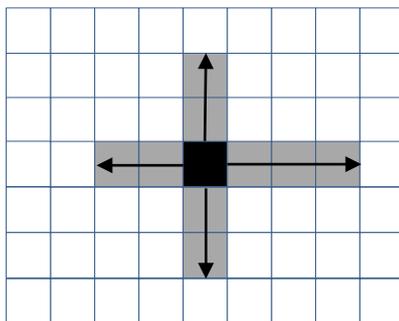


Figure 1: Illustration of determining domain GCM

Information:

- : The Reference grid
- : The grid with correlation of at least 0.3

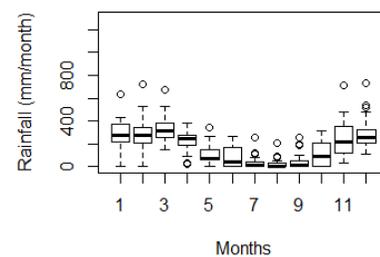
- e. Performing LASSO regression modeling with the domain obtained in (2.d) using the **glmnet** function in the R program, and finding the best lambda (λ) using the **cv.glmnet** function.
- f. Doing predictions and validations using validation data.
- g. Steps 2.a to 2.f were repeated for each GCM grid resolutions, including $0.312^\circ \times 0.312^\circ$; $0.5^\circ \times 0.5^\circ$; and $2.5^\circ \times 2.5^\circ$.

The results of determining grid resolution were shown in Table 1. The grid resolution of $2.5^\circ \times 2.5^\circ$ has relatively high correlation and low RMSEP in each type of land. This could be

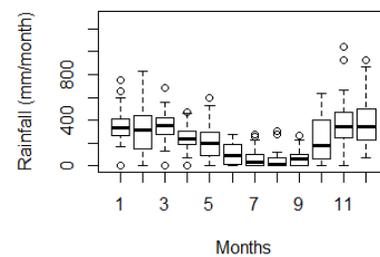
- h. Choosing the best grid resolution based on RMSEP value and the correlation coefficient between the predicted and actual rainfall.

III. RESULT

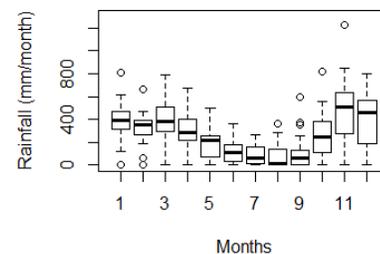
The data exploration was carried out to three different observation stations based on altitude above sea level. The stations were Leles (lowland 0-200 masl), Lengkong (moderate land 200-500 masl), and Sangiang (high altitude > 500 masl) [10]. These stations were used to determine the best grid resolution. The rainfall pattern in Figure 1 showed monthly rainfall increases with altitude above sea level increases. This was in line with the results of the study by Marpaung (2010) which revealed that land with a height of 600-1300 masl has the highest annual rainfall average compared to the land with altitude below 600 meters above sea level. Each station had a pattern similar to the letter U, which means that high rainfall occurs at the beginning and end of the year. This situation was following the monsoon rainfall pattern in West Java.



(a)



(b)



(c)

Figure 1: Rainfall patterns of (a) Leles station (b) Lengkong station (c) Sangiang station

seen from the correlation value respectively for low, medium and plateau were 0.918; 0.868; and 0.790. Also, the RMSEP of $2.5^\circ \times 2.5^\circ$ was also relatively low for each type of lands, which were 50.48; 129.60; and 142.37 respectively for low, medium and high land. The best GCM grid resolution was $2.5^\circ \times 2.5^\circ$.

The visualizations of RMSEP and correlation values for each type of land in Table 1 shown in Figure 2 and Figure 3.

Table 1: RMSEP and Correlation for each GCM grid resolution

| Station | Type of land | Grid resolution | GCM domain | RMSEP | Correlation y and \hat{y} |
|----------|--------------|-----------------|------------|--------|-------------------------------|
| Leles | Low | 2.50°×2.50° | 13×6 | 50.48 | 0.92 |
| | | 0.50°×0.50° | 64×18 | 62.52 | 0.84 |
| | | 0.31°×0.31° | 107×28 | 64.42 | 0.83 |
| Lengkong | Medium | 2.50°×2.50° | 13×6 | 129.60 | 0.87 |
| | | 0.50°×0.50° | 69×26 | 129.71 | 0.87 |
| | | 0.31°×0.31° | 111×26 | 128.75 | 0.91 |
| Sangiang | Plateau | 2.50°×2.50° | 13×6 | 142.37 | 0.79 |
| | | 0.50°×0.50° | 63×14 | 153.49 | 0.67 |
| | | 0.31°×0.31° | 103×23 | 152.35 | 0.67 |

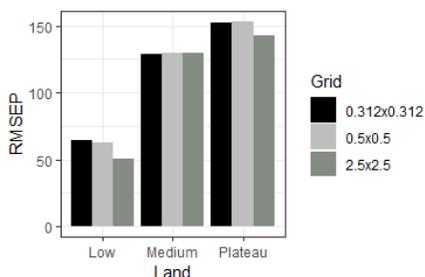


Figure 2: RMSEP for each type of land

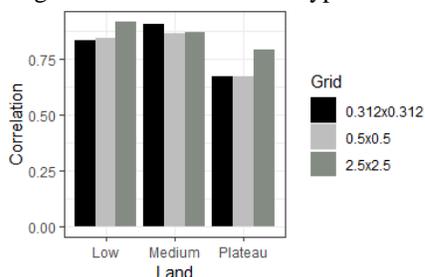


Figure 3: Correlation for each type of land

Previous research, Wigena (2006) which used an 8×8 domain in Indramayu resulted in RMSEP in the range 63-98 and correlation in the range of 0.50-0.76. Santri (2016) which used an 8×8 domain in Indramayu produced RMSEP in the range 67-148 and correlations in the range 0.84-0.94. So that it could be concluded that the grid resolution of 2.5°×2.5° could improve the accuracy of rainfall prediction in the low and medium land

IV. CONCLUSION

The results showed that grid resolution of 2.5°×2.5° was the best grid resolution based on the smallest RMSEP value and the largest correlation in each type of land.

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Analysing Lawrence and the theme of gender and sexuality in *Women in Love*

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Abstract- The paper aims at analysing the Lawrence and the role of gender and sexuality in his select novel *Women in Love* (1920). The novel is a piece of twentieth century work and is written at the backdrop of modernist movement and is categorised as a modernist text.

The study demonstrates the portrayal of man and woman characters against the backdrop of modernism and explores the theme of homosexuality evident in the novel. Lawrence's *Women in Love* (1920) is all about triumphal masculinise over the female submissiveness. Lawrence here, embrace personification of a New Women but in the different light as portrayed his contemporary Mrs. Woolf. Also understanding Lawrence's struggle with his own sexual desires and analysing how his thoughts are evidently reflected in the characters.

My aim is to critique the roles given to men and women in his novel *Women in Love* (1920) and understanding the theme of homosexuality portrayed in the novel.

Index Terms- Gender, Feminism, Homosexuality, Modernism, Masculinity.

I. INTRODUCTION

Modernism at the backdrop of Lawrence's writing: Modernism is a major cultural and artistic movement dominating the western world from approximately 1890 to 1940, depending upon the country modernism is now recognized as one of the most creative periods in human history.

No art was left untouched and most were transformed by this international movement. It is generally agreed that the movement was cross- disciplinary, dominated by its own myth of discontinuity fully urban and technological in nature, extremely self-conscious in its avant- grade and experimental facets and characterized by both an egotistical valuing of the self.

As the below definition states:

Modernism per say cannot be described as a 'movement' or reliably characterized by a uniform style. Indeed it may be said to have embraced a wide range of artistic movements (including symbolism, impressionism, post-impressionism, futurism, constructivism, imagism, vorticism, expressionism, dada & surrealism) and to have originated in cosmopolitan circles in Berlin, Vienna, Munich, Prague, Moscow, London & Paris. At slightly later period it spread to New York & Chicago & became synonymous with World Wide reaction against positivism & representational arts.

(Ian1988)

It helps us understand how modernism was affecting the generation not only in their cultural spheres but also it became an essential part of their living. Changing everything, from architecture to norms and cultures followed by the people of generation. Which in turn, affected, their writings; giving it a way into modernist literature.

Modernism in other words experimented with literary form and expression. Defining Modernism author Peter Childs states: Modernism as a literary movement was driven by a conscious desire to overturn traditional modes of representation and express the new sensibilities of the time.

Whereas, writer Catherine Morley suggested that the horrors of the First World War saw the prevailing assumptions about society reassessed, and modernist writers were influenced by such thinkers as Sigmund Freud and Karl Marx, amongst others, who raised questions about the rationality of human mind.

The reason for highlighting 'modernism' is the mere fact that it played a very important role in the literary creations of the time when Lawrence wrote. He is considered to be an icon of modernism and his novels are important pieces for studying modernist literature. The character development in *Women in Love* (1920) gives the novel an exceptional quality of creativity. Rupert Birkin, the protagonist of the novel, his search for bisexual ethic and his moral seriousness, placing much of Lawrence's fiction within the canonical of "great tradition" of English Novel. He is now valued as a visionary thinker and a significant representative of modernism in English Literature.

II. D.H. LAWRENCE AND HOMOSEXUALITY

D.H. Lawrence is one of the most versatile of all English writers, using almost every literary form in which the English language can express itself. He is namely a novelist, story-writer, critic, poet and painter. Indeed one of the greatest figures of the twentieth century English Literature. Lawrence's works containing sexual freedom led to obscenity trials. He brought about an understanding of the importance of love and harmony in the industrial world where everything was getting materialised. In 1912 he wrote: "What the blood feels, and believes, and says, is always true." The authors daring of describing sexual relationships had angered a number of people during the time.

E.M.Foster, in an obituary notice challenged this view, describing him as "the greatest imaginative novelist of our generation." Lawrence's treatment of the theme of homosexuality

can be found in the novel *Women in Love* (1920). It is noted in the novel that Lawrence and his wife Frieda are depicted as Rupert Birkin and Ursula Brangwen in a tale based partly on Lawrence's scandalous relationship with the writer Katherine Mansfield, her husband, the literary critic John Middleton-Murray as Gudrun and Gerald of the novel.

It is said that it was during the composition of *Women in Love* that Lawrence, frustrated by his failure to forge a deeper bond with Murray, evidently had a sexual relationship with a Cornish farmer named William Henry Hocking in the town of Tregerthen. The short lived affair was said to be a culmination of his prolonged struggle with homosexual feelings.

"I would like to know why nearly every man that approaches greatness tends to homosexuality, whether he admits it or not," Lawrence wrote to a friend in 1913. Where in he, highlights, his own struggle with sexuality. He is also quoted as saying, "I believe the nearest I have come to perfect love was with the young coal miner when I was about sixteen."

Lawrence was the only major modernist writer who was very much involved with the theme of homosexuality in his writings. He certainly has explored the homosexual love in both his male and female characters. He was more interested in the characters with working class background and their sexual orientation perhaps due to his own upbringing of a working class background. He insisted on the primitive rustic love as opposed to the industrialization and mechanization of the man and nation.

III. WOMEN IN LOVE(1920) AND THE THEME OF HOMOSEXUALITY

Women in Love is undoubtedly one of the masterpieces of modern fiction, and it is the novelist's most daring exploration with the theme of homosexuality. The major character in the novel Rupert Birkin is searching for bisexual partner underlying Lawrence's own search. The novel deals with the brilliant quality of character development. Birkin's search for "two kinds of love" is being stressed upon. In the novel's preface Lawrence claimed that the catastrophe of the Great War required that men form a bond lest "new life" be strangled unborn within them". This statement is what is implicitly described in the novel. Whereas the prologue says heterosexual marriage must acknowledge man's need to have the love of another man or else all will suffer a spiritual death. It speaks about Birkin's struggle against the homosexual longings. The Prologue was not published until 1965 and was not included in an edition of *Women in Love* (1920) until 1987.

As mentioned earlier Hocking the farmer with whom Lawrence has sexual relationship is alluded to twice in the Prologue in the description of the "strange Cornish type of man, with dark eyes like holes in his head" who powerfully attracts Birkin as well as minor character of William Hosken. It is noted that Birkin in the Prologue is torn between not only males and females, but between "two classes of men."

The chapter "Gladiatorial" and "Man to Man" speaks about the passion, love and tenderness between men. But nonetheless the sexual relationship between man is deemed failure hence the tragedy of Gerald's death. The quote at the end of the novel "You can't have two kinds of love..." speaks about the failure and futility of such relationships in the society.

IV. D.H. LAWRENCE ON MAN-WOMEN RELATIONSHIP

Lawrence's preoccupation with the process of regeneration outlines the central importance of man- woman relationship:

In life, then, no new things have ever arisen, or can arise, save out female, the male upon the female, the female upon the male...as in my flower, the pistil, female is the centre and swivel, the stamens male, are close- claspings the hub, and the blossom is the great motion into the unknown, so in a man's life, the female is a swivel and centre on which he turns closely, producing his movement. (Niven, Pg.45)

Thus, giving us the account of man-woman relationship, he says it's the delicate balance between the sexes' that defines the physical relation between the two. Both male and female are equally important in the process and the relation has to be neither, overpowering, or controlling but the equal love and passion from both the sides that defines the physical love.

Lawrence believed that the desire to dominate often results in ending a marital relationship. For him it was the respect of the other sex that made a relationship worth living. He also thought ego resulted in a terrible clash of wills that further deteriorated any relationship. He sternly believed that the "otherness" of each individual should be respected.

'Why should we consider ourselves as the broken fragments of the whole?' Lawrence asks in *Women in Love*. 'It is not true.' (W. p125)

There is now to come a new day, when we are beings each of us, fulfilled in difference. The man is pure man, the woman pure woman, they are perfectly polarized. But there is no longer any of the horrible merging, mingling self abnegation of love. There is only the pure duality of polarisation, each one free from any contamination from the other. In each, individual is primal, sex is subordinate, but perfectly polarised. Each has a single separate being, with its own laws. The man has his pure freedom, the woman hers. Each acknowledges the perfection of the polarized sex circuit. Each admits the different nature in the other. (W.p.225) In other words Lawrence writes of conscious people. In almost all he wrote there lies a crucial truth that we are separate, different being from each other; he certainly considered it a escapist or a absurdist attempt to merge beings, to become identical with your sexual partner or to live in an existence wherein individual identities are suspended. He cannot imagine human beings to be the isolated creatures in their own world with no harmony in the universe what so ever. People might believe Lawrence to be an existentialist writer, but because of the premise that all people are distinct from each other might make one believe he is.

The core of Lawrence's belief on man-woman relationship:

- He insists on a total difference of man and woman.
- He denounces love in mental and possessive form.
- He also denies impulse: blending of two personalities into one, further losing identity.
- He break's the platonic myth: two lovers recognise in each other a lost half, and their union brings back complete single.

V. ANALYSING MAN- WOMAN RELATIONSHIP IN LAWRENCE'S WOMEN IN LOVE(1920)

There is much talk in the novel of possession- the man's desire to possess woman's body, the woman's to possess man's spirit, parents to possess their children, managers to possess workers, society to possess its material goods. According to Lawrence, possession disrupts equilibrium.

In a significant chapter of *Women in Love*, 'A Chair', Ursula rejects ownership as a value worth pursuing, and at the end of the novel she and Birkin possess nothing they treasure. Certainly in their case as Lawrence sees we should not believe that they possess each other, for that is precisely something what they are fighting to resist. Ursula retains a healthy possessiveness in her affection for Birkin, but it is hardly dominating.

Lawrence appeals for a total separateness between people, true individuality not equality but what he calls 'inequality'. Examples are Ursula and Birkin from the novel, who come nearest to this ideal, remain as separate beings, still arguing but arguing creatively, at the end of *Women in Love*. They recognise that the equilibrium, compatibility and balance of their relationship sprung from their separateness as human beings, not an impossible mystical bending of coming together and being 'one'. Characters sense that balance and wholeness need not be extinct just because humanity has evolved as sexually divided. Their agonies have much bound up with their certainty that balance and wholeness are waiting to be achieved.

The novel, also, embrace the personification of 'New Woman'. Ursula, 'new and frail like a flower just unfolded' (W, p.416), embodies Lawrence's vision of the new woman. Ursula and Gudrun Brangwen, two sisters who are both educated, who both work and who both are somewhat sexually liberated. They both are not interested in marriage but Ursula decides to marry later in the novel. There is also a character called Pussum, who has repeated physical relation with Gerald.

Lawrence indeed manifests 'New Women' in some of his female characters however his motives may not have the same interest as his contemporary Virginia Woolf. Although women are being categorised as 'New Women' their treatment in the novel will raise questions. Especially some feminists will object to his attitude dealing with women characters.

VI. GERALD AND PUSSUM'S SEXUAL ENCOUNTER

After the act, the Pussum lays in her bed motionless, her round dark eyes like black, unhappy pools(...) perhaps she suffered. (Lawrence.1999. Pg.66)

Her subsequent sadness is portrayed to us, and it suggests sexually liberated woman are actually harming themselves. This is portrayed in the Pussum's thoughts, 'She knew he (Gerald) wanted to give her money' (Lawrence.1999.Pg.68); suggesting sexual act was closer to prostitution than of desire or lust.

Further conversation between Gerald and Birkin convey to us how they perceive these 'New Women.' Birkin states, 'She is the harlot, the actual harlot of adultery to him. (Lawrence.1999.Pg.80)

Gerald describes her as 'rather foul.'(Lawrence.1999.Pg.80)

These derogatory remarks are the consequence of the Pussum's promiscuous activity, thus bestowing negative

connotations upon sexually liberated woman and in this instance, it seems Lawrence is portraying the 'New Woman's' sexual liberation as belittling.

VII. BIRKIN AND URSULA'S RELATION

Birkin and Ursula is another example of man taking control over female. Ursula being working and independent; Lawrence's 'New Woman' decides to leave her job and go wandering with Birkin. It is Birkin who tells Ursula, 'We must drop our jobs, like a shot'. (Lawrence.1999.p274)

Further adding, 'Let us wander a bit' (Lawrence.1999.p274) Birkin is the one who decides and makes Ursula do what he wants her to do. It is he who has the power and control in their relationship and it is he who makes Ursula being independent as she was rather passive.

The transition of Ursula who 'does exactly as she pleases' (Lawrence.1999.p224) is a great contrast to her later subjugation in the novel.

In claiming the free status which the heroine of every nineteenth century novel aspires, Ursula willingly gives one portion of it for greater consolation of shared partnership. Lawrence understood the need of the feminist's struggle of his time; though in his essay on modern womanhood collected in *Phoenix II* he can be gently ironic: 'Women, women everywhere, and all of them on a warpath!'

Lawrence believed that woman may not aim only wanting right to vote or being a mother without being a wife or get an equal pay or easier divorce- he wasn't passionately interested in any of these- but the attainment of 'the new superfine bliss, a peace superseding knowledge.' (Niven, Pg.98)

VIII. CONCLUSION

Lawrence's genius consists on his emphasis on the barely discussed and articulated dynamics of gender and sexuality. As the characters in the novel move in the state of crises, flux and have cathartic confrontation. Alone among the writers of the period he brought a working class perspective to the theme of homosexuality. A self-proclaimed enemy of the upper class forward thinkers, caring least for getting respect in the society; he believed it is the struggle put forth by upper class gentry, he believed in the prominence of the true creative and artistic work. Hence he exceptionally worked on the themes otherwise "unspeakable" in the society with the brilliant creativity and imagination.

The relationship between man and women is the main dominant theme in the novel *Women in Love* along with the theme of homosexuality. The relationships are expressed in various shades, hues and aspects. Such relationship may be between husband and wife or man and man or woman and woman. Sex plays an important part in the development of such relationships in form or the other. Lawrence expresses his inner feelings through these characters. For him both man and woman play a vital role in a relationship. For him one soul, two bodies' kind of love does not exist. He believes in maintaining the independence and "otherness" of each other in a relationship. We can say, he could try by his creation of Ursula Brangwen, to demonstrate his concern

that mankind should have a future and that love and harmony are the feasible goals for man to work towards.

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Spectroscopic Study of Inclusion Complex of the Ethidium Bromide with β -Cyclodextrin in Solution NMR

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Abstract- The present study was conducted with the aim to form an inclusion complex of a toxic carcinogenic mutagenic agent Ethidium-bromide (EtBr) with the host molecule β -cyclodextrin (β -CD). The spectroscopy study of this inclusion complex in absence and presence of β -CD was carried out by Nuclear magnetic resonance (NMR). The binding constant and stoichiometry of the complexes were determined by Scott's method. The inclusion complex of EtBr with β -CD was further confirmed by 2D ^1H - ^1H NMR and further by molecular docking technique. The binding constant and stoichiometry ratio were found to be 301 M^{-1} and 1:1, respectively which indicate the successful formation of the inclusion complex between EtBr and β -CD.

Index Terms- β -cyclodextrin, inclusion complexes, ^1H NMR, ^1H - ^1H NMR, Molecular Docking.

I. INTRODUCTION

Cyclodextrins are extensively used in industries as well as analytical chemistry. The potential uses of cyclodextrins in products and technologies are numerous because its presence in drug not only enhances the solubility, bioavailability, stability, shelf life but also reduces side effects and gastrointestinal drug irritation.^{1, 2, 3, 4} . Cyclodextrins are cyclic oligosaccharides, having hydrophilic outer surface and hydrophobic central cavity, which belong to the family of cage molecule⁵.

Natural Cyclodextrins are α -cyclodextrin, β -cyclodextrin and γ -cyclodextrin, which consist of 6,7 and 8 D-glucopyranose units respectively, and have α -D-glucopyranose (α -1, 4) linkage with the cavity⁶. Ethidium Bromide (3, 8-diamino-5-ethyl-6-phenylphenanthridium bromide, EtBr) is a common intercalating agent and guest molecule in the present work. Ethidium-bromide is an anti-tumor and antiviral compound. Because of its mutagenic and carcinogenic nature it is less therapeutically preferred in the study of molecular biology^{7,8}. NMR Spectroscopy is generally used to analyze the structural elucidation of compounds in an aqueous form. NMR gives direct information about structure of CD-complex that which part of guest molecule is engulfed within the host molecule⁹. In inclusion complex, a complete guest molecule or a part of it is held within the hydrophobic cavity of the host cyclodextrin molecule and during the formation of inclusion complex no new covalent bond is formed or broken. The main driving force of complex formation is to release enthalpy-rich water molecules from the cavity, present in the solution to attain apolar-polar association which forms more stable state^{10,11}.

Molecular docking is a method which predicts the preferred orientation of one molecule to a second when bound to each other to form a stable complex¹².

Ethidium Bromide is harmful, if swallowed and very toxic by inhalational route. It is irritant to the eyes, skin and respiratory system¹³. The formation of inclusion complex increases the drug potency with minimal drug toxicity. Furthermore cyclodextrin entrapment of drugs at the molecular level wards off their direct contact with biological membranes thereby reducing their side effects and local irritation with no drastic loss of therapeutic benefits.

The structural assignment of β -CD with Ethidium Bromide has not been reported so far. EtBr offers an excellent potential for development into an antiviral or antitumor drug delivery system, after complexation with β -CD because its safety issues are overcome. This will enhance its commercial use in Indian market and pharmaceutical companies can expect a huge boost in their revenues. In order to overcome the safety problem of EtBr the present investigation was carried out with the aim to elucidate structural details of interaction between β -CD and Ethidium-Bromide in aqueous form, estimate the extent of binding and stoichiometry of the inclusion complexes.

II. EXPERIMENTAL

Material and Methods

Materials

Ethidium-Bromide and β -cyclodextrin were gifted by Sigma-Aldrich. For molecular docking, structure of Ethidium-Bromide and β -cyclodextrin were taken from Pubchem database (Id 5KCB).

Methods

Sampling In present investigation, 5mM Ethidium-Bromide (3.94mg) of constant concentration solution was prepared in heavy water (D_2O) at 28°C and β -cyclodextrin solution of ten different mass were added, having lowest and highest concentration of 1mM and 10mM respectively¹⁴.

Nuclear Magnetic Resonance The above samples were added to Bruker 800MHz NMR instrument for ^1H NMR (1-D). ^1H - ^1H ROESY spectrum (2-D) was also obtained from the instrument.

Calculation of binding constant Binding constant was determined by Scott's method from above NMR data. The Benesi-Hildebrand equation used for the calculation of binding constant was:

$$\frac{[\beta\text{CD}]}{\Delta\delta_{obs}} = \frac{[\beta\text{CD}]}{\Delta\delta_{max}} + \frac{1}{K\Delta\delta_{max}}$$

where, $\Delta\delta_{obs}$ - observed chemical shifts difference between complexed and the pure β -CD .

$[\beta\text{CD}]$ - Fractional molar concentration of βCD in the EtBr aqueous solution.

$\Delta\delta_{max}$ - Saturated value of chemical shift obtained from Scott's plots.

Molecular docking The molecular docking was carried out using AutoDockVina¹⁵. Ethidium-Bromide and β -cyclodextrin were used as ligand and receptor in docking studies respectively. The grid coordinates used were X = -6.736 Å, Y= -7.692Å, and Z= 4.168Å. The dimension of docking grid box was 40Å X 40Å X40Å with grid spacing of 0.375Å.

III. RESULTS AND DISCUSSION

The results of the present investigation were found to be as follows:

Inclusion complex between β -CD and EtBr: The work in this research was centered on the change in proton chemical shifts of inclusion complex relative to free guest. In present study, chemical shifts of H₃ and H₅ protons of β -cyclodextrin shifted towards the upfield direction while that of drug protons shifted towards the downfield direction relative to the respective pure host/guest proton¹⁶. Similar to our work,¹⁷ has also reported mixed shifts. This may be due to the fact that the protons which are positioned inside the cavity of β -cyclodextrin shows maximum shielding compared to other protons due to the presence of aromatic compound entering in the cavity. Furthermore the results also indicated that H₃ and H₅ protons show significant chemical shift compared to other protons.

Structural analysis of complex

¹H NMR spectra of pure β -cyclodextrin (lower panel) and two of their inclusion complexes (middle and upper panels) are shown in fig.1

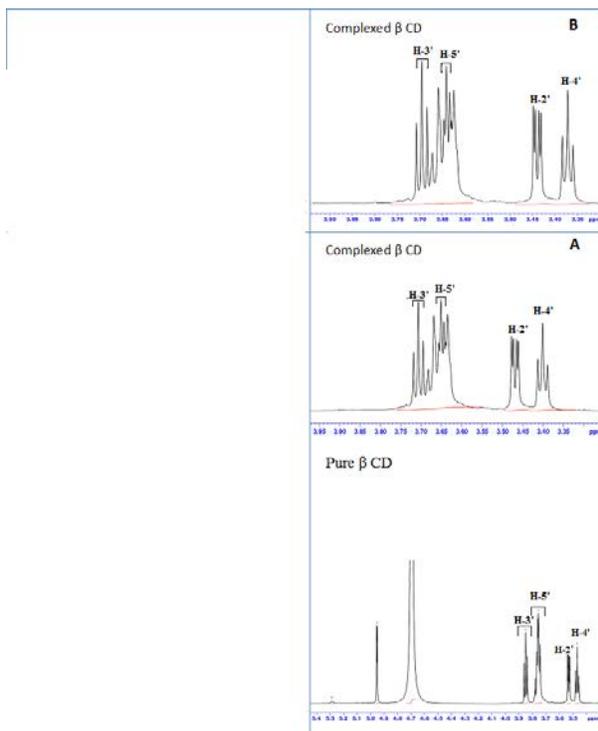


Fig.1: A part of ¹H NMR spectra showing protons of β -cyclodextrin in the absence as well as presence of varying amount of EtBr. Molar ratios (A = 1.67 and B = 1.25) in comparison to pure β -cyclodextrin.

In absence of β -CD, all aromatic protons were found merged and resonating at 6.233 - 7.915 ppm, while in the presence of β -CD resonance position was changed. From the fig.1, the change in chemical shift of inclusion complexes relative to pure β -Cyclodextrin is clearly indent. The change in observed chemical shift relative to pure β -cyclodextrin showed upfield shifts; while

downfield shift changes were observed relative to the EtBr which means the formation of guest-host inclusion complex³.

¹H-¹H Rotating frame Overhauser Effect Spectroscopy (ROESY) It is useful for determining the cross peaks/signals arising from protons that are close to each other in space even if they are not attached with the bond.¹H-¹H ROESY plot of the inclusion complexes are depicted in Fig. 2.

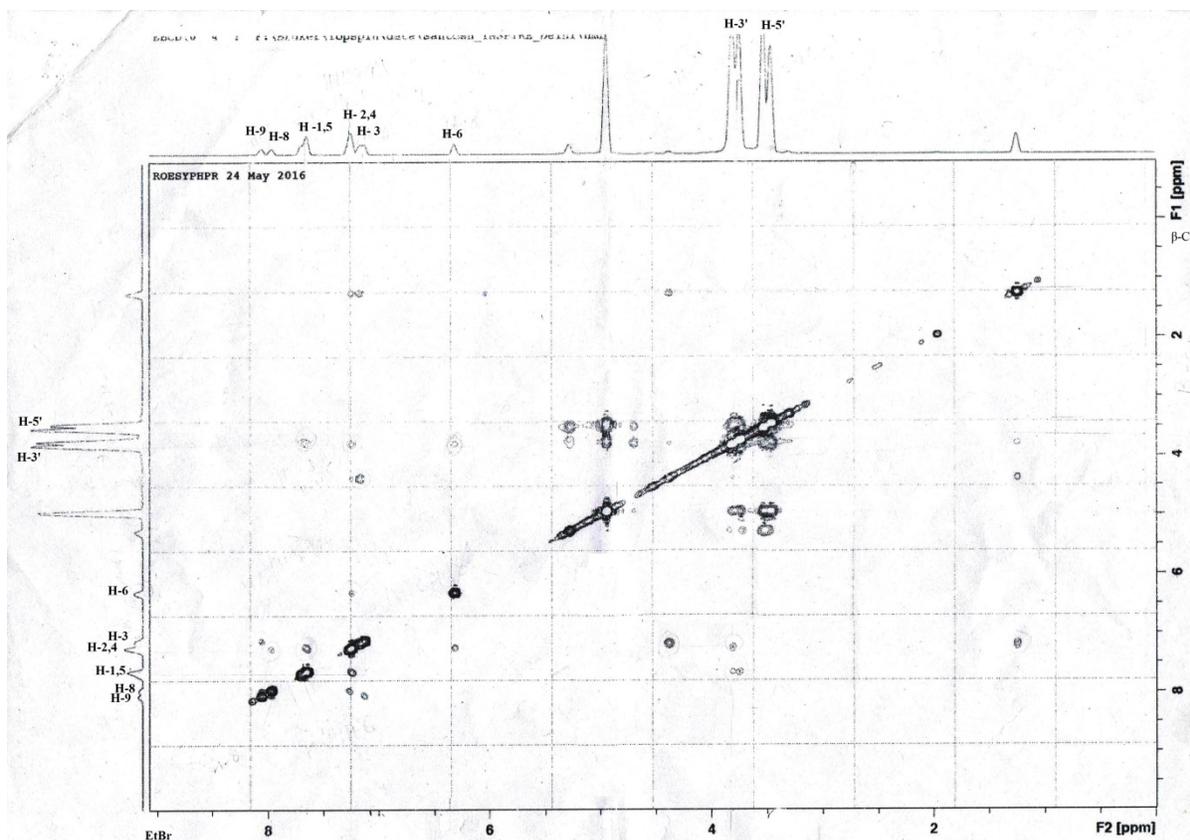


Fig.2: ^1H - ^1H ROESY spectra of inclusion complex, showing all the cross correlation peaks between host and the guest protons. Analysis of the figure revealed that H_3 of 3.851 ppm of β -Cyclodextrin correlated with H_1 and H_5 at 7.616 ppm of EtBr and the same H_3 combines with H_2 and H_4 at 7.144 ppm¹⁸.

Binding constant of Inclusion complex and Stoichiometry

The association constant and stoichiometry of the complexes were studied by Benesi-Hildebrand equation¹⁹. Nine different ratios of β -Cyclodextrin and Ethidium Bromide were used in the present study.

Scott's plots of H_3 and H_5 protons showed straight lines of $\frac{[\beta\text{CD}]}{\Delta\delta_{\text{obs}}}$ versus $[\beta\text{CD}]$ curve (fig. 3)

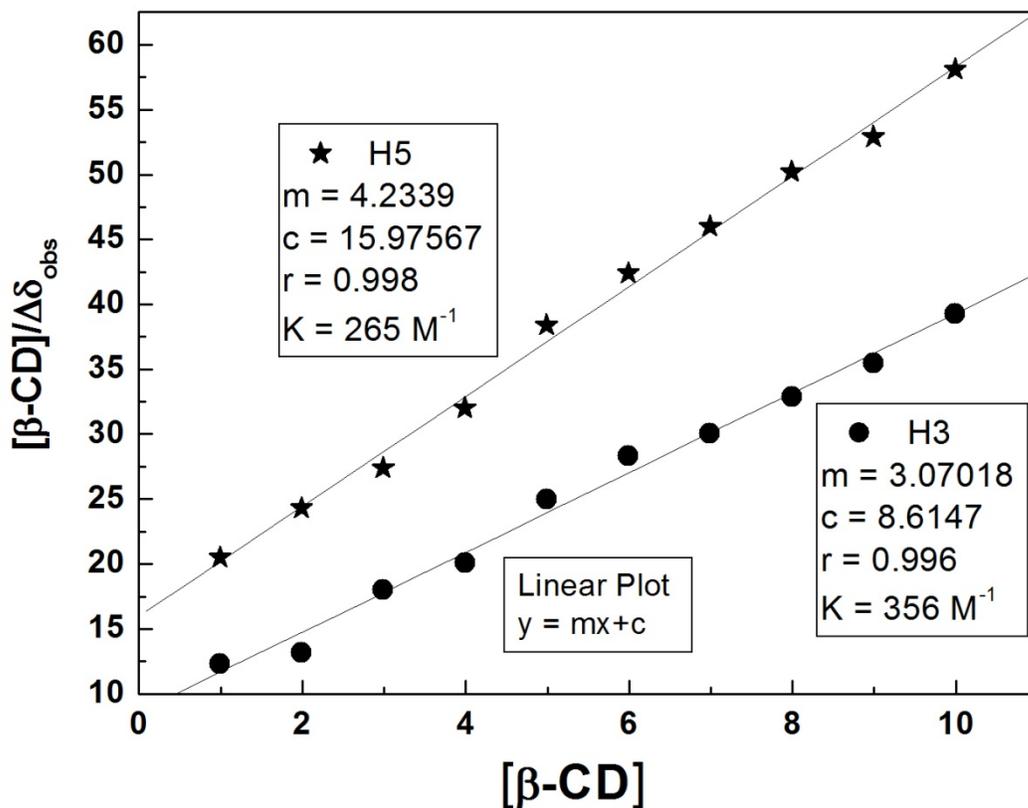


Fig.3: Scott's plots of inclusion complex showing the stoichiometry in the 1:1.

The constant $\frac{1}{\Delta\delta_{max}}$ is the slope of the straight line and $\frac{1}{K \cdot \Delta\delta_{max}}$ is the intersection of the line on the $\frac{[\beta CD]}{\Delta\delta_{obs}}$ axis. It reflected the stiochiometry of an inclusion complex is 1:1. The association constant appeared on the Scott's plot using these values and it was found out to be 310 M^{-1} [Average of two values] ²⁰.

Molecular Docking

Fig. 4 shows the effective ligand–receptor interaction studies done by molecular docking tool using Autodockvina in the present investigation. The model result suggested that there was involvement of one aromatic ring in complexation process. The molecular docking studies further confirmed that there were formation of host-guest complexes. Similar to above finding various other reports are available on the formation of inclusion complex using molecular docking technique ¹¹.

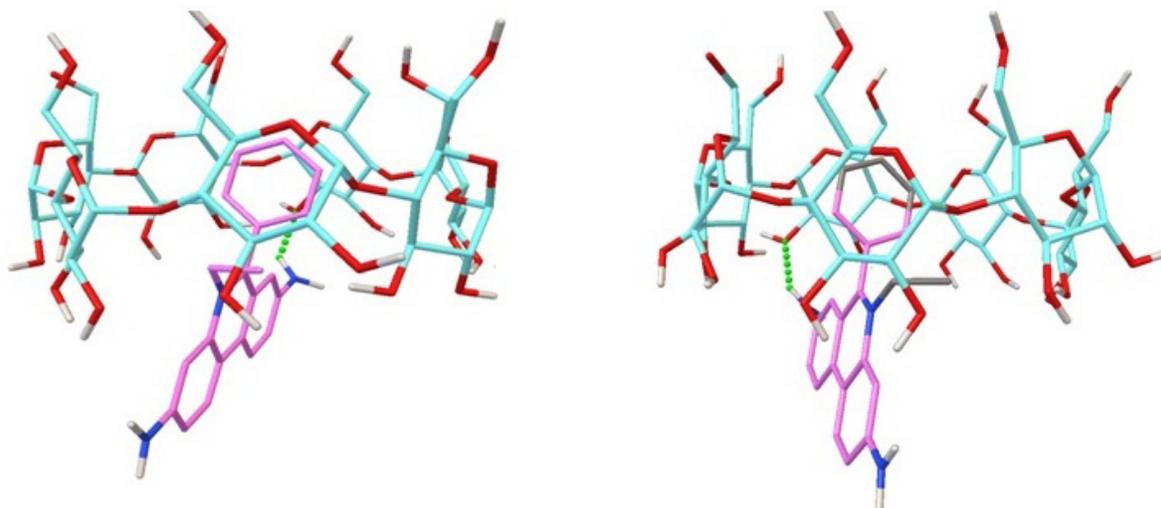


Fig.4: Molecular docking of Ethidium Bromide with β -cyclodextrin for two different binding affinities. The ocean green and red colors branches are of β -cyclodextrin, while pink and blue colours are of Ethidium Bromide, NH_2 of Ethidium Bromide is shown by grey colour.

IV. CONCLUSIONS

The study suggested the formation of hydrogen bond between EtBr and hydroxyl group of β -CD which was the main factor for non-covalent interaction and subsequent stabilization of complexes in an aqueous phase. NMR results suggested that guest-host inclusion complex was formed between β -cyclodextrin and Ethidium Bromide. The stoichiometry of the inclusion complex was in the ratio of 1:1 as obtained from Scott's plot. The interaction of host-guest inclusion was further clear in ROESY. The association constant was found to be 301 M^{-1} . Molecular docking study also supported the same results for the formation of inclusion complex. Structural elucidation of an inclusion complex by other techniques, viz. IR, Mass spectroscopy etc. and safety study are warranted in order to maximize its therapeutic benefits.

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Website Quality Analysis of Evaluation Development Monitoring System Using The Webqual 4.0 Method

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Abstract- In order to improve the implementation of good governance more empowered, managed to, clean and responsible, as well as in the framework of the realization of good Governance, the Government has issued various guidelines and rules that became the basis for the local government, either the province, district or city, to carry out monitoring and evaluation of development in the regions. To that end the existence of Monitoring and evaluation Systems Application Development become a necessity and a must for local governments to simplify and speed up the reporting process development activities. This research method using webqual 4.0 as the Foundation in the process of research and manufacture of the questionnaire. The purpose of this research is to find out whether there is influence of dimensions of webqual 4.0 to user satisfaction. The end result of this analysis is to provide recommendations for improvements to the developers to improve the quality of the system.

Index Terms- Analysis, Quality, User Satisfaction, Webqual, BAPPEDA.

I. INTRODUCTION

In order to realize the good governance of local government are requested to report on the results of the monitoring and evaluation of the implementation of the planning they gradually, The district or city to report to the Province. The province reported the results to the Department or Centre. So any government agencies are encouraged to be accountable and raise its performance on an ongoing basis.

For that the existence of the Monitoring and evaluation Information System of Construction which can be integrated with the internet become a necessity in its own and the requirement for local authorities to facilitate and accelerate the process of reporting activities, but the level of quality Monitoring information system Evaluation-based development of the website has never been measured in the perspective of the end user against the extent of the level of quality monitoring system for evaluation of the development in facilitating the performance of the user and of course, run in accordance with the expected.

Identification of Problems

Based on the results of the above background that is conducting an analysis of the Quality Analysis Of Evaluation Development

Monitoring System on the regional development planning Board in Ngawi, to know the quality of the system in the perspective of the end user in the application of Evaluation Development Monitoring System in Ngawi.

Research Questions

Based on the description of the background and the formulation of the problem to be solved are as follows:

1. How does the influence between the existing dimensions in the webqual 4.0 against the end user's point of view on the level of the quality Evaluation Development Monitoring System in governance Ngawi?
2. Where in a Dimension inside the webqual 4.0 that contribute to a greater level of quality Evaluation Development Monitoring System in governance Ngawi?
3. Based on the relationships between dimensions in the Evaluation Development Monitoring System with webqual 4.0 step as to what should be done in order to improve the quality of the website based information System?

Research Purposes

Based on the description of the background and formulation of the problem above, the objectives of this study are as follows:

1. Analyze the quality of the website Evaluation Development Monitoring System from the perspective of end users, namely against the variable User Satisfaction
2. To find out where is the dimension of webqual 4.0 that contribute the most dominant in the measurement of the quality of the website Evaluation Development Monitoring System on the regional development planning board in Ngawi.
3. Provide recommendations based on the results of the measurement of the quality of the website Evaluation Development Monitoring System about what actions should be undertaken by the development planning Bodies at Ngawi in order to improve the quality of the website.

II. REVIEW OF THE LITERATURE

Website

According to (Robert Charlick, 2008) defining Good Governance as a management of all kinds of public affairs

effectively through regulation and good policies in order to promote civic values.

Badan Perencanaan Pembangunan Daerah (BAPPEDA)

Bappeda agencies planning and regional development that was created in 1980 through a Presidential Decree No. 27-year 1980. Bappeda has a body or auth arrangement and structure of the Organization in it. Bappeda also have duties and functions in the planning process, including the process technocratic, participatory, process top-down and bottom-up. In the tasks and functions of the planning stages, bappeda has a role as the compiler of the plan, control and implementation plans. After passing the bappeda planning phase served in the preparation of RPJMD, RPJPD, and RKPD.

Monitoring and Evaluation

Monitoring and evaluation is a way in identifying, gather the facts, analyze and interpret data, as well as presenting information for making decisions for the direction.

The Analysis

According to (Komaruddin, 2001) The analysis is activities thought to outline a whole stepped components so that it can recognize the signs of the components, his relationship with each other and their respective functions in one integrated whole.

The Quality

According to (Goeth and Davis, 2012) stated that quality is a dynamic conditions that relate to the product, services, human, process, and the environment that meets or exceeds expectations.

Webqual 4.0

Webqual is method of quality measurement techniques or website based on the perception of the end user. This method is the development of the widely used previous Servqual in the measurement of quality of service. Webqual compiled based on research on three areas (dimension) the quality that is as follows:

- The dimensions of the *usability quality*

Usability quality is attribute of the qualities that describe or measure how easy the use of an interface (*interface*). The word of “*Usability*” also refers to a method for improving ease of usage during the design process.

- The dimensions of *information quality*

The quality of the Information depends on three things namely: information should be accurate, timely, and relevant.

- The dimensions of *interaction quality*

The quality of interaction is the extent to which the system can interact with the user, organizations or other users, in order to make the relationship against the system can run continuously.

Outline of research Webqual 4.0 can illustrate like a following image 1:

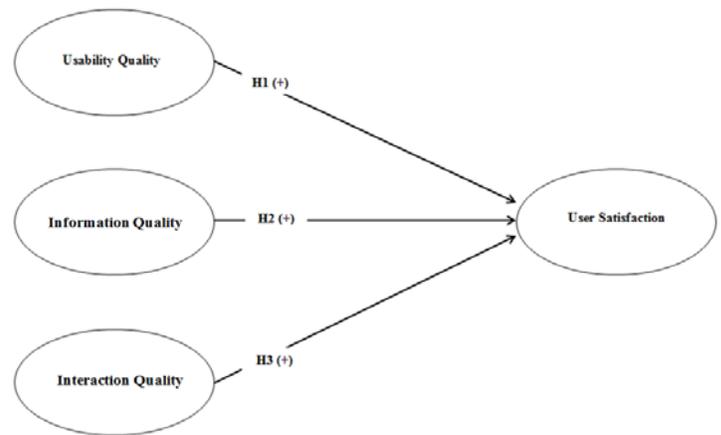


Image 1. Webqual model 4.0

Questionnaire

The questionnaire is a way of collecting data by spreading a list of questions to respondents, with the hope that they will provide a response to the question list.

The Hypothesis

According to (Saefuddin, 2009), a hypothesis is a tentative statement regarding the parameters of random variables. The word hypothesis comes from the two words combined, that is *hipo* meaning hidden, and *theses* that means the statement. According to the hypothesis of the origin of the saying means statement regarding something that is hidden, something not known the truth for sure.

Test Validity

According to (Azwar in Zulkifli, 2009), the validity of the word *validity* that means the extent to which the precision and accuracy of a measuring instrument (test) in performing the functions of size. A test is said to have high validity when the tool is run a measuring function appropriately or provide the appropriate measurement results with the intention of doing the measurement.

Test Reliability

According to (Zulkifli, 2009), reabilitas comes from the word *reliability* means the degree to which the results of a measurement can be trusted. A reliable measurement results when in recent times the execution of measurements of the same realtif, for the aspects measured within the subject indeed has not changed. According to (Nur in Zulkifli, 2009), stated that the reliability measure concerning how far the score deviation of the individual, or z-score, relatively consistent when done repetition administering tests with the same or equivalent test.

Test Assumptions

According to (Irwan and Siti, 2015), good regression model must satisfy the classical assumptions. The fulfillment of the classical assumption intended to manufacture the model regression did not find statistical issues.

Multiple Linear Regression

Regression analysis is one of the statistical data analysis techniques that are often used to examine the relationship between

several variables and predict a variable (Kutner, Nachtsheim and Neter, 2004).

III. RESEARCH METHODOLOGY

Research methodology is a series of research activities are based on the basic assumptions, philosophical views and geological, questions and issues facing (Nana Syaodih Sukmadinata, 2011). Based on the purpose of the study is to measure the quality of the Monitoring system of evaluation of development who are in BAPPEDA Ngawi, then using a qualitative research approach.

The qualitative approach is the process by which research and understanding based on methodologies that investigating a phenomenon of social and human issues. On this approach, researchers will create a complex picture, researching the words, a detailed report from the point of view of the respondents and do a study on the actual situation. The following is a stage in the research such as the Image 2 below:

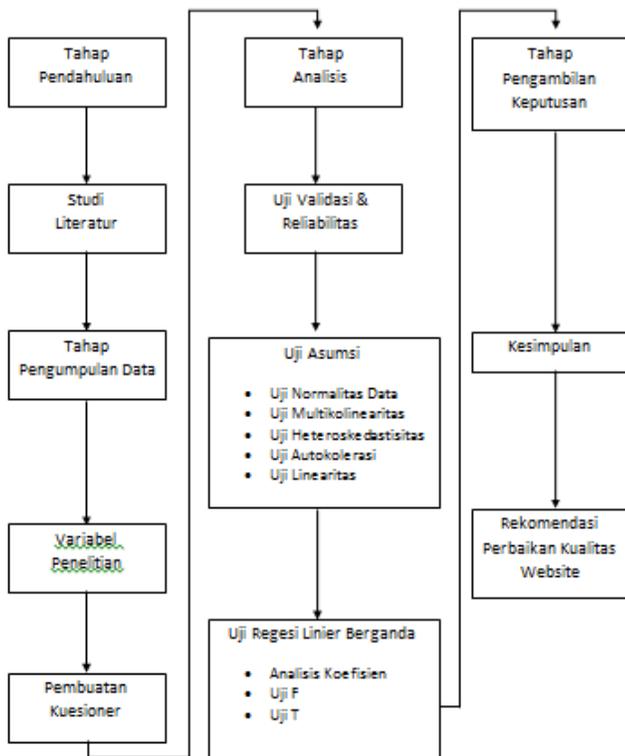


Image 2. Stage Analysis Research

The Stage of Data Collection

On this research includes several stages in data collection that is looking for samples, types and sources of data that will be used. A quantity of the sample used is user website Monitoring system of evaluation of development who are in BAPPEDA Ngawi as much as 100 respondents.

Types and sources of Data

Using this type of data collection and data source consists of primary data, that is data obtained directly from respondents through questionnaires distributed.

Research Variables

Research includes several variables variables that will be measured using the webqual 4.0 method. Research variables include the independent variables (free variable) and the dependent variable (the variable related).

Identification of Variables

Variable based on three dimensions on Webqual 4.0, will then be used as a free variable. These include a three dimensional: *Usability Quality* as variables X1, *Information Quality* as variables X2, *Interaction Quality* as variables X3. For variables bound (Y) used *User Satisfaction*.

The relationship between variables with item statement can be seen on Operational Variables such as following table 1:

Tabel 1. Oprasional Variable

| Variable | Indicator |
|--------------------------|---|
| (Usability Quality) (X1) | 1) Easy to learn (X1.1) 2) Easy to understand (X1.2) 3) Easy traceability (X1.3) 4) Easy to use (X1.4) 5) An interesting look (X1.5) 6) Web design in accordance (X1.6) 7) Easily search for information (X1.7) |

| Variable | Indicator |
|----------------------------|--|
| (Information Quality) (X2) | 1) Accurate information (X2.1) 2) Reliable information (X2.2) 3) Timely information (X2.3) 4) Relevant information (X2.4) 5) Easy to understand information (X2.5) 6) Complete and detailed information (X2.6) 7) Propotional information (X2.7) |

| Variable | Indicator |
|----------------------------|--|
| (Interaction Quality) (X3) | 1) A good reputation (X3.1) 2) Website security when downloading (X3.2) 3) The provision of space for member (X3.3) 4) Maintaining the security of user data (X3.4) 5) Provision of discussion between member (X3.5) 6) Appropriate information needs of users (X3.6) |

Tabel 1. Oprasional Variable

| Varable | Indicator |
|----------------------------|--|
| (User Satisfaction) (Y) | 1) Taste like the look of the website (Y1.1) 2) The fun interact (Y1.2) 3) Fast website access (Y1.3) 4) The website can be accessed by either with gadgets (<i>smartphone</i> , etc.) (Y1.4) 5) Website accessed properly in browser (<i>chrome</i> , <i>opera</i> , <i>mozilla</i> , <i>internet explorer</i>) (Y1.5) 6) The website can be used as examples for other websites (Y1.6) |

Data Collection

This research data obtained by the method of interview with the parties concerned as well as the dissemination of the questionnaire to respondents. Things that includes a questionnaire is about the name and the position of the respondent, *usability quality*, *information quality*, *interaction quality*, dan *user satisfaction*.

Dissemination of the questionnaire done by disseminating a questionnaire in the form of form directly to respondents. Respondents were asked to agree or not to agree to the proposed statement of researchers on the basis of the perception of each respondent.

Data Analysis

Data is already collected on research evaluation monitoring system analysis of construction on BAPPEDA in Ngawi pass some test data analysis include test validation and reliability, test assumptions, as well as multiple linear regesi test.

IV. RESULT AND DISCUSSION

Results and discussion consisted of an overview of the respondents, the quality of a website, test validity and reliability, test assumptions, multiple linear regression analysis, the influence of website quality against user Satisfaction to Evaluation Monitoring system development located in BAPPEDA Ngawi.

An Overview of The Website of SMEP

This application serves to ease in presenting a very informative analysis for stakeholders. Generally an early appearance on the Development evaluation of the Monitoring system are in BAPPEDA Ngawi can be seen in Image 3 below:



Image 3. The Home Page Of The Application.
Source: Ngawikab.esmep (2017)

Test of Validity

Test the validity of using the r value table with 0.05 significance. The r value for tables with n = 100 then can r table of 0.1946, so if the correlation value is more than the value of r table then the item is considered valid, whereas if is less than the prescribed limits then the item is considered not valid.

Table 2. Validity Of The Test Results Table

| No item | Rcount | Rtable | Description |
|---------|--------|--------|-------------|
| X1.1 | 0,571 | 0,1946 | Valid |
| X1.2 | 0,547 | 0,1946 | Valid |
| X1.3 | 0,425 | 0,1946 | Valid |
| X1.4 | 0,449 | 0,1946 | Valid |
| X1.5 | 0,550 | 0,1946 | Valid |
| X1.6 | 0,404 | 0,1946 | Valid |
| X1.7 | 0,616 | 0,1946 | Valid |
| X2.1 | 0,621 | 0,1946 | Valid |
| X2.2 | 0,487 | 0,1946 | Valid |
| X2.3 | 0,651 | 0,1946 | Valid |
| X2.4 | 0,392 | 0,1946 | Valid |
| X2.5 | 0,479 | 0,1946 | Valid |
| X2.6 | 0,530 | 0,1946 | Valid |
| X2.7 | 0,628 | 0,1946 | Valid |
| X3.1 | 0,575 | 0,1946 | Valid |
| X3.2 | 0,596 | 0,1946 | Valid |
| X3.3 | 0,604 | 0,1946 | Valid |
| X3.4 | 0,554 | 0,1946 | Valid |
| X3.5 | 0,261 | 0,1946 | Valid |
| X3.6 | 0,395 | 0,1946 | Valid |
| Y1.1 | 0,439 | 0,1946 | Valid |
| Y1.2 | 0,592 | 0,1946 | Valid |
| Y1.3 | 0,691 | 0,1946 | Valid |
| Y1.4 | 0,724 | 0,1946 | Valid |
| Y1.5 | 0,526 | 0,1946 | Valid |
| Y1.6 | 0,629 | 0,1946 | Valid |

Test of Reliability

Reliability test is useful to establish whether the instrument in this questionnaire may be used more than once, at least not by the same respondents would produce consistent data. In other words, the instrument reliability characterise the degree of consistency, by using the method *cronbach's alpha* referring to the Alpha value.

Basically taking his decision is if the alpha value of lebh on r table, where r tabel that refers to the value of 100 to the respondents in 0.1946 significance 5% table r statistic to test the 2 sides then the items now used revealed reliable or consistent.

Table 3. Reliability Test Results Summary

| No | Variable | Alpha Cronbach's Value | Description |
|----|--------------------------|------------------------|------------------------|
| 1 | Usability Quality (X1) | 0,499 > 0,1946 | Reliability/Consistent |
| 2 | Information Quality (X2) | 0,591 > 0,1946 | Reliability/Consistent |
| 3 | Interaction Quality (X3) | 0,383 > 0,1946 | Reliability/Consistent |
| 4 | User Satisfaction (Y) | 0,654 > 0,1946 | Reliability/Consistent |

A Classic Assumption Test

The purpose of testing the assumptions is to provide assurance that the regression obtained has precision in estimation, unbiased and consistent. A classic assumption test needed to determine whether the results of the estimation of the regression is performed completely free of symptoms of heteroskedastisitas, symptoms of multicollinearity, and symptoms of autocorrelation.

Test of Normality

Test of normality aims to test whether the research data that belong to a normal distribution or not. Test the normalization of the data is performed using the method of graph, of the graph can be seen spread data on the source of the diagonal on a normal graph *P - P Plot of regression standarized residual*.

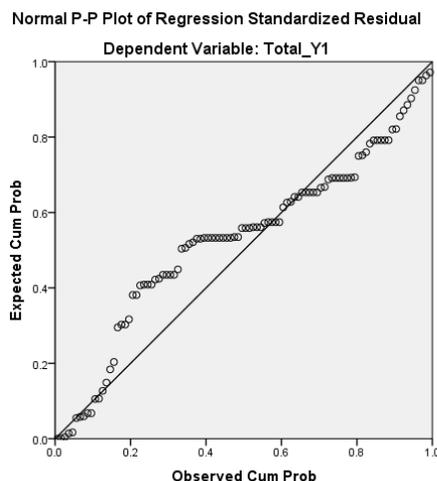


Image 4. Test for normality Normal Graph P-P polt

From the graph it is known that the points spread around the line and follow the direction of a diagonal line, It can therefore be

inferred that the distributed data with regression model has been normal and meet the assumptions of normality.

Test of Multicollinearity

Multikolinieritas test aimed at testing whether the regression models found of the existence of the correlation or relationship between free variables (the independent). A regression model which should not happen good correlation between free variables (not the case multikolinieritas).

From table 4 below, be aware that the value of the Tolerance of a third independent variable is greater than 0.10 and VIF (*Variance Inflation Factor*) of the three variables is less than 10.00 then it can be inferred that the problem does not occur on regression model of multicollinearity.

Table 4. Test Summary Multikolinieritas.

| Variable | Tolerance | VIF | Description |
|--------------------------|--------------|---------------|--------------------------------|
| Usability Quality (X1) | 0,557 > 0,10 | 1,796 < 10,00 | Not the case Multikolinieritas |
| Information Quality (X2) | 0,554 > 0,10 | 1,839 < 10,00 | Not the case Multikolinieritas |
| Interaction Quality (X3) | 0,869 > 0,10 | 1,151 < 10,00 | Not the case Multikolinieritas |

Test of Heteroskedastisitas

Test study on heteroskedastisitas using the correlation coefficient test *Glejser Test*. Test method *Glejser Test* that is absolute value regression residual against independent variable.

Table 5. Summary Of Test Result Heteroskedastisitas Glejer Test

| Variable | The Value Significance | Description |
|--------------------------|------------------------|----------------------------------|
| Usability Quality (X1) | 0,166 > 0,05 | Not the case Heteroskedastisitas |
| Information Quality (X2) | 0,315 > 0,05 | Not the case Heteroskedastisitas |
| Interaction Quality (X3) | 0,229 > 0,05 | Not the case Heteroskedastisitas |

Because there is no variable that the value of their significance below 0.05 or smaller then it can be inferred that in the regression model does not happen Heteroskedastisitas issue.

Test of Autocorrelation

Autocorrelation test aimed at testing whether in linear regression models there is a correlation between the error of a bully in the period t-1 (previous). To detect whether there is autocorrelation is generally done using test Durbin-Watson (Dw test).

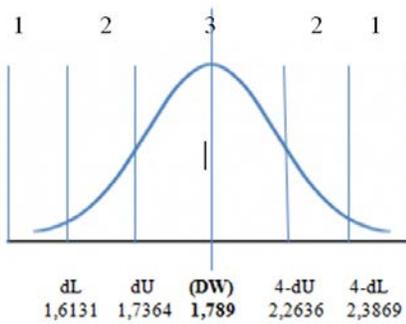


Image 5. Area determination test H_0 in *Durbin-Watson*

Be aware that the value of the Durbin-Watson of 1.789 lies in the area of $dU < DW < 4-dU$ ($1,7364 < 1,789 < 2,2636$) then it can be inferred that it is not the case the regression model on the autocorrelation

Test of Linearity

In general test linieritas aims to find out whether two variables have a linear relationship significantly or not. Good data is supposed to be there is a linear relationship between the variables (X) and variable (Y).

Table 6. Summary Of Test Result Linearity

| Relationship Variables | Based On The Value Of Sig. | Description |
|------------------------|----------------------------|----------------------|
| Y * X1 | 0,193 > 0,05 | Linear significantly |
| Y * X2 | 0,209 > 0,05 | Linear significantly |
| Y * X3 | 0,116 > 0,05 | Linear significantly |

Multiple Linear Regression Test

Linear regression analysis is one way or technique to find relationships between variables with other variables that are declared in the form of mathematical equations in a functional relationship.

Table 7. Summary Table Of Regression.

| Variable | Koefisiensi Regression | T count | Significance |
|--|------------------------|---------|--------------|
| Constants | 1,626 | 0,673 | 0,503 |
| Usability Quality (X1) | 0,470 | 4,292 | 0,000 |
| Information Quality (X2) | 0,371 | 3,670 | 0,000 |
| Interaction Quality (X3) | 0,108 | 0,989 | 0,325 |
| F calculate = 34,736 and $R^2 = 0,520$ | | | |

The Regression Coefficients are Jointly Testing (Test F)

Obtained for F table of 3.09 then F count (34.736) > F table (3.09) such that H_0 is rejected. So in conclusion, namely Usability Quality, Information Quality, and Quality Interaction together effect on User Satisfaction.

The Regression Coefficients in Partial Test (Test T)

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Further testing of the influence of the independent variable are examined against partially variable following the procedure of dependandan done.

Table 8. T test table for 2 sides.

| Pr df | 0.25 | 0.10 | 0.05 | 0.025 |
|----------|---------|---------|---------|---------|
| | 0.50 | 0.20 | 0.10 | 0.050 |
| 81 | 0.67753 | 1.29209 | 1.66388 | 1.98969 |
| 82 | 0.67749 | 1.29196 | 1.66365 | 1.98932 |
| 83 | 0.67746 | 1.29183 | 1.66342 | 1.98896 |
| 84 | 0.67742 | 1.29171 | 1.66320 | 1.98861 |
| 85 | 0.67739 | 1.29159 | 1.66298 | 1.98827 |
| 86 | 0.67735 | 1.29147 | 1.66277 | 1.98793 |
| 87 | 0.67732 | 1.29136 | 1.66256 | 1.98761 |
| 88 | 0.67729 | 1.29125 | 1.66235 | 1.98729 |
| 89 | 0.67726 | 1.29114 | 1.66216 | 1.98698 |
| 90 | 0.67723 | 1.29103 | 1.66196 | 1.98667 |
| 91 | 0.67720 | 1.29092 | 1.66177 | 1.98638 |
| 92 | 0.67717 | 1.29082 | 1.66159 | 1.98609 |
| 93 | 0.67714 | 1.29072 | 1.66140 | 1.98580 |
| 94 | 0.67711 | 1.29062 | 1.66123 | 1.98552 |
| 95 | 0.67708 | 1.29053 | 1.66105 | 1.98525 |
| 96 | 0.67705 | 1.29043 | 1.66088 | 1.98498 |

Determine t count and table t obtained t count was 4.292 (in table 7). t table (table 8) can be searched on the statistics table on the significance of $0.05/2 = 0.025$ (test 2 sides) with $df = n - k - 1$ or $100 - 3 - 1 = 96$ (n is the number of respondents and k is the number of independent variables). The obtained t table of 1.984.

Testing b_1 (*Usability Quality*) for taking the decision is t count \leq t table or $-t$ count $\geq -t$ table H_0 are received and t count $>$ t table or $-t$ count $< -t$ table in conclusion H_0 rejected. Note that t count (4.292) > t table (1.984) then H_0 is rejected, the conclusion namely variables Usability Quality affects User Satisfaction.

Testing the b_2 (*Information Quality*) for taking the decision is t count $<$ t table or $-t$ count $\geq -t$ table so H_0 is accepted and t count $>$ t table or $-t$ count $< -t$ table then H_0 is rejected. Note that t count (3,670) > t table (1,984) then H_0 is rejected, the conclusion that is the variable *Quality of Information* affects *User Satisfaction*.

Testing b_3 (*Interaction Quality*) for taking the decision is t count \leq t table or $-t$ count $\geq -t$ table so H_0 accepted and t count $>$ t table or $-t$ count $< -t$ table then H_0 is rejected. Note that t count (0,989) < t table (1,984) then H_0 is accepted, the conclusion that is the variable *Interaction Quality* does not affect *User Satisfaction*.

The Influence Of Usability Quality Against User Satisfaction

Based on table 7 *Usability Quality* with the value of the coefficient of 0.470 positive and significant effect against *User Satisfaction*. This is evident from the value Tcount = 4,292 greater than the value of the Ttable = 1,989 or value sig = 0,000 the smaller of $\alpha = 0,05$, then it can be inferred that the existence of the influence *Usability Quality* against *User Satisfaction*.

The Influence Of Information Quality Against User Satisfaction

Based on table 7 *Information Quality* with the value of the coefficient of 0,371 a positive and significant effect against *User Satisfaction*. This is evident from the value Tcount = 3,670 greater than the value of the Ttable = 1,989 or value sig = 0,000 the

smaller of $\alpha = 0,05$, then it can be inferred that the existence of the influence of *Information Quality* against *User Satisfaction*.

The Influence Interaction Quality Against User Satisfaction

Based on table 7 *Interaction Quality* with the value of the coefficient of 0,108 a positive and significant effect against *User Satisfaction*. This is evident from the value $T_{count} = 0,989$ the smaller of $T_{table} = 1,989$ however, the value of $sig = 0,325$ greater than $\alpha = 0,05$, then it can be inferred that the absence of influence of the *Interaction Quality* against *User Satisfaction*.

Recommendations on User Satisfaction

From the results of the calculations have been done, retrieved T_{count} value of each variable that is the variable *Usability Quality* in the amount of 4,292, variable *Information Quality* in the amount of 3,670 and variable *Interaction Quality* in the amount of 0,989. The value of the T_{count} variable *Usability Quality* and variable *Information Quality* larger than T_{table} that means the existence of a positive and significant influence towards *User Satisfaction*. For that it needs the recommendation for improvement the quality of the website Evaluation Development Monitoring System that was in the BAPPEDA Ngawi on the variable *Usability Quality* and variable *Information Quality*.

Recommendations Usability Quality Against User Satisfaction

Based on the results of the test are done to the variable *Usability Quality* that has significant influence on satisfaction of users on website Evaluation Development Monitoring System that was in the BAPPEDA Ngawi, with indicators that affect user satisfaction is expected to Developer *website* give the look of a website that is easy to understand in and understood by employees or staff that is in the scope of BAPPEDA Ngawi so simplify user understanding towards the function of the website Evaluation Development Monitoring System. To the Developer expected to pay attention to the colors, fonts, images and content in the website for future development so as to give ease to the user interact.

Recommendations Information Quality Against User Satisfaction

Based on the results of a test against a variable *Information Quality* that has significant value effect on satisfaction of users on website Evaluation Development Monitoring System that was in the BAPPEDA Ngawi. Expected to website development Evaluation Development Monitoring System can provide the right information, clear, accurate and trustworthy.

The most influential dimension against Website Evaluation Development Monitoring System

Of multiple linear regression test results generated variable value from quality research website Evaluation Development Monitoring System that was in the BAPPEDA Ngawi for variable *Usability Quality* greater than variable *Information Quality* and variable *Interaction Quality*, so *Usability Quality* has a greater influence, It can be seen from T_{count} variable *Usability Quality* is 4.292 the value T_{count} variable *Information Quality* is 3.670 and variable *Interaction Quality* is 0,989.

V. CONCLUSIONS AND RECOMMENDATION

Conclusion

Based on the results of the research on the analysis of website quality Evaluation Development Monitoring System that was in the BAPPEDA Ngawi against user satisfaction then generate the following conclusions:

- Usability quality and information quality a positive and significant effect against user satisfaction.
- Dimensions on usability quality contribute to greater user satisfaction levels affect, due to the result of t_{hitung} on a variable usability quality of 4,292 compared to the value of t_{hitung} on the variable information quality and interaction quality.
- Dimensions on interaction quality is 0,989 that has no influence on the level of user satisfaction, due to the result of the value of the $sig = 0,325$ greater than $\alpha = 0,05$, then it can be inferred that the absence of influence Interaction Quality against User Satisfaction.

Recommendation

Based on the research that has been done, then the author would like to propose some suggestions that could be a consideration and input the following:

- Website of Evaluation Development Monitoring System that was in the BAPPEDA Ngawi further improved in terms of quality of usability fixes like making the search content quality website to get better from now on. We recommend for further analysis comparing some website of Evaluation Development Monitoring System similar in different areas in order to know the advantages and disadvantages of each website.
- For further research in order to add new indicators and variables, as well as adding some grain questions.
- Data collection can be obtained from the other party's point of view like BAPPEDA Government officials in other Counties or Cities.

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Hazard Risk Assessment and Management Methodologies Review: Sri Lanka

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Abstract - Sri Lanka has 65,000 sq.km of land area with many areas prone to natural hazards. The last decades have witnessed the occurrence of an increased number of natural hazards in Sri Lanka. Due to the Climate changes and inappropriate land use changes have been increased natural hazards in Sri Lanka. It is important to study the assessment and management methodologies. The main objective of this study was identifying literatures about hazard assessment and management methodologies in Sri Lanka. Only data were collected based on scientific publications reviewed from 1994 to 2018 is broken down into domain types: geophysical hazard and hydro-meteorological events. This research has done the most affected geographical areas and proposes a different risk assessment and management strategies that will support more suitable management measures and stakeholders participation.

Index Terms - Hazard, Geophysical, Hydro- meteorological, Risk assessment, Stakeholders

I. INTRODUCTION

Sri Lanka has an area of 65,000 square kilometers and a population of 18.7 million (Department of Census and Statistics 2001). Last year's natural hazards have been increased 22 times during the last two decades, mainly due to increased hydro – meteorological disasters. In terms of frequency disasters affecting the people and the economy, the flood is the highest (56%), drought (18%), winds (10%) and landslides 16%) (www.desinventar.lk). Natural hazard impacts have been considerably affected the economy and development gains. Disaster management center in Sri Lanka evaluated losses and damages social sector (1,940 million rupees or 38%), productive sector (2,574 million rupees or 51%), infrastructure (5,058.9 million rupees or 51%) (www.desinventar.lk).

In Sri Lanka natural hazard types can be divided into two main types, namely meteorological hazard (winds, forest fires, floods, drought), geological hazard (Landslide, tsunami). The most frequent natural hazards that affect Sri Lanka are droughts, floods, landslides, cyclones, vector borne epidemics (malaria and dengue), and coastal erosion (Tissera 1997). Tsunamis are infrequent but have caused severe damage. Recent understanding of the tectonics of the Indian Ocean region points to an increasing risk of earthquakes (Dahanayaka, 2004).

The main objective of this study was identifying literatures about hazard risk and management in Sri Lanka. Only data were collected through literature review.

II. METHODOLOGY

A. Geological Hazard Methodologies In Sri Lanka

Based on scientific publications, prevalent risk assessment and management methodologies are reviewed year from 2000 to present and categorized into two hazard event groups: hydro-meteorological and geophysical. The main objective of this study was identifying critical comparisons of analyzing risk assessment and methodologies are presented in order to highlight main differences and common points and to identify gaps for future development and research.

These two main groups address the impacts and risk and analyze criteria based on varying assumptions. Table 1.1 is designed with the conceptual framework expressed in each risk assessment or management method – specifically risk, hazard, vulnerability and exposure concepts and their application to the specific natural hazard under examination.

Table 1.1: Structure of the criteria used with definition - literature review

| Criteria | Definition |
|----------------------------------|--|
| Objective | Purpose of the research. |
| Analytical approach | Specifies the kind of analysis employed in the method. |
| Input and output | Reports the applied tools and models and describes the input data used in the analytical approach and how the method's results are presented – extended detailing of the final output of every step of the method. |
| Strengths (S) and weaknesses (W) | Highlights strong points and limitations of the method. |

III. FINDINGS

A. Geophysical Hazard

Geophysical hazards include landslides, avalanches, earthquakes and volcanic eruptions; landslide events account for some of the most relevant hazards in Sri Lanka. In Sri Lanka landslides include two main characteristics: (1) material involved landslide (rock, earth) and (2) type of movement landslide (falls, topples, slides, spreads, flows). Landslides are closely connected with hydro-meteorological hazards, as storms can be often linked as a main cause. Landslides are a major threat to human life, property, buildings, infrastructure and natural environments – especially in the hilly regions in Sri Lanka. The landslide susceptibility is spread over the entire hilly region of Sri Lanka, namely in seven districts; Badulla, Nuwara Eliya, Kandy, Kalutara, Ratnapura, Kegalle, Matale, Matara and Galle (National Building Research Organization – NBRO, 2003).

B. Landslide Hazard Methodologies In Sri Lanka

A methods review of the predominant landslide hazards is presented in Table 1.2 and is broken down using the criteria described from Table 1.1.

Dhanushka et al (1) (2015) has used quantitative method for the identifying landslide risk and mapping for the Sri Lanka. This study has been developed human settlement map using of overlaying method, weighted method and pairwise ranking method use to weighting the human settlement categories. Mapping process has been carried out by using QGIS which is an open source GIS application. The analyzed data included past satellite images they have been helped identifying building density, open spaces and land uses. Using weighted and pairwise methods has been developed risk maps as high risk, medium and low risk. This risk map will be used for environmental investment in guide plan for the development, early warning system and gathering further information on demographic and housing.

Deheragoda et al (2) (2003) studied social survey among the landslide affected families in the Kotapola DS division in the Matara District of the Sri Lanka. In this study, questionnaire, case studies, geographical coordinates method were used for identifying landslide affected and vulnerable locations in the Kotapola area. SINMAP model was used mainly used to predict landslide vulnerability for the future. This study will be help regional awareness programme for the Sri Lanka and for the relocation programme.

Virajh et al (3) (2012) has been studied susceptibilities to shallow landslide occurrence in the Kalawana Divisional division in Rathnapura District. This study used two data collection methods such as fieldwork and laboratory test. An analytical Hierarchical process has been used for the development of the attributes map. GIS data sets have combined by weighted average analysis (WAA), landslide susceptibility map of the study area have been created. The resulting information have compared with the landslide susceptibility map derived through the SINMAP model. Both outputs are useful for better understanding of landslide susceptibility and they will be helpful for the reduction and mitigation of future landslide hazards of the study area.

Edirisooriya (4) (2018) was created a landslide zone map using of SINMAP model to the Elaphatha Divisional division of the Rathnapura district. This model found 87% stable, 7% marginal and 5.62% having unstable land of the study area. This data are very important for the development and planning activities of the study area.

Weerasingha et.al (5) (2006) studied a deterministic slope stability predicting tool for landslide vulnerability assessment in the Ratnapura town area. Slope stability analysis model – SINMAP was used in this study. Further GIS technology was used for producing DEM and stability Index grid theme based on 1:10,000 scale contour data. The major output of the SINMAP model is the Stability Index grid theme, which can be used as a landslide hazard zonation map. The model also provides slope area plot charts and statistical summary for each calibration region in the study area facilitating the data interpretation. The results of this study indicate about 72% reliability in predicting slope instability in the selected study area. The output of this result should be significant for the geotechnical and geological evaluation of the site and implementing of the remedial measures and restricted land use practices to the unstable areas. However, it is important to increase the awareness of people who utilize the mountainous areas, in general, regarding the possible causes of slope instability and the importance of applying better land use practices and construction practices.

Prasanna (6) (2018) studied risk assessment for the high land slide hazard area in Hali Ella GN division in Badulla district. This paper assessed risk according to the frequency, magnitude, and type of hazard and the vulnerability and exposure. Data were collected through secondary and primary data collection methods. stratified samples, house-by-house survey, participatory GIS procedures, building footprint maps have been employed to acquire socio-economic information of both the buildings and inhabitants accommodate in risk buildings of the study area. This paper has been found livelihood of the families rely on lands in landslide prone areas, majority of the houses are not designed by professionals and are constructed without obtained approval from relevant authorities, majority of the houses not obtain clearance for construction in landslide prone areas, nearly half share of houses locate on steep slope ($>31^\circ$) terrain, majority of housing units have no drainage system available to discharge rain water, access road to nearly one third of the housing units have the possibility of damage by disaster and nearly two third of the housing units have no alternative roads to reach their houses, inhabitants in nearly two third of the housing units do not receive instructions on disaster preparedness. The resulting information should be applying formulate and practice risk-based land use planning, develop preparedness plans, early warning systems and hold regular public preparedness drill to enhance the knowledge and ability of the local community to predict, prepare, and respond and to cope with the effect of disasters.

In the study conducted by Kaleela et.al (7) (2017) examines impact of landslide on environment and socio economy in the Badulla district. Primary and Secondary data were used to collect the qualitative and quantitative information. Primary data has been gathered through the observation, group discussion, direct interview and field visit. This methodologies found physical and human factors mainly affected increasing of landslide in the Badulla district of Sri Lanka.

Bandara et.al (8) (1994) studied landslides in the Badulla district. This paper discussed the relationship between geological conditions, rainfall, and land use and slope patterns with causes for landslides in the study area. Field investigation method was used in this study and it was found that most of the landslides originated from the soil of superficial colluviums, residual and weathered rock areas. Further, this study examined the rate of landslide occurrence in the scrap and the dip slope areas respectively.

C. Hydro-Meteorological Hazards Sri Lanka

Hydro-meteorological hazards comprise primarily of floods, storms, water scarcity, extreme temperature events and forest fires. Floods are the most common type of natural disaster in Sri Lanka and they contribute to almost 50% of the total disaster occurrences in the country that devastate lives and property year after year. The district of Colombo, Gampaha Ratnapura Galle, Matara Kalutara, Ampara, Polonnaruwa, Trincomale are inundated by floods during the South –western monsoon period and North – eastern monsoon period. Floods have killed about 350 people between 1994 and 2010 and left almost 3.5 million people homeless.

D. Flood Hazard Risk Assessment Methodologies In Sri Lanka

A methods review of the predominant hydro-meteorological hazards are presented in Table 1.2 and is broken down using the criteria described from Table 1.1. Within the reviewed papers, a varying definition of risk is provided; authors define risk using different parameters and assumptions. Kumari et.al (1) (2018) studied the qualitative flood risk assessment for the Western Province of Sri Lanka. Risk index was used for this study, which was purely based on weighted parameters. Risk index calculated according to the hazard index, exposure index, and vulnerability index. Accordingly, have been developed flood hazard map, exposure map and social vulnerability map. Populations in 08 (0.9%) GN Divisions are socially at high flood risk, but out of those 08, only 01 is with very high flood hazard and only 04 are with high flood hazard. The results of the economic risk analysis indicate that the population in 01 (0.1%) GN divisions are economically at very high risk of flood, the population in 65 (7.1%) GN Divisions is at high risk. Generated flood risk maps are instrumental in identifying the GN Divisions with high flood risk and can be utilized for determining the appropriate disaster

mitigation options prior to implementing the planned developments for the area. The derived information supports for making decisions on preparedness planning, early warning and other measures which can be implemented for increasing the adaptive capacity of a vulnerable population, and reducing their disaster risk. The outcome of the study also provides provisions for allocating sufficient funds for disaster relief and post disaster rehabilitation.

Edirisooriya (2) (2018) developed the inundation map using of Gumble model for the Ratnapura Divisional Secretariat area (DSD). The main methodology applied in this study was a geographical information system and used digital elevation model, 21 year flood heights records. Throughout this study low, moderate and high flood hazard map and probability of inundation maps for 5 ,10 ,20 30 40 ,50 and 100 years were developed. The results of the inundation maps found 64.3% of the study area comes under the high hazard zone. These include Ratnapura town, Ratnapura town west, Godigamuwa,Thirivanaketiya and Weralupe. These inundation maps are useful for flood emergency management, implementation of relief and rehabilitation programs,

Soolangaarachi et.al (3) (2005) did a flood hazard assessment for the Rathnapura Municipal Council area. This assessment included a land use zonation map that was developed using secondary data as well as primary data generated through field information. Rajapakse (4) (2003) developed a flood hazard map for the Ratnapura city based on secondary and primary data. This study attempted at developing a plan to minimize damages to life and property caused by floods in Ratnapura city. Liyanarachchi et.al (5) (2006) studied the flood situation in the Ratnapura area. This study was developed digital elevation model and that base developed inundation level in the Rathnapura Municipal Council area. Throughout this study, low moderate and high flood hazard maps were developed. These inundation maps will be useful for policy planners.

Dilhani1 et.al (6) (...) studied flood risk mitigation strategies in vernacular dwelling in the Rathnapura district. Data have been collected through 15 case studies. Case studies have been analyzed using chronological analysis methods. Five parameters have been identified to develop flood risk mitigation strategies of the study area. These parameters are location and orientation, plan configuration, substructure super structure and services. This study has identified the absence of modern materials and professional knowledge in the case study area of the district. Accordingly, this study will be used for the development of materials and construction practices in the flood risk areas in Sri Lanka.

TABLE 1.1 : LANDSLIDE HAZARD METHODOLOGIES REVIEW IN SRI LANKA

| Author and year | Objective | Methodology | Research out put | Strength |
|-----------------|-----------|-------------|------------------|----------|
|-----------------|-----------|-------------|------------------|----------|

| | | | | |
|----------------------------|---|--|---|--|
| Dhanushka at.al (1) – 2015 | Identifying landslide risk in Sri Lanka . | Quantitative methods. (overlying, weighted, pairwise ranking), QGIS. | Human settlement map, risk map. | S- Environmental investment. - Risk map further information on demographic and housing, early warning system. |
| Deheragoda at.al (2) 2003. | Social survey among the landslide affected families . | Questionnaire , case studies, Geographical coordinates M – SINMAP | Understanding of landslide probability(probability map), social and physical impacts . | S - Regional awareness, relocation purpose. W. - Time, Communication problem . |
| Virajh et.al (3) 2012 | Susceptibilities to shallow landslide occurrence | Field work, laboratory test ,GIS, Hierachical processes. M-SINMAP, | Understanding of landslide susceptibility(Attribute map, landslide susceptibility map). | S - Reduction and mitigation of future landslide hazards. Development and planning activities |
| Edirisooriya (4) 2013 | Identifying landslide zone map using of SINMAP model. | Geographical coordinates , GIS M-SINMAP, | Understanding of landslide susceptibility (DEM landslide susceptibility map.) | Geotechnical and geological evaluation, site and implementing of the remedial measures and restricted land use practices to the unstable areas. |
| Weerasingha et.al (5) | Deterministic slope stability predicting tool for landslide vulnerability assessment in Rat | DEM, stability index gride, GIS. M-SINMAP | Understanding of landslide susceptibility (Slope map, plot chart, stability map). | |
| Prasannaa (6) 2018 | Risk assessment for the high land slide hazard area in Hali Ella GN division in Badulla district. | House by house survey, PRA. | Livelihood of the families rely on lands in landslide prone areas. | S -Formulate and practice risk-based land use planning, develop preparedness plans, early warning systems and hold regular public preparedness drill to enhance the knowledge and ability of the local community. |
| Kaleela et.al (7) 2017 | Impact of landslide on environment and socio-economy in the Badulla district. | observation, group discussion, direct interview and field visit | Physical and human factors, mainly affected increasing of landslide in the Badulla district | |
| Bandara et.al (8) 1994 | Landslides locations in the Badulla district. | Field investigation method. | Landslides originated from the soil of superficial colluviums, residual and weathered rock areas. | |

TABLE 1.2: FLOOD HAZARD METHODOLOGIES REVIEW IN SRI LANKA

| Author and year | Objective | Methodology | Research out put | Strength |
|-------------------------------|--|--|---|--|
| Kumari et.al (1) 2018 | Qualitative flood risk assessment for the Western Province of Sri Lanka. | Risk index (hazard index, exposure index, and vulnerability index). | Populations in 08 (0.9%) GN Divisions are socially at high flood risk, population in 01 (0.1%) GN divisions is economically at very high risk of flood. | flood risk maps can be utilized for determining the appropriate disaster mitigation options. |
| Edirisooriya (2) 2018 | Developed the inundation map for the Ratnapura DS division. | Field data, Flood level data, GPS data. M- Gumbal model. | Flood inundation maps probability of inundation map. | Flood emergency management, implementation of relief and rehabilitation programmes, |
| Soolangaarachi (3) 2005 | Flood hazard assessment for the Rathnapura Municipal Council area. | Secondary data, primary data. | Land use zonation map. | |
| Rajapakse (4) 2007 | Developed a flood hazard map for the Ratnapura city. | Secondary and primary data. | Inundation map. | Developing a plan to minimize damages to life and property. |
| Liyanarachchi et.al (5) 2006. | Developed a flood hazard map for the Ratnapura MC area. | Inundation level, M- digital elevation model and that base developed inundation level. | Inundation map. | Inundation maps will be useful for policy planners. |
| Dilhani1 et.al (4) 2016 | Risk mitigation strategies in vernacular dwelling in the Rathnapura district | 15 case studies. | Identified absence of modern materials and professional knowledge in the case study area. | Development of materials and construction practices in the flood risk areas. |

IV. CONCLUSIONS

Based on the review, the existing assessment and management methodologies for the two domains denote natural hazards under given reference to recent analysis and discussion of scientific publications. The analyzed papers are focused only landslides and flood hazards.

This research done the most affected geographic areas and proposes a different risk assessment and management strategies that will be support more suitable management measures (e.g. cost - effectiveness) and stakeholders' participation (e.g. Public participation through workshops)

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The Implementation of Problem Based Learning using Video in Civic Class to Improve Learning Outcome and Student Activities of Grade 5 Students of Public Elementary School of Bulak Rukem I No. 258 Surabaya

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Abstract-This study aimed to improve students' learning outcomes and activities in the Civic Class of Theme 7 Sub-theme 2 with Problem Based Learning model using Video in second semester of grade 5 Public Elementary School of Bulak Rukem I No: 258 Surabaya. This is a classroom action research carried out in 2 cycles consisting of preliminary study, planning, implementing, reflecting and revision. There were three kind of data used in this research namely students' learning outcome, teacher competence, and students' activity. Students' learning outcomes were obtained from a test for each cycle, while teacher competence and students' activity were obtained from observation sheet. The result showed that there were 21 out of 39 students that (53.8%) met the passing grade in the first cycle and 32 students (82%) met the passing grade in the second cycle.

Index Terms - teaching model, video, learning activity, learning outcomes.

I. INTRODUCTION

Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves, society, nation and state. Functionally, education is an effort to prepare someone to fight for the future so that they can live more prosperously, as an individual and as a group of a community, a nation and among nations. From a religious perspective, education is also effort to prepare someone to reach the happiness in the future, not only in the world but also the world after life.

Civic teaching is still not optimal. It seems stagnant, boring, and less interesting to students. This is due to the fact that the teaching is still mostly teacher-centered and barely implements basic innovative teaching strategies. Therefore, renewed strategies and innovation are absolutely needed in teaching Civic. The results of an observation of civic class in Public Elementary School of Bulak Rukem I number 258 Surabaya showed that students there still have limited understanding about the material (civic). There were only 21 students (53.8%) who met the passing grade, while the other 18 students (46.2%) got scores below the passing grade. This data shows that teaching objective is not achieved as student's understanding about the topic is still limited. (Primary Data: SDN Bulak Rukem I No: 258 Surabaya)

There are two factors that are believed to cause numbers of students don't complete civic teaching. First, students are passive. They do not play any active role during the teaching process. At the beginning of teaching, the teacher informs the teaching objectives. Then, students are told to learn and memorize the material from the textbook. After that, the teacher opens a question and answer session which is followed by exercises, answering questions in the textbook. Thus, the learning activity becomes a boring routine dominated by lecture, question and answer, and assignments. Second, student's knowledge is limited. They are only told to memorize facts and materials written in the textbook and do not have any media to help them to have better understanding about the topic.

To overcome the problems, teachers need to use varied teaching models and media. This study tried to offer a solution in improving the activities and learning outcomes of students by implementing problem-based learning model (PBL) using videos.

Problem Based Learning Model

Baud & Feletti stated that problem-based learning is a way of teaching toward structuring as an approach that involves students to deal with problems through real practice in accordance with everyday life [1]. Problem-Based Learning is a teaching model that is used to generate high-level intelligence of students in a condition that are oriented to existing problems, including learning how to learn [2]. This teaching model is characterized by the activity of asking students to answer a real and meaningful problem. The problem is made as real as possible to make it easier for students to conduct their own studies and discoveries.

Referring to the various opinions above, it can be concluded that problem-based learning is a learning model which is programmed and described to develop the ability of students to solve problems according to daily life.

The Syntax of Problem Based Learning Model

| Phase | Teacher Activities |
|--|---|
| Phase 1: Orientate student to the problem | Teacher explains the purpose of teaching, describes the required logistics, and motivates students to be actively involved in solving the selected problem. |
| Phase 2: Organize students | Teacher helps students define and organize learning tasks related to the problem. |
| Phase 3: Individual and group research guide | Teacher encourages students to gather appropriate information and to carry out experiments for explanations and problem solving. |
| Phase 4: Develop and present the work | Teacher assists students in planning and preparing suitable works such as reports, models, and sharing assignments with friends. |
| Phase 5: Analyze and evaluate problem-solving process | Teacher helps students for investigations and their reflection processes. |

Video Media

Video media can provide pleasant conditions for students. By using videos, students can participate in fun, effective, and efficient learning. This is believed to offer a positive effect on the activity and learning outcomes. The selection of video as the learning media is based on the previous researches that found that using video for teaching can improve learning outcomes [3]. Using appropriate learning media and methods to organize and present relevant information can improve the efficiency of the independent learning process.

Student Learning Activities

Student activities involve physical and mental actions. In learning activities, both are interrelated [4]. Both play important roles in influencing student action and motivation. The enthusiasm of students in learning becomes one of indicators of the student eagerness to learn. Students are categorized as enthusiastic when they actively ask educators or discuss with other students, are eager to do the task, are able to answer questions, and are enthusiastic when given the task of learning. All attitudinal characteristics can be viewed from two aspects, namely the process aspect and the outcome aspect.

Learning Outcomes

According to Abdurrahman, learning outcomes are abilities acquired by children after going through learning activities [5]. Learning outcomes are the most important part of learning. Student learning outcomes in a broader sense covering cognitive, affective, and psychomotor [6]. Learning outcomes are outputs from an input processing system. The input is in the form of various informations while the output is action or performance.

II. IDENTIFY, RESEARCH AND COLLECT IDEA

This research is Classroom-Action Research. Classroom action research is a study to solve teaching problems in the classroom [7]. Classroom action research is an observation of learning actions such as actions that are intentionally caused and simultaneously occur in class [8]. The aims of Classroom Action Research are to advance the quality of teaching processes and outcomes, to solve teaching problems, to advance professionalism, and to develop academic habits. This study used CAR model described by Riyanto which is a modification of the Kemmis and Mc. Taggart model. The model covers four stages (1) initial study, (2) planning, (3) action / observation, and (4) reflection [9].

Location and Subject

The subjects in this study were 5th grade students of Public Elementary School of Bulak Rukem I No: 258 Surabaya consisting of 21 boys and 18 girls. This research was conducted at Public Elementary School of Bulak Rukem I No: 258 Surabaya.

Data Collection

1. Observation

Student behavior is a process of an action that can be observed and can be measured through an observation [6]. The observation of this study is carried out during the civic class. This observation is carried out to get the bigger picture of what are the advantages and disadvantages of the teaching stage. The observations include two things:

- a. Student activities. It is all forms of behavior and all activities of students during the class.
- b. Teacher activities. It is all forms of behavior and all activities of students during the class.

2. Test

Tests as assessments are problems or questions given to students in the form of oral tests, written tests, or action tests to assess and measure student learning outcomes [6]. This study only focused on the assessment of aspects of knowledge. Student knowledge was assessed using a test given to students in the form of fill-gap and short essay test. The test were carried out at the end of learning in each cycle.

Data Validity and Data Analysis

1. Student Activities

Observation result were analysed using the following formula:

$$P = \frac{F}{N} \times 100\%$$

Annotation:

- P = percentage of activity
- F = observed acvitivity scored
- N = maximum scored for all observed activity [10].

The results were then converted into these categories:

- 81 – 100 : excellent
- 61 – 80 : good
- 41– 60 : fair
- 21 – 40 : poor
- 0 – 20 : very poor [11]

2. Learning Outcome Result

The average score of the class was calculated using the following formula:

$$M = \frac{\sum X}{N}$$

Annotation:

- M : the class average score;
 - $\sum X$: the total of student score;
 - N : number of students who taking the test;
- (Sudjiono, 2010:81)

The mastery learning was calculated using the following formula:

$$P = \frac{f}{N} \times 100\%$$

Annotation:

- P : percentage of the mastery learning;
- f : number of students who pass the minimum grade;
- N : number of students who taking the test [11].

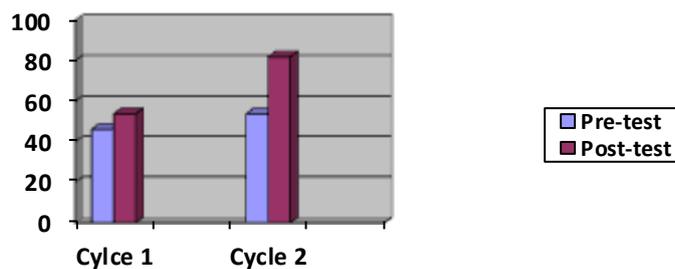
Success. The indicators of success in this observation are:

1. The observation of student activities were considered successful if at least 80% of the indicators planned for the teaching were occured during the observation process.
2. Student mastery learning is considered successful if 80% of the students get a score of equal to or more than the passing grade (≤ 75).

III. RESULTS AND DISCUSSION

There was a significant increase in learning outcomes and student activities. The test results showed that students who met the passing grade in the first cycle were 21 students (53.8%), while students who did not meet the passing grade were 18 students (46.2%). In the second phase, the number of students who met the passing grade increase significantly to 82% (32 students), while the number of students who pass the minimum score dropped to only 17.94% (7 students). The average learning outcomes also showed an increase from 74.14 in the first cycle to 83.14 in the second cycle.

Based on the data above, it can be concluded that the learning outcomes increased. There were 11 students showed improvement, from 21 who pass the minimum grade in cycle 1 to 32 students in cycle 2 or from 18 students who did not pass the minimum grade in cycle 1 to 7 students in the cycle 2. Besides, the average learning outcomes also showed improvement. It increased 8 points. Then, it can be said that the cycle 2 was successful. It was shown by the percentage of mastery learning of 86.20% and the average score of 83.14. The progress is shown in the diagram 1.



IV.

CONCLUSION AND SUGGESTION

Based on the result above, it can be concluded that:

The implementation of problem-based learning model using video in civic class to improve student activities and learning outcomes of grade 5 students of Public Elementary School of Bulak Rukem I No: 258. In cycle 1, students were reluctant to ask questions and give opinions, passive during discussion, and embarrassed to come forward presenting the results of their discussion. However, in the second cycle, students were dared to ask and give their opinions, were active in discussing and willing to come forward to present the results of the discussion without being told by the teacher. This can be proven from research data that shows that student learning activities have increased.

The implementation of problem-based learning model using video in civic class can improve learning outcomes.

Based on the conclusion above, it is recommended for the school to:

Implement the Problem Based Learning model using video in the civic class, especially for grade 5.

Make this learning model as the alternative teaching model for other subjects.

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Social Media Shapes Youth's Identity and Self Concept in Sawarna, Lebak Banten, Indonesia

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Abstract- *This research studies the influence of social media on the development of youth identity and self concept in State High Vocational School SMKN I Bayah, Lebak Banten more deeply. The consumption pattern of social media among adolescents will have effect on the adolescents themselves. In this research the expected effects are at the level of the attitudes effect on the development of identity and self-concept. The message or news content published on social media can affect the attitudes of adolescents, particularly high vocational school students. At first social media is used to establish relationships or connect friendships and information searches, right now the media function has changed the meaning. In some cases, social media can influence audience's attitudes and those towards violent behavior. However, This research examines the positive effects, i.e. the development of adolescents' self-identity and self-concept. This research was conducted using a survey method for high vocational school students SMK I Bayah Banten.*

Index Terms- Social Media, Self Identity, Self Concept, Youth in Sawarna Banten

I. INTRODUCTION

Children live in their time. Children and adolescents have their own lives. They interact with each other. Technology affects their daily lives. Children and adolescents can now be said to be millennial generation and they cannot be separated from digital media. Philip Chan (UNICEF Australia Young Ambassador Young and Well Cooperative Research Centre, Youth Brains Trust) has stated:

Digital media is a powerful way for children to realise their rights, from accessing information, playing games, to expressing themselves freely and even anonymously. Technology has a crucial role in empowering children by facilitating communication, education and activism. It means children don't have to rely on adults and can have a voice of their own. Yet not all children have equal access to digital media. Even with access, digital media poses risks for children such as internet safety and cyberbullying. In any new policy or decision-making, it is absolutely important to listen to children's voices firsthand, rather than assuming what is best for them." (Children's Rights in the Digital Age: A download from children around the world, October 2014)

In July and August 2014, UNICEF conducted research involving 148 children from 16 countries on how the young generation's perspective on their rights in the digital age. Each children and adolescents have the rights to use digital media, UNICEF explains these rights: 1. The rights to access; 2. It is the young generation that mostly uses the digital media; 3. Literacy is the most basic thing for the young generation; 4. Narrative risk is dominated; 5. Smart to distinguish between online and offline; 6. Balancing between risk and opportunity; 7. Being able to actualize themselves through media uses; 8. It is the young generation's perspective; 9. A place to find knowledge; 10. Government and Practitioners continuously to communicate with the young generation. (2014: 8-12).

According to a survey of the Indonesian Internet Service Providers Association (APJII) in collaboration with University of Indonesia's Communication Study Center (Puskakom UI) conducted in Indonesia, based on the age of users, the majority of internet users in Indonesia is in the age range of 18-25 years old (49.0%). It means that the largest segment of internet users in Indonesia is those who are in the category of digital natives. (<http://www.beritasatu.com/iptek/261297-mayoritas-netizen-di-indonesia-berusia-1825-tahun.html>).

The International NGO Forum on Indonesian Development (INFID) in collaboration with the Gusdurian Network Indonesia conducted a survey with the title of "Persepsi dan Sikap Generasi Muda terhadap Radikalisasi dan Ekstremisme Kekerasan Berbasis Agama" (Perception and Attitude of the Young Generation on Religion-Based Radicalization, Extremism and Violence). The two institutions observed through popular social media among young people, i.e. Twitter, Facebook, Instagram, messaging applications (WhatsApp and Telegram) and YouTube. The respondents were taken from the age range of 15-30 years with the same male and female gender ratio of 50:50 (<https://tirto.id/survei-pesan-intoleransi-bertebaran-di-media-sosial-cfeY15>).

Ibnu Hamad (2008: 10) says the nature and fact of mass media editorial tasks is to tell events and therefore, it does not say excessively that the entire media contents are a constructed reality. Moreover, it is naturally right that the development of reality construction in each media differs one another despite the reality is the same. How to construct the reality of these facts depends on the editorial policy based on the media politics. Mass media particularly the Internet definitely provides greater opportunities for anyone to be creative, gets information from many things, and actualizes themselves. However, the internet media sometimes provides

false information and it is believed to be the truth for lack of knowledge and insights of the internet users. Therefore, the research questions in this research are: (1) How far is the content of social media messages in Indonesia? (2) How far does the content of social media messages affect the development of identity and self-concept in state high vocational school students?

This research studies communication technology, particularly social media technology. It observes the limited effects in patterns of social media use or consumption on the young generation, i.e. high school students. The effects aimed at the younger generation in this research is the development of identity and self-concept.

As time goes by, technology has become more advanced from analog technology to digital one. This has impact on media developments then it appears new media. According to McQuail, new media is a place where all communication messages are decentralized; message distribution via satellite increases the use of cable and computer networks; the degree of audience involvement in the communication process rises drastically. Moreover, other definitions of New Media are that the media uses the Internet, the technology-based online media, flexible characters, potentially interactive and can function privately or publicly (Mondry, 2008: 13).

"Social media currently has become a part of modern human life. It is estimated that in the future there will be a trend with the 3S term, i.e. Social, Share, and Speed ". Social indicates that how anyone connects with other people and shares one another. Share itself shows that how anyone shares his experience with others, through texts, photos, videos and whatever it is through social networks.

Based on the research results on how many hours adolescents spend their time with their computers, it shows that :

Parents in the Annenberg survey report that children (between 2 and 17 years) in homes with computers spend approximately 1 h and 37 min a day on computers, including video games (Stanger & Gridina, 1999). In the Home Net study, machine records of weekly usage averaged across approximately 2 years of data between 1995 and 1998 show that among the teens who had access to the Internet at home, usage averaged about 3 h/week during weeks when they used it, and over 10% used it more than 16 h/week. Teens in the study were much heavier users of the Internet and all its services than were their parents. The teens used the Internet for schoolwork, for communication with both local and distant friends, and to have fun, especially by finding information related to their interests and hobbies. Teenagers were more likely than adults to report using the Internet for social purposes. (Subrahmanyam, et al, 2001 : 9)

The research results state that the computer uses greatly vary from entertaining oneself, doing homework, finding education information, communicating with friends, joining groups to reading news. This also makes adolescents forget other activities. In addition, the research results also reveals that adolescents who use computers at home influence their academic performance. It is described as follows :

One program of note is that of Cole (1996), who has been experimenting with the use of electronic communication and games with children in both classroom and after-school settings for nearly 15 years. The after-school programs are called "The Fifth Dimension," and include the typical uses of home computers, such as educational software, computer games, searching the Internet, and multiuser dungeons (MUD) activities. Subject matter includes social development, geography, communications, reading, writing, math, social studies, health, technology, language, and problem solving (Blanton, Moorman, Hayes, & Warner, 1997).

Tapscott (2009) writes the norms of Internet Generation. Firstly, they want freedom in everything they do, i.e. freedom of choice and freedom of expression. Secondly, they like to make things according to their tastes (customization and personalization). Thirdly, they seek corporation integration and openness when they decide something they will buy or where they will work. Fourthly, the internet generation wants entertainment and games in their jobs, education and social life. Fifthly, they are the generation that relies on collaboration and relationships. Sixthly, the internet generation needs speed. Seventhly, they are innovators. The needs of digital native's life are fully integrated with the internet. They have become part of a digital environment that is familiar with the internet since their childhood and therefore, the primary, secondary and tertiary needs can be totally felt through the hold of a device (Sukaesih, SB, & Harmanto, 2015); (Supratman, 2018).

Identity is important in a society where they have many members. It is individuals' picture through: physical appearance, racial characteristics, skin color, language they use, self-assessment, and other perception factors all of which are used to construct cultural identity. According to Klap (Berger, 2010:125), the identity includes all things to individuals who can state legally and can be trusted about themselves - their status, name, personality, and past.

According to Tajfel & Turner (Gudykunst & Mody, 2002:225), Social Identity Theory (SIT) aims that individuals have a concept in their own selves when they socialize and identify their own selves. Personal identity sees that individuals are unique creatures. They have culture and live in a group. Moreover, social identity refers to knowledge in members of cultural groups and communicate it with other cultures. The characteristics of individuals get influence from collectivistic orientation in individual communication: (1) Personality Orientations describes how personal orientation relates to or communicate with others. (2) Individual Values are personality values that individuals possess when they maintain their self confidence when they make communication. (3) Self Constructuals (self perception/ expression) describe how individuals express themselves when they communicate with others.

The main focus in this theory will see how identity is produced in social categories (Hogg, 1993; Hogg & Abraham, 1988; Turner 1991, in (Gudykunst & Mody, 2002:225). Social categories can be in a kind of ethnicity, gender and political affiliation as a part of social structures. Individuals belong to the social category and are basically members of the social categories. Identity connects

individuals to society through members of a group. Otherwise, it will influence individual beliefs, behavior, and knowledge in their relationships with members of other social groups. In the perspective of communication, identity is not generated on its own, but it is produced through a communication process with others. The main principle in the identity arises when a message changes between two people. The identity can be negotiated, strengthened, and changed in a communication process. Therefore, the purpose of this identity aims to build a communication (Ayun, 2015).

According to the research results conducted by Fanny Hendro Aryo Putro, it explains that self identity is an individual self-image arrangement as a person. According to Michael Hecht and his colleagues in (LittleJohn, 2008:131) about the communication theory of identity, the identity is a major link between individuals and society and communication is the link that makes this relationship to occur. Through identity and self-opening process, each individual tries to develop relationships with others through physical and personal attractiveness, and therefore, they can get others' views and perceptions (Mulyana, 2010).

Moreover, the identity development occurs when a series of ideas appears on social media. In this matter, identity announcement gets influence from physical characteristics (for example, gender, ethnicity, attraction) and knowledge as well as social background. Personal attributes often control identity placement. In contrast, the online environment allows individuals to engage in the controlled settings where an ideal identity can be conveyed. In the development of cyber media in the globalized era of communication technology development, almost all global societies turn to communication technology. Right now the communication technology has become the main key in everyday life. It means that society cannot be separated from communication technology as the information resources. Communication technology today becomes the modern media icon and the most influential ones are the Internet media and popular technologies like smartphones (Putro, 2017).

The concept of self concept can be taken from Symbolic Interaction Theory. It is a way of thinking about the mind, self, and society. George Herbert Mead in (Morissan, Wardhani, & Hamid, 2013:126) understands symbolic interaction as an interaction between humans, both verbally and nonverbally to give rise meaning. With the action and response from other individuals, we indirectly give meaning to the words or actions that still exist. The fundamental thing in the theory is the importance of meaning in human behavior, self-concept, and relationship between individuals and society. Mead states that three important concepts in this theory, i.e: (1) Society in the thinking of symbolic interaction theory comprises behaviors that work together among the members. Mead mentions that society is manifested or formed with the presence of symbols in a kind of signals from the body. Due to human ability to pronounce symbols and act as well as make response to what is produced, we will have empathy and take on their roles. (2) According to understanding of self in the Symbolic Interactions Theory, individuals interact one another to produce a certain idea about their own selves. The theory reveals about self, how experience interacts with others. In this theory, self comprises a set of three-dimensional elements. "The first dimension is the display dimension in which whether the self aspect can be shown to public or private one. "The second dimension is realization or source, i.e. the degree in a particular part or area of "self" which is believed to come from within the individuals themselves or from outside. The self element which is believed to originate from the internal is called the individually realized term while the self element that is trusted to come from the individuals' relationship with the group is called the collectively realized term. The third dimension is called an agent, i.e. the degree or level of active power that self generates. The active elements are actions that the individuals take while the passive ones are the opposite" (Morissan, Wardhani, & Hamid, 2013:126).

The research results conducted by Pamela Felita, et al (Felita, Siahaja, Wijaya, & Melisa, 2016) show that adolescents are the largest community in Indonesian society who uses social media regularly. The initial reason of definitely active social media uses is to seek attention, ask opinions, and develop their image but over time eventually they become dependent. A number of researches shows that due to excessive social media uses, adolescents are found to experience incongruence in their self-concept. The incongruence occurs due to distance or discrepancy between the real and ideal self concept. The survey results show that the majority of adolescents who actively uses social media wants to look good and display their ideal self-concept image on their social media profiles despite it is not in accordance with the real self-concept they have had.

Carl Rogers has developed the theory of 'self' and the perception of 'self' or self. According to Roger, the self concept is a collection of perceptions and self-awareness as an organized "me". The self-concept consists of elements such as individuals' characteristics and abilities, perceptions and concepts of self relationships with others and the environment as well as goals and ideas in their own selves. According to Roger, the self develops from individuals' interaction with their environment and they will try to behave according to the self (Roger, 1969). The self concept has three basic components and these consist of ideal self, public self, and real self in (White & Duncan, 2011). The ideal self is the self-concept that the client desires to have, such as good, moral and respected person. The view of an ideal self concept occasionally creates a conflict between the ideal of self and real self. The real self is a way that an individual views him/herself. The conflict between the ideal self and real self motivates the clients to change him/herself and therefore, it is in accordance with the ideal self-concept. However, the viewpoint of the ideal self-concept must be realistic. Furthermore, the public self is the client's mind regarding the views of other people and the environment around him/her which affects the ideal of self and real self of the individual. When the three components are developed in a balanced and appropriate manner, a positive self concept will be created (White & Duncan, 2011).

Adolescents are very likely to have an aspiration to pursue a career. However, the ideal will change in another time. This experiment is seen as a deliberate effort, as part of the stage of searching for the adolescents' identity. In the end the adolescents will ignore the roles and personalities that are not in accordance with their identity (Santrock, 2013). If a adolescent succeeds in completing this stage, he or she will find what is called "self-identity". However, if it fails the adolescent will have difficulty in defining him/herself (the identity confusion). The identity confusion has some characteristics, i.e. their attitude to isolate themselves

and try to avoid the groups of friends and family (Santrock, 2013). When they try to find their identity, the adolescents need peers. In this transition age, they do not want to be considered as children again. The adolescents need to show their existence, show who they are, and need recognition from their environment. In this time they need to find answers to the "who am I" questions. These answers can be obtained from various experiences together with their peers. The peers frequently contribute to the way a adolescent to values him/herself (Mulamawitri, 2001).

According to Rogers, this gap will make individuals develop negative self concepts. This certainly has negative impact on adolescent self-development (Feist & Feist, 2010). Social media uses can have negative impact. It creates discrepancy between ideal and actual self-concept. By displaying the individual's ideal self-concept, a gap arises between the actual and ideal self-concept. When adolescents provide and get feedback from their peers through social media, they continuously evaluates themselves based on the feedback and assessment. This evaluation finally influences the development of the adolescents' self-concept.

II. RESEARCH METHOD

This research was based on a positivistic paradigm with a quantitative approach. The quantitative research methods in the research is the explanatory survey method. The population in this research was State High Vocational School students SMKN I Bayah, Lebak Banten. It used probability sampling technique, i.e. using simple random sampling. Total sample amounted to 100 students from State High Vocational School SMKN I Bayah, Lebak Banten. It based on a questionnaire to measure the data contained in this research. Before the questionnaire was distributed, the validity and reliability of the questionnaire were tested before the instruments would be used in field. The results are as follows:

| Cronbach's Alpha | N of Items |
|------------------|------------|
| .857 | 40 |

Based on the data at above, the alpha value is .857, and the number is above 0.6. This means that the instrument is reliable. Based on the validity test, all of the numbers are above 0.3. Therefore, the question itemss are valid.

| Cronbach's Alpha | N of Items |
|------------------|------------|
| .932 | 29 |

Based on the data at above, the alpha value is .932, and it is is above 0.6. This means that the instrument is reliable. Based on the validity test, all numbers are above 0.3. Therefore, the question items are valid. The data analysis in this research used the Product Moment Correlations correlation test and simple linear regression analysis.

Hypothesis:

Ho. There is no influence of social media uses on the development of identity and self-concept in State High Vocation School Students SMKN I Bayah

Ha. There is influence of social media uses on the development of identity and self-concept in State High Vocation School Students SMKN I Bayah

III. FINDINGS

State Vocational High School SMKN I Bayah is located at Jalan Raya Bayah - Malingping Km. 1, West Bayah Village Administration Unit, Bayah, Lebak 42393 Banten Province. Number Decree of Establishment: 420 / Kep.280 / Disdik / 2012 dated 11/11/2012. Number Decree of Accreditation: 44 / BAP-S / M / III / 2013 Accreditation B. The respondents' identity can be described as follows: half of the respondents were men (58.8%) and women (41.2%). Half of the respondents allocated their money to buy snacks and they allocated to buy internet pulses less than IDR100,000 totaling 52% of the respondents and the remaining ones with total value of IDR100,000-IDR500,000.

Concerning the frequency of social media uses, the respondents spent more than 5-10 times (41.2%), less than 5 times (34.3%) and more than 10 times (24.5%). Concerning the duration of social media uses, the most was less than 5 hours (43.1%), 5-10 hours (39.2%) and more than 10 hours (17.6%). The respondents had and used social media everyday, i.e. the category opf two social media (33.3,%); three social media (26.5%); four social media (22.5%), more than four social media (3.9%). This means that the majority of respondents are active in using social media 62.7%, 22.5% less active and 14.7% inactive. The respondents mostly used social media for the needs of entertainment (43.1%); finding knowledge (32.4%) and friendship (24.5%). The behavior of social media uses is mostly for school needs (50%), seeking information (25.5%) and entertainment needs (24.5%).

The majority of the respondents who used social media argued that social media uses increased their abilities. In this matter, more than half of them stated that they increased their competitiveness (56.9%), communication skills (23.5%) and the empathic abilities (19.6%). The respondents mostly stated that social media uses could develop their self-identity. The median answer was 82.4% and the high one was 17.6%. The social media uses develop the self-concept development moderately (64.7%), extremely (34.3%) and insignificantly (1%).

Table 1.3. Development of Self Identity

| No. | Description | | | Indicators | | | |
|-----|-------------------|------------------|-----|-----------------|-----|---------------------------|-----|
| 1 | Personality | Communicating | 46% | Making Friends | 50% | Positive Status | 4% |
| 2 | Individual Values | Smart | 40% | Being Happy | 30% | Extroverted | 30% |
| 3 | Self Expression | Uploading Photos | 50% | Showing Hobbies | 40% | Showing Personal Problems | 10% |

High vocational school students SMKN I Bayah used social media to develop their identity. In the development of their personality, they used social media for friendships. They wanted to have sociable personality and could have many friends. Secondly, they used it for communication (46%). They wanted to have communication skill and had many friend. Thirdly, they did not excessively care about positive status and so, the students of SMKN I Bayah did not make any significant attention about this matter.

Individual values they wanted to appear were Smart as well as Happy and Open. Each was 40% and 30% consecutively. Self expression that State High Vocational School Students SMKN I Bayah saw was to upload photos of their daily activities. These include selfi and photos with their friends and family. It reached 50%. Another self-expression was to show their hobbies (40%). Their personal problems were also expressed through social media and the percentage was relatively low (10%).

Table 1.4. Self Concept

| No. | Description | | | Indicators | | | |
|-----|------------------|-----------------------|-----|------------------|-----|------------|-----|
| | Display | Populer berorganisasi | 40% | fashionable | 20% | Sportsman | 40% |
| | Realisasi Sumber | Wiseful | 50% | Ideal Self Image | 20% | Networking | 30% |
| | Agent | Active Self | 70% | Passive Self | | | 30% |

It can be seen that the development of self-concept can be seen from the Display dimension. In this matter, State High Vocational School Students SMKN I Bayah wanted to be considered as organizational activists and sportsmen. Each was 40% consecutively that they were very active in the field of organization and sports. However, some students showed themselves as fashionable individuals (20%). The development of self-concept from the dimension of the source realization can be shown that State High Vocational School students SMK I Bayah required to be considered to have wise personality (50%), like networking (30%) and ideal self-image (20%). As an agent, they were more likely to be seen as Active (70%) than passive (30%).

Table 1.5. Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1 | .194 ^a | .038 | -.002 | .383 |

a. Predictors: (Constant), Actively Social Media Uses, Daily Social Media Uses, Duration of Social Media Uses, Frequency of Social Media Uses

The significance level was above 0.05, and the influence of the variable of social media uses was not significant and it only contributed 3.8% to the development of self-identity, the remaining 66.2% got influence from other factors that were not examined in this research.

Table 1.6. ANOVA^a

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|-------|------------|----------------|-----|-------------|------|-------------------|
| 1 | Regression | .559 | 4 | .140 | .950 | .439 ^b |
| | Residual | 14.265 | 97 | .147 | | |
| Total | | 14.824 | 101 | | | |

a. Dependent Variable: Variable of Self Identity

b. Predictors: (Constant), Actively Social Media Uses, Daily Social Media Uses, Duration of Social Media Uses, Frequency of Social Media Uses

It showed that the value of F count was 0.950 and the significance level to test the hypothesis was 0.05. It viewed the significance level of 0.439. This meant that the value was above 0.05, and therefore, the influence of social media uses had no significant effect on the development of self-identity. Therefore, Ho is accepted and Ha is rejected.

Table 1.7. Coefficients^a

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|-------|--------------------------------|-----------------------------|------------|---------------------------|--------|------|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 2.210 | .168 | | 13.173 | .000 |
| | Frequency of Social Media Uses | .011 | .060 | .023 | .189 | .851 |
| | Duration of Social Media Uses | -.088 | .059 | -.171 | -1.489 | .140 |
| | Daily Social Media Uses | .048 | .035 | .150 | 1.365 | .175 |
| | Actively Social Media Uses | -.015 | .054 | -.030 | -.286 | .776 |

a. Dependent Variable: Variable of Self Identity

If the value of X rises by one unit, then Y will increase the value. The variable of self-identity will increase by 1.1% if you frequently use social media. It increases 8.8% if you use social media for a long time and it only increases 4.8% if you use it every day. However, it will decrease 1.5% if you actively use social media. The research results shows that all the variables do not significantly affect the Y variable.

Table 1.8. Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1 | .116 ^a | .014 | -.027 | .501 |

a. Predictors: (Constant), Actively Social Media Uses, Daily Social Media Uses, Duration of Social Media Uses, Frequency of Social Media Uses

The significance level was 0.501, and it was above 0.05. Therefore, the variable, i.e. the influence of social media uses was not significant and it only contributed 0.14% to the development of self-concept, the remaining ones (99%) got influence from other factors and it was not examined in the research.

Table 1.9. ANOVA^a

| Model | Sum of Squares | df | Mean Square | F | Sig. | |
|-------|----------------|--------|-------------|------|------|-------------------|
| 1 | Regression | .333 | 4 | .083 | .332 | .856 ^b |
| | Residual | 24.333 | 97 | .251 | | |
| | Total | 24.667 | 101 | | | |

a. Dependent Variable: Variable of Self Concept

b. Predictors: (Constant), Actively Social Media Uses, Daily Social Media Uses, Duration of Social Media Uses, Frequency of Social Media Uses

Based on the table at above it showed that the value of F count was 0.332 and the significance level to test the hypothesis was 0.05. We saw the significance level of 0.856. This meant that the value was above 0.05, and therefore, the effect of social media uses did not significantly influence the development of self-concept. Therefore, Ho is accepted and Ha is rejected.

Table 1.10. Coefficients^a

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|-------|--------------------------------|-----------------------------|------------|---------------------------|--------|------|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 2.214 | .219 | | 10.103 | .000 |
| | Frequency of Social Media Uses | .068 | .078 | .106 | .871 | .386 |
| | Duration of Social Media Uses | -.016 | .077 | -.023 | -.201 | .841 |
| | Daily Social Media Uses | -.022 | .045 | -.054 | -.485 | .629 |

| | | | | | |
|----------------------------|------|------|------|------|------|
| Actively Social Media Uses | .032 | .070 | .049 | .461 | .646 |
|----------------------------|------|------|------|------|------|

a. Dependent Variable: The Variable of Self Concept

If the value of X increases by one unit, then Y will increase the value. The variable of self-identity will increase by 0.68% if you frequently use social media. It decreases by 0.16% if you use social media for a long time. Moreover, it decreases by 0.22% if you use social media every day. Finally, it will increase 0.32% if you actively use social media. Therefore, the research results indicate that all the variables do not significantly affect the Y variable.

The development of self-identity and self-concept among State High Vocational School students SMKN I Bayah did not get influence from social media uses. The students still carried out their activities despite there was lack of social media use. When studying at school, their handphones are collected. Therefore, they could not use their handphones in class or during school hours. Moreover, they could not use social media as well. The condition made them less active in social media uses.

It was in appropriate to Putro's research. The research states that social media uses closely relate to mood, the uses of a pseudonym and no sense of responsibility concerning what they have uploaded (Putro, *Perilaku Penggunaan Media Sosial dan Identitas Diri (Studi Deskriptif Kualitatif tentang Perilaku Penggunaan Media sosial dan IDentitas Diri di Kalangan Mahasiswa S1 Jurusan Komunikasi Universitas Slamet Riyadi Surakarta)*, 2018); From another research conducted by Sakti and Yulianto, social media use gets influence from thoughts, experience and society; therefore, it does not only relate to the pattern of social media use (Sakti & Yulianto, 2018).

The contribution of social media usage to identity development is very low. This is because what influences the development of identity and self-concept is message content that exist on social media rather than on the pattern of social media use or exposure. This is in accordance with Ayun's research (Ayun, 2015). However, it differs from the research of Felita and his colleagues who state that social media is a place to display their ideal self-image despite it is not in accordance with their real self-concept they have had (Felita, Siahaja, Wijaya, & Melisa, *pemakaian Media Sosial dan Self Concept pada Remaja*, 2016).

IV. CONCLUSION

The first hypothesis that social media uses influence the self-identity development is not proven. This can be seen from the value produced by the F-count value is 0.950 and the significant level to test the hypothesis is 0.05. It is shown that the significance level is 0.439. It means that the value is above 0.05 and therefore, social media uses has no significant effect on the self-identity formation. As a results, the null hypothesis (Ho) is accepted and Ha is rejected. Therefore, there is no influence between the pattern of social media uses and the self-identify development of students of High Vocational School (SMKN) I Bayah, Lebak Banten.

The second hypothesis shows that the pattern of social media uses influences the self-concept development. This can be seen in the number produced by the F count value is 0.332 and a significance level to test the hypothesis is 0.05. Viewed from the significance level, it indicates 0.856. This means that the value is above 0.05, and therefore, the effect of social media uses does not significantly influence the self-concept development. Therefore, Ho is accepted and Ha is rejected. Moreover, there is no influence between the patterns of social media uses and the self-concept development among high vocational school students SMK I Bayah, Lebak Banten. Suggestions for further researches in future relate to the influence of social media content on the development of individual identity and self-concept.

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Some Partial Differential Equations In \mathbb{R}^n

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Abstract- In this paper, the initial-value problems are studied and solved for homogeneous and non-homogeneous transport equations. Moreover, the fundamental solution and mean value theorem are used to derive Laplace's equation. Finally, general solution of one-dimensional wave equation is established to apply d'Alembert's formula.

Index Terms- homogeneous transport, non-homogeneous transport, Laplace equation, Wave equation, d'Alembert's formula

I. INTRODUCTION

A partial differential equation (PDE) is an equation involving an unknown function of two or more variables and certain of its partial derivatives.

Using the notation explained in a typical PDE, fix an integer $k \geq 1$ and let U denote an open subset of \mathbb{R}^n .

An expression of the form

$$F(D^k u(x), D^{k-1} u(x), \dots, Du(x), u(x), x) = 0 \quad (x \in U)$$

is called a k order partial differential equation, where

$$F: \mathbb{R}^{n^k} \times \mathbb{R}^{n^{k-1}} \times \dots \times \mathbb{R}^n \times \mathbb{R} \times U \rightarrow \mathbb{R}$$

In this paper, three fundamental linear partial differential equations for which various explicit formulas for solutions are available. These are

the transport equation $u_t + b \cdot Du = 0$

Laplace's equation $\Delta u = 0$

the wave equation $u_{tt} - \Delta u = 0$

The geometric notations are that

(i) A point in \mathbb{R}^{n+1} will often be denoted as $(x, t) = (x_1, \dots, x_n, t)$, and we usually interpret $t = x_{n+1}$ as time.

A point $x \in \mathbb{R}^n$ will sometimes be written $x = (x', x_n)$ for $x' = (x_1, \dots, x_{n-1}) \in \mathbb{R}^{n-1}$

(ii) U, V and W usually denote open subsets of \mathbb{R}^n . We write $V \subset\subset U$ if $V \subset \bar{V} \subset U$, \bar{V} is compact, and say V is compactly contained in U .

(iii) $\partial U =$ boundary of U ,

$$\bar{U} = U \cup \partial U \text{ closure of } U.$$

(iv) $U_T = U \times (0, T)$

(v) $B^0 = \{y \in \mathbb{R}^n \mid |x - y| < r\}$ = open ball with center x and radius $r > 0$.

(vi) $B(x, r) =$ closed ball with center x and radius $r > 0$.

(vii) $\alpha(n) =$ volume of unit ball $B(0, 1)$ in \mathbb{R}^n

$$= \frac{\pi^{\frac{n}{2}}}{\Gamma(\frac{n}{2}+1)} \text{ where } \Gamma(x) = \int_0^\infty t^{x-1} e^{-t} dt$$

$\alpha(n) =$ surface area of unit sphere $\partial B(0, 1)$ in \mathbb{R}^n

(viii) If $a = (a_1, \dots, a_n)$ and $b = (b_1, \dots, b_n)$ belong to \mathbb{R}^n

$$a \cdot b = \sum_{i=1}^n a_i b_i, |a| = (\sum_{i=1}^n a_i^2)^{\frac{1}{2}}, |b| = (\sum_{i=1}^n b_i^2)^{\frac{1}{2}}$$

The notations of functions are that

(i) If $u: U \rightarrow \mathbb{R}$ we write

$$u(x) = (u^1(x), \dots, u^m(x)) \quad (x \in U)$$

we say u is smooth provided u is infinitely differentiable.

(ii) If u, v are two functions, we write $u \equiv v$ to mean that u is identically equal to v ; that is, the functions u, v agree for all values of their arguments. We use the notation

$$u := v \text{ to define } u \text{ as equaling } v.$$

(iii) If $u: U \rightarrow \mathbb{R}$ we write

$$u(x) = (u^1(x), \dots, u^m(x)) \quad (x \in U)$$

The function u^k is the k th component to u , $k = 1, \dots, m$.

(iv) Averages:

$$\int_{B(x,r)} f dy = \frac{1}{\alpha(n)r^n} \int_{B(x,r)} f dy = \text{average of } f \text{ over}$$

the ball $B(x, r)$

and

$$\int_{\partial B(x,r)} f dS := \frac{1}{n\alpha(n)r^{n-1}} \int_{\partial B(x,r)} f dS = \text{average of } f \text{ over the sphere } \partial B(x, r).$$

Then, the partial differential equations are used to solve the transport equation, Laplace's equation and the wave equation for initial value problems.

II. TRANSPORT EQUATION

One of the simplest partial differential equations is the transport equation with constant coefficients. This is the PDE

$$u_t + b \cdot Du = 0 \text{ in } \mathbb{R}^n \times (0, \infty) \quad (1)$$

where b is a fixed vector in \mathbb{R}^n , $b = (b_1, \dots, b_n)$ and $u: \mathbb{R}^n \times [0, \infty) \rightarrow \mathbb{R}$ is the unknown, $u = u(x, t)$. Here $x = (x_1, \dots, x_n) \in \mathbb{R}^n$

denotes a typical point in space, and $t \geq 0$ denotes a typical time. We write $Du = D_x u = (u_{x_1}, \dots, u_{x_n})$ for the gradient of u with respect to spatial variables x .

For any point $(x, t) \in \mathbb{R}^n \times (0, \infty)$ we define

$$z(s) := u(x + sb, t + s) \quad (s \in \mathbb{R})$$

We then calculate

$z(s) = Du(x + sb, t + s).b + u_t(x + sb, t + s) = 0$
 the second equality holding owing to (1). Thus $z(\cdot)$ is a constant function of s , and consequently for each point (x, t) , u is constant

on the line through (x, t) with the direction $(b, 1) \in \mathbb{R}^{n+1}$. Hence if we know the value of u at any point on each such line, know its value everywhere in $\mathbb{R}^n \times (0, \infty)$

III. INITIAL VALUE PROBLEM AND NONHOMOGENEOUS PROBLEM OF SOME PARTIAL DIFFERENT EQUATIONS

Now it is the time to articulate the research work with ideas gathered in above steps by adopting any of below suitable approaches:

A. Initial Value Problem

We consider the initial-value problem

$$\left. \begin{aligned} u_t + b.Du &= 0 \text{ in } \mathbb{R}^n \times (0, \infty) \\ u &= g \text{ on } \mathbb{R}^n \times (0, \infty) \end{aligned} \right\} \quad (2)$$

Here $b \in \mathbb{R}^n$ and $g: \mathbb{R}^n \rightarrow \mathbb{R}$ are known, and the problem is to compute u . Given (x, t) as above, the line through (x, t) with direction $(b, 1)$ is represented parametrically by $(x + sb, t + s)$ ($s \in \mathbb{R}$). This line hits the plane $\Gamma := \mathbb{R}^n \times \{t = 0\}$ when $s = -t$, at the point $(x - tb, 0)$. Since u is constant on the line and $u(x - tb, 0) = g(x - tb)$, we deduce

$$u(x, t) = g(x - tb) \quad (x \in \mathbb{R}^n, t \geq 0) \quad (3)$$

So, if (2) has a sufficiently regular solution u , it must certainly be given by (3). And conversely, it is easy to check directly that if g is C^1 then u defined by (3) is indeed a solution of (2).

B. Nonhomogeneous Problem

Next we consider the associated nonhomogeneous problem

$$\left. \begin{aligned} u_t + b.Du &= 0 \text{ in } \mathbb{R}^n \times (0, \infty) \\ u &= g \text{ on } \mathbb{R}^n \times (0, \infty) \end{aligned} \right\} \quad (4)$$

As before fix $(x, t) \in \mathbb{R}^{n+1}$ and, inspired by the calculation above, set $z(s) := u(x + sb, t + s)$ for $s \in \mathbb{R}$. Then

$$z(s) = Du(x + sb, t + s).b + u_t(x + sb, t + s) = f(x + sb, t + s)$$

Consequently

$$\begin{aligned} u(x, t) - g(x - tb) &= z(0) - z(-t) \\ &= \int_{-t}^0 z(s) ds \\ &= \int_{-t}^0 f(x + sb, t + s) ds \end{aligned}$$

By the change of variables $t + s = s_1$, we get

$$u(x, t) - g(x - tb) = \int_0^t f(x + (s - t)b, s_1) ds_1$$

$$u(x, t) - g(x - tb) = \int_0^t f(x + (s - t)b, s) ds$$

and so

$$u(x, t) = g(x - tb) + \int_0^t f(x + (s - t)b, s) ds$$

$$, (x \in \mathbb{R}^n, t \geq 0) \quad (5)$$

Among the most important of all partial differential equations are undoubtedly Laplace's equations

$$\Delta u = 0 \quad (6)$$

and Poisson's equation

$$-\Delta u = f. \quad (7)$$

In both (6) and (7), $x \in U$ and the unknown is $u: \bar{U} \rightarrow \mathbb{R}$ $u = u(x)$, where $U \subset \mathbb{R}^n$ is a given open set. In (7), the function $f: U \rightarrow \mathbb{R}$ is also given.

IV. DERIVATION OF SOLUTION FOR LAPLACE'S EQUATION AND WAVE EQUATION

Let u be a solution of Laplace's equation (6) in $U = U \subset \mathbb{R}^n$ of the form

$$u(x) = v(r),$$

where $r = |x| = (x_1^2 + \dots + x_n^2)^{\frac{1}{2}}$ and v is to be selected (if possible) so that $\Delta u = 0$ holds. First note for $i = 1, \dots, n$ that

$$\frac{\partial r}{\partial x_i} = \frac{1}{2} (x_1^2 + \dots + x_n^2)^{-\frac{1}{2}} \cdot 2x_i = \frac{x_i}{|x|} = \frac{x_i}{r}.$$

We thus have

$$u_{x_i} = \frac{\partial u}{\partial x_i} = \frac{dv}{dr} \cdot \frac{\partial r}{\partial x_i} = v'(r) \frac{x_i}{r},$$

$$\begin{aligned} u_{x_i x_i} &= v''(r) \left(\frac{x_i}{r}\right)^2 + \frac{v'(r)}{r} + v'(r) x_i \left(-\frac{1}{r^2}\right) \cdot \frac{x_i}{r} \\ &= v''(r) \frac{x_i^2}{r^2} + v'(r) \left(\frac{1}{r} - \frac{x_i^2}{r^3}\right), \end{aligned}$$

$$\sum_{i=1}^n u_{x_i x_i} = \sum_{i=1}^n v''(r) \frac{x_i^2}{r^2} + \sum_{i=1}^n v'(r) \left(\frac{1}{r} - \frac{x_i^2}{r^3} \right)$$

$$= \frac{v''(r)}{r^2} (x_1^2 + \dots + x_n^2) + \frac{v'(r)}{r} \cdot n - \frac{v'(r)}{r^3} (x_1^2 + \dots + x_n^2).$$

Hence
$$\Delta u = \frac{v''(r)}{r^2} \cdot r^2 + \frac{v'(r)}{r} \cdot n - \frac{v'(r)}{r^3} \cdot r^2$$

$$= v''(r) + \frac{v'(r)}{r} (n-1).$$

Since $\Delta u = 0$,

$$v''(r) + \frac{n-1}{r} v'(r) = 0, \tag{8}$$

$$v'' = \frac{1-n}{r} v',$$

$$\frac{v''}{v'} = \frac{1-n}{r}.$$

Integrating both sides,

$$\log |v'| = (1-n) \log r + \log a,$$

$$v' = ar^{1-n}.$$

If $n \geq 3$

$$v = a \frac{r^{2-n}}{2-n} + c$$

$$= \frac{a}{2-n} r^{2-n} + c$$

where $b = \frac{a}{2-n}$

If $n = 2$,

$$v'(r) = \frac{a}{r}$$

$$v = a \log r + c$$

$$v(r) = \begin{cases} a \log r + c & (n = 2) \\ \frac{b}{r^{n-2}} + c & (n \geq 3) \end{cases}$$

where b and c are constants.

The function is

$$\phi(x) = \begin{cases} -\frac{1}{2\pi} \log|x| & (n = 2) \\ \frac{1}{n(n-2)\alpha(n)|x|^{n-2}} & (n \geq 3) \end{cases} \tag{9}$$

that defined for $x \in \mathbb{R}^n, x \neq 0$, is the fundamental solution of Laplace's equations.

The wave equation is a simplified model for a vibrating string ($n = 1$), membrane ($n = 2$), or elastic solid ($n = 3$). In these physical interpretation $u(x, t)$ represents the displacement in some direction of the point x at time $t \geq 0$.

the wave equation is $u_{tt} - \Delta u = 0$, $\tag{10}$

and the nonhomogeneous wave equation is

$$u_{tt} - \Delta u = f \tag{11}$$

subject to appropriate initial and boundary conditions. Hence $t > 0$ and $x \in U$ where $U \subset \mathbb{R}^n$ is open. The unknown is $u: \bar{U} \times$

$[0, \infty) \rightarrow \mathbb{R}, u = u(x, t)$, and the Laplacian Δ is taken with respect to the spatial variables $x = (x_1, \dots, x_n)$. In (11) the function $f: U \times [0, \infty) \rightarrow \mathbb{R}$ is given.

Let V represent any smooth subregion of U . The acceleration within V is then

$$\frac{d^2}{dt^2} \int_V u dx = \int_V u_{tt} dx$$

and the net contact force is

$$- \int_{\partial V} \mathbf{F} \cdot \mathbf{v} dS,$$

where \mathbf{F} denotes the force acting on V through ∂V and the mass density is taken to be unity.

Newton's law asserts that the mass times the acceleration equals the net force:

$$\int_V u_{tt} dx = - \int_{\partial V} \mathbf{F} \cdot \mathbf{v} dS.$$

This identity obtains for each subregion V and so

$$u_{tt} = -\text{div } \mathbf{F}.$$

For elastic bodies, \mathbf{F} is a function of the displacement gradient Du , whence

$$u_{tt} + \text{div } \mathbf{F}(Du) = 0$$

for small Du , the linearization $\mathbf{F}(Du) \approx a Du$ is often appropriate; and so

$$u_{tt} - a \Delta u = 0.$$

This is the wave equation if $a = 1$.

This physical interpretation strongly suggests it will be mathematically appropriate to specify two initial conditions, on the displacement u and the velocity u_t , at time $t = 0$.

V. DERIVATION OF D'ALEMBERT'S FORMULA

We consider the initial-value problem for the one-dimensional wave equation in all of P :

$$\begin{cases} u_{tt} - u_{xx} = 0 & \text{in } \mathbb{R}^n \times (0, \infty) \\ u = g, u_t = h & \text{on } \mathbb{R}^n \times (0, \infty) \end{cases} \tag{12}$$

where g, h are given. We desire to derive a formula for u in terms of g and h .

Note that the PDE in (12) can be "factored" to read

$$\left(\frac{\partial}{\partial t} + \frac{\partial}{\partial x} \right) \left(\frac{\partial}{\partial t} - \frac{\partial}{\partial x} \right) u = 0. \tag{13}$$

Let

$$v(x, t) := \left(\frac{\partial}{\partial t} - \frac{\partial}{\partial x} \right) u(x, t). \tag{14}$$

Then (13) says

$$v_t(x, t) + v_x(x, t) = 0 \quad (x \in \mathbb{R}, t > 0)$$

This is a transport equation with constant coefficients. Applying formula (3) (with $n = 1, b = 1$), we find

$$v(x, t) = a(x - t) \tag{15}$$

for $a(x) := v(x, 0)$. Combining now (13) - (15), we obtain

$$u_t(x, t) - u_x(x, t) = a(x - t) \quad \text{in } \mathbb{R} \times (0, \infty)$$

This is a nonhomogeneous transport equation; and so formula (5) (with $n = 1$, $b = -1$, $f(x, t) = a(x - t)$) implies for $b(x); = u(x, 0)$ that

$$u(x, t) = \int_0^t a(x + (t-s) - s) ds + b(x + t) \\ = \frac{1}{2} \int_{x-t}^{x+t} a(y) dy + b(x + t). \tag{16}$$

We lastly invoke the initial conditions in (12) to compute a and b . The first initial condition in (12) gives

$$b(x) = g(x) \quad x \in \mathbb{R}$$

whereas the second initial condition and (26) imply

$$a(x) = v(x, 0) = u_t(x, 0) - u_x(x, 0) \\ = h(x) - g'(x) \quad (x \in \mathbb{R})$$

Our substituting into (16) now yields

$$u(x, t) = \frac{1}{2} \int_{x-t}^{x+t} h(y) - g'(y) dy + g(x + t).$$

Hence

$$u(x, t) = \frac{1}{2} [g(x + t) + g(x - t)] + \frac{1}{2} \int_{x-t}^{x+t} h(y) dy, \\ (x \in \mathbb{R}, t \geq 0) \tag{17}$$

This is d'Alembert's formula.

To solve the solution of wave equation for $n = 1$,

Assume $g \in C^2(\mathbb{R})$, $h \in C^1(\mathbb{R})$ and define u by d'Alembert's formula. Then

(i) $u \in C^2(\mathbb{R} \times [0, \infty))$

(ii) $u_{tt} - u_{xx} = 0$ in $\mathbb{R} \times (0, \infty)$ and

$$\lim_{(x,t) \rightarrow (x^0, 0), t > 0} u(x, t) = g(x^0), \quad \lim_{(x,t) \rightarrow (x^0, 0), t > 0} u_t(x, t) = h(x^0),$$

(iii) for each point $x^0 \in \mathbb{R}$

The proof is

We have

$$u(x, t) = \frac{1}{2} [g(x + t) + g(x - t)] + \frac{1}{2} \int_{x-t}^{x+t} h(y) dy \\ (x \in \mathbb{R}, t \geq 0) \tag{18}$$

since $g \in C^2(\mathbb{R})$, $h \in C^1(\mathbb{R})$, $u \in C^2(\mathbb{R} \times [0, \infty))$.

Next, we differentiate (18) with respect to x , we get

$$u_x = \frac{1}{2} [g'(x + t) + g'(x - t)] + \frac{1}{2} [h(x + t) - h(x - t)].$$

Again,

$$u_{xx} = \frac{1}{2} [g''(x + t) + g''(x - t)] + \frac{1}{2} [h'(x + t) - h'(x - t)]. \tag{19}$$

In addition, we differentiate (18) with respect to t , we get

$$u_t = \frac{1}{2} [g'(x + t) - g'(x - t)] + \frac{1}{2} [h(x + t) + h(x - t)]. \tag{20}$$

Again,

$$u_{tt} = \frac{1}{2} [g''(x + t) + g''(x - t)] + \frac{1}{2} [h'(x + t) - h'(x - t)]. \tag{21}$$

So, we get

$$u_{tt} - u_{xx} = 0.$$

Finally, we get

$$\lim_{(x,t) \rightarrow (x^0, 0)} u(x, t) = u(x^0, 0) = \frac{1}{2} [2g(x^0)] = g(x^0).$$

Then, from (20),

$$\lim_{\substack{(x,t) \rightarrow (x^0, 0) \\ t > 0}} u_t(x, t) = u_t(x^0, 0)$$

$$= \frac{1}{2} [g'(x^0) - g'(x^0)] + \frac{1}{2} [h(x^0) + h(x^0)] = h(x^0).$$

VI. CONCLUSION

This paper contains a brief summary of the work done and some recommendations for future research directions. These some partial differential equations are based on the computation of inequalities and integration. Some of the application areas include these equations such as Laplace's equation, Wave equation.

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Impact of *Trianthema portulacastrum linn* (*saravallai*) incorporated dhal powder on the blood iron status of anemic adolescent girls

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Abstract- Introduction: Adolescence is considered as a nutritionally critical period of life. Anemia is the most prevalent nutritional problem worldwide and it is mainly caused due to iron deficiency. India has the world's highest prevalence of iron deficiency anemia among women, with 60 to 70 percent of the adolescent girls being anemic. *Trianthema portulacastrum Linn* is a herb used in ayurvedic medicine. Different parts of *Trianthema portulacastrum Linn*, are traditionally used as analgesic, stomachic, laxative, treatment of blood disease, anemia, inflammation, and night blindness. **Objective:** To assess the efficacy of "Saravallai dhal powder" (*Trianthema portulacastrum linn*) in improving the blood iron profile of anemic adolescent girls. **Materials and Methods:** Saravallai dhal powder (SDP) was prepared from *Trianthema portulacastrum Linn* (Saravallai leaf Powder" and dhal powder (Bengal gram, Roasted Bengal gram, Black gram and Groundnut (1:1:1:1) were mixed in 1:1 proportion. Energy (Computed), moisture, ash, fiber, carbohydrate (difference method), protein, iron, and calcium were estimated in triplicates. Initially blood hemoglobin was estimated for one hundred girls. Eighty anemic adolescent volunteers were chosen out of hundred (control group n=40 and experimental group n=40) and 20g of saravallai dhal powder (SDP) was supplemented to the experimental group for 90 days. **Result:** The SDP contained energy (1885.47±74.39kJ), carbohydrate (58.89±2.21g%), protein(23.74±0.53g), fat(7.94±2.52g%), crude fiber 18.6±0.52g%), ash (12.3g±0.2g), calcium (589.33±8.14mg), iron(30.13±2.40mg), Zinc (0.9±0.10mg), carotene (544.66±28.30µg), thiamine and riboflavin (0.32±0.02mg, 0.1±0.02mg). The girls' blood iron parameters(Hb(12.92±1.24),RBCcount(4.30±0.41),PCV(38.77±3.74),SI(65.67±32.62),TIBC(391±45.39), Transferrin Saturation(20.9±7.60) and SF(30.45±14.99)) improved considerably after supplementation. **Conclusion:** Saravallai (*Trianthema portulacastrum Linn*) dhal Powder improves blood iron parameters. T. portulacastrum has been proved to possess strong anthelmintic activity in vivo. The beneficial effects of this underutilized green to tackle anemia, at a much lower cost without any side effects.

I. INTRODUCTION

Adolescent girls are at a high risk for anemia and malnutrition. According to WHO adolescent age group is between 10-19

years (Siva *et al*,2016)¹.Inadequate nutrition during adolescent can have serious consequences throughout the reproductive years of life and beyond. Anemia is the most prevalent nutritional problem worldwide and it is mainly caused due to iron deficiency. Although it involves all age groups and sex, the adolescent girls are more vulnerable to it. The pre-pregnancy anemic status of adolescent girls is crucial as it has long term intergenerational consequences

In 2008 WHO reported that 24.8% of the world's population is affected by anemia, of whom 42% were pregnant women, 30% non-pregnant women, and 47% were preschool children. A 2011 WHO study estimated global anemia prevalence to be 496 million of non-pregnant women and 32.4 million of pregnant women aged 15 - 49 years (WHO 2014)².

In India the prevalence of anemia among adolescent girls were 56 percent (Aguayo *et al* 2013)³ and according to Lancet Global Health (2013)⁴ 29 and 38 percent of non-pregnant and pregnant women aged 15–49 years are anemic due to increased iron demand, menstrual blood loss, infection, worm infection etc (Kumari *et al* 2017)⁵.Even a much earlier study by ICMR (District Nutrition Project) in 16 districts of 11 states, on prevalence of anemia in non-pregnant adolescent girls (11-18 years) showed rates as high as 90.1 percent with severe anemia (Hb<7 g/dl) in 7.1 percent (Teoteja and Singh, 2002)⁶.Rajaratnam *et al.*, (2002)⁷ had opined that anemia among rural girls of Tamilnadu is also high as in other parts of the county.

Hence it is imperative to plan intervention programs that would increase the blood iron status among adolescent girls through various programs. While Long term approaches include dietary improvement for increasing the iron content of the diet by including iron-rich foods such as green leafy vegetables (GLVs), and cooking in iron pots; **enhancing iron bio-availability** in the existing diets by including foods rich in iron absorption promoters such as ascorbic acid and animal foods such as fish and meat; **promotion of home/kitchen gardening** to increase the availability of common iron rich food such as green leafy vegetables and increasing iron intake through **fortification** The Short term approaches are direct **supplementation** either weekly or daily. Side effects associated with the allopathic drugs and the resultant chemophobia have prompted research into traditional health care system throughout the world (Fulzele *et al.*, 2002)⁸. World Health Organization (WHO) has recommended the use of traditional health and folk medicine systems as they are

proved to be more effective in correcting the health problems hence worldwide a renewed interest is seen in tapping the traditional and easily feasible strategies to prevent anemia.

Rationale: Different parts of *Trianthema portulacastrum* Linn, (*Saravallai*) are traditionally used as analgesic, stomachic, laxative, and for treatment of blood disease. This study with the indigenous green leafy vegetable will help to reaffirm the beneficial effects of the underutilized greens to tackle anemia which is one of the major public health problems of our country, at a much lower cost without any side effects.

Objectives:

- To estimate the nutrients present in the newly developed “*Saravallai* (*Trianthema portulacastrum* linn) dhal powder”
- To assess the efficacy of “*Saravallai* dhal powder” (*Trianthema portulacastrum* linn) in improving the blood iron profile of anemic adolescents.

II. MATERIALS AND METHODS

The study was conducted in two phases and Phase I consisted of formulation of “*Saravallai* Dhal Powder” (SDP) and Phase II was on the impact of SDP on the blood parameters of the anemic volunteers

Phase I

(i) Preparation of *saravallai* powder

Trianthema portulacastrum Linn (*Saravallai*) the red colored form (*Lal Sabuni*), a deep rooted perennial spreading leaves found as a weed in abundance in rural area of *Dharmapuri* district were chosen. Fresh, healthy and disease free *saravallai* greens were collected. They were identified and authenticated by the taxonomist at the Department of Botany, PSG College of Arts and Science, Coimbatore, India. The selected under-utilized plant (*Saravallai*) were weighed, cleaned and washed with sufficient water to remove foreign organic matter. The leaves of *saravallai* were completely dried in shade, pulverized in a mixer grinder, sieved (using 60 mesh) repeatedly to get a free flowing fine powder, packed in HDPE covers and stored in air tight containers so as to retain its potency and to prevent moisture entry.

(ii) Preparation of dhal powder

Bengal gram dhal, Roasted Bengal gram dhal, Black gram dhal and Groundnut (dehusked) were cleaned ones and roasted for five to seven minutes at medium heat (70°C). All the above items were ground separately in a (butterfly brand) blender to get a coarse textured powder then they were mixed in a 1:1:1:1 proportion and stored in HDPE covers and kept in air tight container.

(iii) Formulation of *saravallai* dhal powder and sensory evaluation

The “*saravallai* leaves powder” and the “dhal powder” were mixed in 1:1 proportions to formulate *Saravallai* dhal powder (SDP). Organoleptic evaluation of the SDP was carried out using a score card developed exclusively for this purpose with the help of taste panel members. The panelist indicated their preferences on a five point hedonic scale for each of the sensory attributes.

The “*saravallai* dhal powder” was estimated in triplicates for mineral and vitamin content as per the standard Association of Official Analytical Chemists (AOAC) methods. The actual amount of iron that is available to the body from the *Saravallai* Dhal Powder was estimated in the laboratory in duplicates using the “Invitro iron availability” procedure of Rao and Prabhavathi (1978)⁹ and Govindaraj *et al.*, (2007)¹⁰ as “Bioaccessibility” (or biological availability) is defined as the proportion of nutrient in the food that can be absorbed and utilized and is the key to nutrient effectiveness.

Phase II

Islamiah Women’s Arts and Science College, Vaniyambadi in Vellore district was chosen for conducting the study. This area was selected because the entire sample could be obtained with fewer variations in the social, economic, cultural aspects and also food habits **One hundred** girls volunteered for the study. The study participants were informed about the study knew the composition of the products and participated voluntarily. The Ethical clearance certificate was forwarded by Medical Joint Director, Vellore, and approved by Chief Medical officer at Vaniyambadi Government Hospital, Vellore district, Tamil Nadu, India. Initially blood hemoglobin was estimated for all the **one hundred girls** who were willing to undergo blood test and eat *saravallai* dhal powder continuously for 90 days. Blood was drawn using hygienic disposal syringes and transferred to the tubes that contained the anticoagulants and transported to the laboratory in cold condition for the determination of hematological parameters. Among them (n=40) who had hemoglobin above 12g percent were designated as control group. Girls whose hemoglobin below 12g percent (n=40) were considered as anemic as per WHO (2001)¹¹ guidelines and designated as experimental group. Twenty girls were omitted from the study, because some of them did not want any more blood test to be done and few others had minor illness such as fever, and still a few others were not willing to eat *saravallai* dhal powder.

Dietary intake data was collected from all the volunteers (n=80 by Twenty four hour diet recall. For determining the quantities standard cups and spoons were used. The food intake of the respondents for three consecutive work days was recorded and their nutrient intake was computed of using the nutrient content of foods as given by Rao *et al.*, (2010)¹² after calculating the raw equivalents. The difference between the actual mean iron intake of the selected girls and the ICMR dietary recommendation (2010)¹³ for iron was calculated. The quantity of *saravallai* dhal powder that could be consumed per day by the adolescents was ascertained. Based on these two criteria twenty grams *saravallai* dhal powder was packed in separate HDPE covers and supplied to the experimental group (n=40) volunteers every day. They were instructed to consume the same at lunch time with a glass of water. They were requested to avoid drinking coffee or tea immediately after consuming *saravallai* dhal powder. The supplementation was carried out for a period of 90 days immediately after anthelmintic therapy with 400 mg single-dose of albendazole as per the advice of the medical practitioner since anthelmintic therapy combined with iron supplementation enhances Hb response to iron supplementation (Stoltzfus and Dreyfus, 1997)¹⁴. The blood analysis was done before and at the end of the supplementation

period. The control group girls were instructed to follow their regular diet without skipping.

Hemoglobin percentage, red blood corpuscle count and packed cell volume were done for the eighty sub-sample. From this eighty sample a further smaller sample of ten each from Control and Experimental group were drawn and their serum iron, serum total iron binding capacity, Transferrin saturation and serum ferritin were estimated due to high cost of these tests.

III. RESULTS AND DISCUSSION

The total mineral quantity, (Table-I) expressed as ash content was 12.3 ± 0.2 g percent in the SDP. While Agashe et al., (2015)¹⁵ and Hussain et al., (2010)¹⁶ had reported an ash value of 13.0 and 10.15 ± 0.6 g percent in *Trianthema portulacastrum* (*saravallai*) on dry weight basis, Gupta et al., (2004)¹⁷ found an ash value of 2.29g in fresh leaves. The SDP value also near the former quoted value

Table-I
Mineral and vitamin content of saravallai dhal powder

| Nutrients | Mean | Standard Deviation |
|------------------|--------|--------------------|
| Ash(g) | 12.3 | 0.2 |
| Calcium(mg) | 589.33 | 8.14 |
| Iron(mg) | 30.13 | 2.40 |
| Zinc(mg) | 0.90 | 0.10 |
| Magnesium(mg) | 112.00 | 5.29 |
| β -carotene (μg) | 544.66 | 28.30 |
| Thiamine(mg) | 0.32 | 0.02 |
| Riboflavin(mg) | 0.10 | 0.02 |
| Vitamin-C(mg) | 29.38 | 1.19 |

The **calcium** content of *Saravallai* Dhal Powder was high at 589.33 ± 8.14 mg percent. Whereas Shivhare et al., (2012)¹⁸, Hussain et al., (2010) and Gupta et al., (2004) reported a much lower value of calcium (0.3mg percent (fresh) 311ppm (dry) and 52mg/100g (fresh) in *Trianthema portulacastrum* leaves respectively.

The **iron** content of *Saravallai* dhal powder was 30.13 ± 2.40 mg percent. Patricia et al., (2014)¹⁹, Khan et al., (2013)²⁰, Shivhare et al., (2012)²¹, Hussain et al., (2010) and Gooneratne and Kumarapperuma (2004)²², Gupta et al., (2004) reported a value of 30.87 ± 0.16 (Hibiscus sabdariffa), 45.80 ± 0.01 mg (Vigna unguiculata), (6.44 ± 0.4) mg/100g (*Trianthema portulacastrum* - dry leaves), 50 ppm (*T.portulacastrum* -fresh leaves), 1185ppm (*T.portulacastrum*-dry leaves) 6.7 ± 1.5 mg/100g (*T.portulacastrum* -fresh leaves), and 4.16 mg/100g (fresh *Trianthema portulacastrum* leaves) respectively.

The dry powder of SDP (*T.portulacastrum*) contained 0.9 ± 0.10 mg percent of **zinc**. Khan et al., (2013), Shivhare et al., (2012), and Gupta et al., (2004) reported a much lower value of 0.20 ± 0.02 , 30.0ppm and 0.46 mg/100g zinc from their study on *T.portulacastrum* (*Bishkhapra*). The *saravallai* dhal powder prepared for the current investigation had 112.00 ± 5.29 mg percent of **magnesium**. Shivhare et al., (2012) and Gooneratne and Kumarapperuma (2004) reported a value of 0.2 percent (Dry powder) and 153mg/100g (fresh) magnesium in *Trianthema portulacastrum* While the former value is lower than the present finding, the latter reported value is higher.

The vitamin **β-carotene**, content was 544.66 ± 28.30 μg percent in the SDP. The values quoted by Khan et al., (2015) Shivhare et al., (2012), Gooneratne and Kumarapperuma (2004)

and Gupta et al., (2004) for β-carotene, 0.81mg/g, 2.3, 4.0 and 4.0mg/100g respectively are higher than the present finding.

Thiamine and riboflavin content of the *Saravallai* Dhal Powder were 0.32 ± 0.02 mg and 0.1 ± 0.02 mg. While Gupta et al., (2004) reported lower thiamin (0.1mg percent) content (*T. portulacastrum*-fresh leaves), Khan et al., (2013) reported a higher value for riboflavin (2.02mg/g) for the same *T. portulacastrum*. Ascorbic acid content of the *Saravallai* dhal Powder of the current investigation was 29.38 ± 1.19 mg.

The contaminant **lead** and anti-nutrient factors such as **phytic acid and oxalates** were 0.21 ± 0.01 , 1.08 ± 0.05 and 1.43 ± 0.13 mg percent in the prepared *saravallai* dhal powder.

A **phytate** content of 17.25 ± 0.00 (Vigna unguiculata) to 86.45 ± 0.10 (Hibiscus sabdariffa) and 2.02mg percent (*Trianthema portulacastrum*) was observed by Patricia et al., (2014) and Gupta et al., (2004). Udusoro, Ekop and Udo (2013)²³, reported the phytate content in untreated *Gongronema latifolium* (*Utazi* leaf), *Vermonia amygdalina* (Bitter leaf), *Ocimum canum sims* (Curry leaf), *Heinsia crinata* (Bush apple leaf) and *Talinum triangulare* (Waterleaf) grown in Nigeria as 40.01, 33.34, 41.27, 41.91 and 43.81mg/100g. However these values are higher than the SDP value. According to Patricia et al., (2014) the oxalate content ranged from 780.00 ± 0.00 (*Amaranthus hybridus*) to 1310 ± 78.00 mg (Hibiscus sabdariffa) percent, but Naik, Jammuna and Nayak (2013)²⁴ quoted only 40.5mg percent of oxalate in *Peucedanum graveolens*. While Pattan and Usha devi (2011)²⁵ reported 45 (*Gynandropsis pentaphylla*) to 275mg (*Brassica oleracea*) percent of oxalate, Joshi Mathur (2010)²⁶ had reported an oxalate content of 9.49 ± 0.14 (Beet greens), 0.56 ± 0.22 (Carrot greens), 0.32 ± 0.84

(Cauliflower greens) and 2.26 ± 0.06 mg (Turnip greens) percent. Udousoro, Ekop and Udo(2013), reported the oxalate content in untreated *Gongronema latifolium* (Utazi leaf), *Vermonia amygdalina* (Bitter leaf), *Ocimum canum sims* (Curry leaf), *Heinsia crinata* (Bush apple leaf) and *Talinum triangulare* (Waterleaf) grown in Nigeria as 132.00, 246.40, 246.40, 193.60 and 184.80mg/100g respectively. While some of these values are above the present finding in *Saravallai* Dhal Powder, some others are lower.

(i) Bio accessible iron

Bioavailability (or biological availability) is the key to “nutrient effectiveness”. This is defined as the proportion of the nutrient in food that can be utilized and absorbed (Ballot *et al.*, 1987)²⁷ and Gilloly *et al.*, 1983)²⁸.

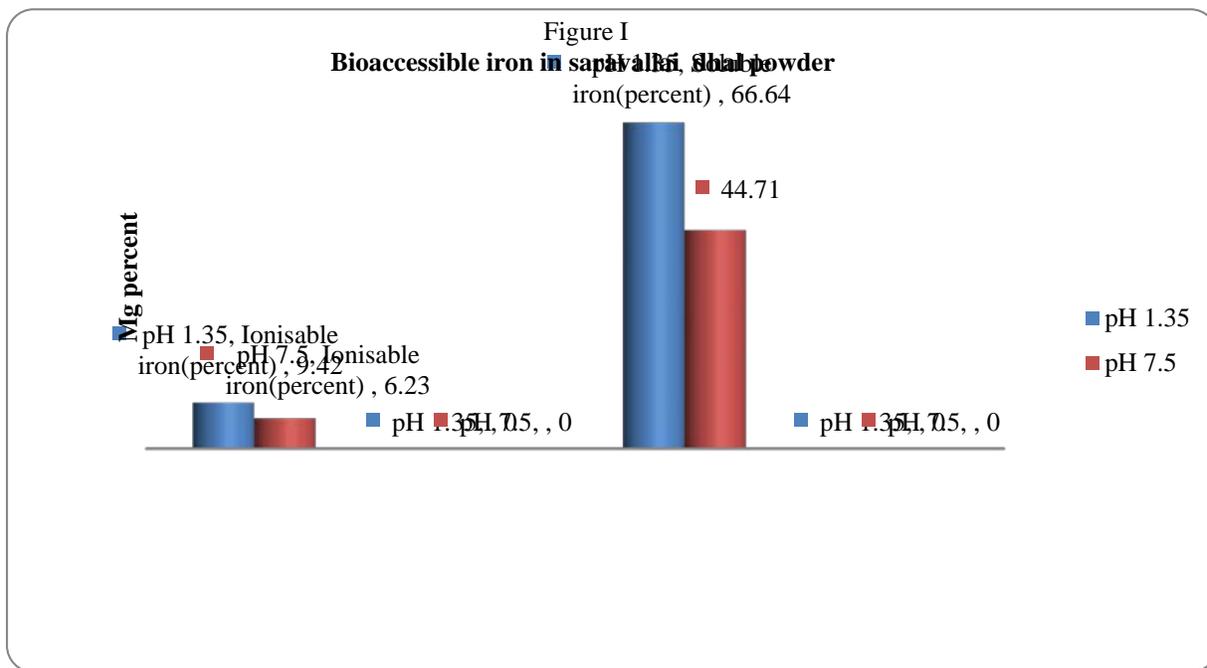
The total iron content of *saravallai* dhal powder was 30.13 ± 2.40 mg/100g.

It could be observed from (Figure I) that ionisable iron is considerably lower than the soluble iron at both the pH i.e. 1.35

and 7.5. The percentage of Ionizable (9.42) and soluble (66.64) iron at acidic pH (pH 1.35) were better than the percentage of ionisable iron (6.23) and soluble (44.71) at alkaline pH (pH 7.5), hence the Ionizable iron at pH 1.35 was 2.84 ± 0.0 and it was 1.88 ± 0.0 mg/100g at pH 7.5. The soluble iron was 20.08 ± 0.0 and 13.47 ± 0.0 mg/100g at pH 1.35 and pH 7.5.

According to Rao and Prabhavathi (1978) the Ionizable and soluble iron at pH 7.5 can be directly correlated with percent in-vivo iron absorption and the highest correlation with physiological availability in humans could be observed with ionisable iron at pH 7.5.

It is clear from the foregoing discussions that the experimental group girls’ intake of nutrients at the baseline survey was highly inadequate. To bridge the gap between inadequate intake, they were supplemented with 20 grams of *saravallai* dhal powder. After supplementation their intake of nutrients improved considerably.



(ii) Blood iron status of the selected girls

(i) Hemoglobin

Hemoglobin is the conjugated protein containing four heme groups and is the oxygen carrying pigment of erythrocytes. It is evident from the table- II that the control group girls’ (who did not receive any supplementation) Hemoglobin showed not much of a change and it remained at 12.1 ± 0.16 g percent, whereas the

Table II
Mean blood iron parameters of selected sub-samples

| Blood parameters | Normal values | Control group n=40 | | | Experimental group n=40 | | |
|-------------------------------------|---------------|-----------------------|------------------|----------|----------------------------|-----------------|----------|
| | | Mean±SD | | | | | |
| | | SV | EV | P values | BS | AS | P values |
| Hemoglobin (g percent) | 11.7-15.5* | 12.21 ±0.02 | 12.1 ±0.16 | 0.0007 | 10.44 ±1.52 | 12.92 ±1.24 | 0.0001 |
| Red blood corpuscle count (mc/cumm) | 4.2 - 5.4** | 4.07 ±0.06 | 4.03 ±0.05 | 0.0008 | 3.51 ±0.54 | 4.30 ±0.41 | 0.0001 |
| Packed cell volume (percent) | 35-45* | 36.63 ±0.61 | 36.3 ±0.48 | 0.0007 | 31.62 ±4.86 | 38.77 ±3.74 | 0.0001 |
| | | Control group n=10 | | | Experimental group n=10 | | |
| Serum iron (µg/dl) | 50-170* | 27.65 ±0.47 | 27.39 ±0.46 | 0.0010 | 23.78 ±2.69 | 65.67 ±32.62 | 0.0025 |
| Total iron binding capacity (µg/dl) | 250-425* | 383.05 ±17.08 | 378.27 ±16.10 | 0.0006 | 459.10 ±47.94 | 391±45.39 | 0.0001 |
| Transferrin saturation (percent) | 15-50* | 25.20 ±0.79 | 25.30 ±1.16 | 0.8589 | 9.8 ±6.81 | 20.9 ±7.60 | 0.0005 |
| Serum ferritin (ng/ml) | 10-120** | 23.09 ±2.82 | 22.6 ±2.71 | 0.1668 | 10.68 ±9.29 | 30.45 ±14.99 | 0.0001 |

SV-Start Value EV-End value

BS-Before supplementation AS-After supplementation # Calculated values

*Burtis and Ashhood (2008)

**Srilakshmi (2014)

experimental group girls' Hemoglobin increased by 2.48 g percent and it was 12.92±1.24g percent at the end of 90 days supplementation of *saravallai* dhal powder. It could be observed that the mean hemoglobin of experimental group girls which was below the WHO (2001) standard of 12g percent for defining anemia before supplementation; improved and it came within the standard range after supplementation. While Lande's (2014)²⁹ spirulina incorporated chappati improved by 0.8 to 1.1 percent, Divya and Choudhary's (2014)³⁰ whey guava beverage also enhanced Hb (Before supplementation 9.50 to 10.24 and AS 11.06 to 11.42). Talha's (2014)³¹ millet mix-nurti dense biscuits to 11-13yrs anemic children (hb <11g/dl) increased the hemoglobin by 1.66g/dl and 0.7g/dl in moderate and mild anemia. Naik, Jamuna and Nayak (2013) reported in their study an increase in hemoglobin from 9.8 to 11.8g percent in the experimental group girls after feeding *shepu* greens incorporated product for 90 days. Apte, Jahagirdar and Chiplonkar(2006)³² investigated the effect of GLV as a natural fortificant of multiple micronutrients through a human trial and reported that three weeks' supplementation of GLV with more oil resulted in significant increase of plasma β-carotene (51percent) and Hemoglobin (nine percent) and they concluded that using 100 g GLV/day with 10 g oil could be a single moderate strategy for supplementation of iron, β-carotene, ascorbic acid and zinc. . In the present study the Hemoglobin (AS) of experimental group girls was weakly positively correlated (r = 0.20) with iron intake.

(ii) Red Blood Corpuscle Count

The **erythrocyte count** of the control group girls was almost same from the start date (4.07mc/cumm±0.06) till the study completion date (4.03mc/cumm±0.05). In the experimental group girls the erythrocyte count which was sub-normal at 3.51±0.54mc/cumm improved to 4.30 mc/cumm±0.42 after supplementation and this value was much better than even the control group girls' red blood cell count. When compared to the standard red blood corpus cell count as given by WHO (2001)except the experimental group before supplementation values (3.51mc/cumm±0.54) rest all were within the normal range of 4-5mc/cumm, however even in the control group the red blood corpuscle count was just above the normal values which could be termed as "low normal". The normal red blood corpus cell count as given by Srilakshmi(2014)³³ is 4.2 to 5.4mc/cumm. When compared to this standard; even the control group's red blood corpus cell count was lower than the standard. The experimental group's mean erythrocyte count was very much lower than the standard values before supplementation.

(iii) Packed Cell Volume

The mean **hematocrit** value of the control group girls was 36.63 ±0.61 and 36.3±0.49 percent in the beginning and at the end of the study. The experimental group participants' mean packed cell volume which was 31.62 ±4.86 percent raised to 38.77±3.74 percent after the supplementation with *saravallai* dhal powder for ninety days. However all the above mean values were

below the standard hematocrit (Srilakshmi 2014) values of 40-50 percent. It could be observed that even in the control group girls, the cell volume was lower even though the red blood corpuscle count was just normal. Burtis & Ashwood (2008)³⁴, WHO(2001) and Mahan & Stump (2000)³⁵ had quoted a reference value of 35-45, 36 and 37-47 percent hematocrit value. When the present study's PCV values were compared with the above given standard values, the control groups PCV (before and after) values were within the standard of the first author. The experimental groups' PCV values were lower than all the above three authors' reference values before supplementation, however after the completion of the intervention the PCV had actually improved and this value was just few points above the standard value as given by Burtis and Ashwood (2008). The test of significance values obtained for PCV of the control group ($P=0.0007$) and experimental group ($P=0.0001$) indicated a significant difference between the base line and final values.

(v) Serum Iron

The serum iron is the amount of circulating iron that is bound to transferrin. The serum iron of the control group girls sub-samples ($n=10$) was 27.65 ± 0.47 and 27.39 ± 0.46 $\mu\text{g/dl}$ before and after the study period. The experimental groups' mean serum iron was 23.78 ± 2.69 $\mu\text{g/dl}$ before supplementation, however after the intake of *saravallai* dhal powder for a period of ninety days, the serum iron increased by 41.89 $\mu\text{g/dl}$. Burtis & Ashwood (2008), Mahan & Stump (2000) and had quoted the reference values of 50-170 and 50-175 $\mu\text{g/dl}$ serum iron. When the present study's values were compared with the above given cut off values, the control groups' serum iron (before and after study period) were below the standard values. The experimental groups' serum iron values were lower than the above two authors' reference values before supplementation, however at end of the study, the serum iron had actually improved to 65.67 ± 32.62 $\mu\text{g/dl}$ (Experimental group) and had come within the normal range given above and could be termed as "Low normal". It has to be noted here that the volunteers who were designated as control group had their Hemoglobin just above the borderline and not very high. The low serum iron in this group indicates that even the control group needs an intervention to improve their serum iron status. There was a significant difference between the beginning and end of the study period's serum iron values in both the control ($P=0.0001$) and experimental groups ($P=0.0025$).

(vi) Total Iron Binding Capacity

Total iron binding capacity (TIBC) is a measurement of the potential for plasma to bind ferric ion and it depends on the number of free binding sites on the plasma iron transport protein i.e. transferrin (Burtis and Ashwood, 2008). In the present study the control group girls' total iron binding capacity was 383.05 ± 17.08 $\mu\text{g/dl}$ whereas in their experimental counterparts it was higher at 459.1 ± 47.94 $\mu\text{g/dl}$ at beginning of the study. When compared to the reference values (250-425 $\mu\text{g/dl}$) of Burtis and Ashwood, (2008) and Mahan and Stump, 2000 (250-450 $\mu\text{g/dl}$), the control group's TIBC values was within the reference standards, but the experimental group's baseline value (459.1 ± 47.94 $\mu\text{g/dl}$) was much above the normal range. According to Mahan and Stump, (2000) the increased total iron binding capacity indicates iron deficiency, hence it could be opined that the present

study's experimental group girls have iron deficiency. At the end of the study the control group's total iron binding capacity (378.27 ± 16.1 $\mu\text{g/dl}$) was more or less similar to that of the initial values, whereas the experimental group's TIBC had decreased by 68 $\mu\text{g/dl}$ and stood at 391.0 ± 45.39 $\mu\text{g/dl}$ and this values was well within the reference range of Burtis and Ashwood, (2003) and Mahan and Stump (2000). The statistical tool 'T' test for total iron binding capacity of the control group ($P=0.0006$) and experimental group ($P=0.0001$) indicated a significant difference between the base line and final values.

(vii) Transferrin Saturation

Transferrin saturation is the ratio of Serum iron and Total iron binding capacity multiplied by 100. It is an extremely sensitive indicator of functional iron depletion. The mean transferrin saturation values of the control group girls from the beginning (25.2 ± 0.78 percent) to the end (25.3 ± 1.15 percent) of the study did not show much variation. However in the experimental group girls before supplementation it was quite low to 9.8 ± 6.81 percent at the beginning of the period, but when the supplementation period was over it had risen to 20.9 ± 7.60 percent. These values were compared to the reference standard of Mahan & Stump, (2000) and Burtis & Ashwood (2008) which was 15-50 percent. As per this value the mean transferrin saturation values of the experimental group was very much lower indicating that the iron bound to "transferrin" the plasma protein that transports iron from gut wall to tissues was very much lower. It could also be seen that even in the control group the transferrin saturation was in the lower border of the normal transferrin saturation range. Among the selected samples ($n=10$) there was no statistically significant difference ($P=0.8589$) in the transferrin saturation values between the two values of control (Before and after study period). In experimental group the transferrin saturation differed significantly ($P=0.0005$) before and after supplementation.

(viii) Serum Ferritin

Ferritin is a storage protein that sequesters the iron normally gathered in liver, spleen and marrow and its concentration is directly proportional to the amount of ferritin inside the storage cell and indirectly proportional to the amount of iron present in the cell (Mahan and Stump, 2000). The mean serum ferritin of control group girls was 23.09 ± 2.82 ng/ml before commencement of the study and 22.6 ± 2.71 ng/ml on completion of study. Although these values are within the normal range of 12 to 150 ng/ml and 10 to 120 ng/ml as given by Mahan and Stump, (2000) and Burtis and Ashwood, (2008) respectively, they are "low normal" values. This reaffirms that the control group girls also have low iron store. In the experimental group girls before the supplementation of *saravallai* dhal powder the serum ferritin was just 10.68 ± 9.28 ng/ml . After supplementation it had increased to $30.45 \text{ng/ml} \pm 14.99$ and this value was even higher than the control groups serum ferritin values. According to Burtis and Ashwood, (2008) plasma ferritin concentration decline very early in the development of iron deficiency long before changes are observed in blood hemoglobin concentration. RBC size or Serum iron concentration serves as a very sensitive indicator of iron deficiency i.e., uncomplicated by other concurrent diseases. From this it could be stated that the ferritin level is in compromised level

not only in experimental girls but also in the control group girls. The paired 'T' test done for the base line and final values for serum ferritin of the control (n=10) and experimental groups-(n=10) separately were (0.1668) and (0.0001). By conventional criteria the former value (0.1668) is considered to be not statistically significant but the latter value (0.0001) is extremely significant. Several independent studies undertaken by Kavitha and Radhika(2001)³⁶, Radhaisri and Muthlaxmi (2001)³⁷, Anuradha and Sangeetha (2001)³⁸, Thirumani Devi and Uma (2001)³⁹ and Sengar *et al.*,(2000)⁴⁰ on wheat grass juice (containing 3.3mg of iron and 13.14 mg of ascorbic acid per 100ml), hibiscus flower extract, soya malt, spirulina and Ber fruit supplementation to the anemic adolescent girls reported significant increase in hemoglobin, serum iron and serum ferritin respectively.

From the foregoing discussions, it is clear that the blood iron parameters of the experimental group had shown considerable increment after ninety days of *Saravallai* Dhal Powder supplementation. The additional iron supplied through SDP was 6.02 mg percent, but the total iron received by the experimental group girls worked out to 12.67mg/day which includes an amount of 6.65 ± 1.68 mg that they received from their regular food intake. Although the total iron intake in the experimental girls was only 50 percent ICMR (2010) dietary recommendations (26mg/day) still it had helped to improve the blood iron parameters.

Several reasons could be put forth for this **improved blood iron status**.

The **first** and the foremost is that the percentage of ionizable iron (6.24) and soluble (44.71) iron at (pH 7.5) in SDP used for supplementation was better and according to Rao and Prabhavathi (1978) the ionizable and soluble iron at pH 7.5 can be directly correlated with percent in-vivo iron absorption and the highest correlation with physiological availability in humans could be observed with ionizable iron at pH7.5.

Secondly the most commonly accepted and affirmed iron absorption inhibitors such as phytic acid (1.08 ± 0.05 mg) and oxalates (1.43 ± 0.13 mg) were very much low and in the prepared *saravallai* dhal powder. Hence as such the iron from this *saravallai* green has better bioaccessibility. Earlier studies by Agte, Jahagirdar and Chiplonkar ,(2006) Das, Raghuramulu and Rao (2005)⁴¹ Fahey(2005)⁴² and Nambiar & Seshadri(2001)⁴³ Chiplonkar *et al.*,(1999)⁴⁴ on green leafy vegetables had also reported that green leafy vegetables although has a lower amount of total iron(1.82 to 3.76mg/100g),it has a high ionisable iron from 30. 22 to 52.13 percent and GLV-based meals will increase gross as well as bioavailable iron intake which will help in meeting daily requirements of iron, hence can be effectively used to treat anemia.

Thirdly *T. portulacastrum* has been proved to possess strong Anthelmintic activity in vivo (Hussain *et al.*, 2011)⁴⁵, thus, justifying their effectiveness in improving the iron status among the selected girls.

Fourthly the human body tightly regulates the absorption of iron such that there is an inverse relationship between iron status and absorption(Kalasuremath *et al.*, 2015)⁴⁶ and several studies have shown that more iron is absorbed in an iron deficient state than in an iron repletion state (Walczyk *et al.*,2008)⁴⁷. All the above reasons could have collectively helped to increase blood parameters.

IV. CONCLUSION

Anemia is high prevalence among adolescent girls. The finest way to prevent anemia is inclusion of GLV based foods in regular diet . In this way supplementation of *Saravallai* Dhal Powder to anemic adolescent girls, their blood iron parameters improved considerably. Because the SDP had better bioaccessible iron , anthelmintic effects and low anti nutrient content.

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Liver Abscess - A Case Study

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Abstract- Liver abscess is a pus-filled cyst in the liver. The liver is an organ in the digestive system that assists the digestive process and carries out many other essential functions. These functions include producing bile to help break down food into energy; creating essential substances, such as hormones; cleaning toxins from the blood, including those from medication, alcohol and drugs; and controlling fat storage and cholesterol production and release. Early diagnosis and early treatment process may reduce the complication of the disease condition.

Index Terms- Liver, Abscess, Rupture, Abdominal pain, Ascities

I. INTRODUCTION

CASE STUDY OF MR X

Mr X 67 Years old male presented with history of abdominal pain for 5 days. Mr X had a past history of diabetes mellitus, Hypertension and he underwent surgery in scrotum. There was no family history of hereditary disease. In present history patient developed fever, abdominal pain and constipation for 5 days. Patient was brought on septic shock and initially we went to peritoneal drainage was done. On examination abdominal distension noted and liver sizes increases 8.85cm hyper echoic section noted, ascities present in USG Abdomen, chest x-ray showed increased broncho vascular markings and USG Chest Right pleural effusion noted. Mr X was diagnosed as Rupture Liver Abscess.

Liver Abscess is pus – filled mass inside the Liver. Common causes are abdominal infections such as appendicitis or diverticulitis due to haematogenous spread through the portal vein.



INCIDENCE:

The incidence rate of liver abscess was 0.3%, 1.1% and 1.5% at 1 year, 5 years and 7 years. Overall hospital mortality was 10.1% 224/100,000 persons affected with liver abscess.

TYPES:

There are three major forms of liver abscess, classified by **etiology**:

- **Pyogenic liver abscess**, which is most often polymicrobial, accounts for 80% of hepatic abscess cases in the United States.
- **Amoebic liver abscess** due to **Entamoeba histolytica** accounts for 10% of cases.

Fungal abscess, most often due to **Candida** species, accounts for less than 10% of cases

ETIOLOGY:

- Abdominal infection such as **appendicitis**, **diverticulitis**, or a **perforated bowel**
- Infection in the blood
- Infection of the bile draining tubes
- Recent **endoscopy** of the bile draining tubes
- Trauma that damages the liver

The most common bacteria that cause liver abscesses are:

- Bacteroides
- Enterococcus
- Escherichia coli
- Klebsiella
- Staphylococcus
- Streptococcus

In most cases, more than one type of bacteria is found

PATOPHYSIOLOGY:

Infections in organs in the portal bed can result in a localized septic thrombophlebitis, which can lead to liver abscess. Septic emboli are released into the portal circulation, trapped by the hepatic sinusoids, and become the nidus for microabscess formation. These micro abscesses initially are multiple but usually coalesce into a solitary lesion. Microabscess formation can also be due to hematogenous dissemination of organisms in association with systemic bacteremia, such as endocarditis and pyelonephritis.

CLINICAL MANIFESTATION:

| BOOK PICTURE | PATIENT PICTURE |
|---|--|
| <ul style="list-style-type: none"> • Clay-colored stool • Dark urine • Fever, chills • Loss of appetite • Unintentional weight loss • Weakness • Yellow skin (jaundice) • Abdominal pain <ul style="list-style-type: none"> • Particularly in the right, upper part of the abdomen • Intense, continuous, or stabbing pain • Diarrhea (in only one-third of patients) • General discomfort, uneasiness, or ill feeling (malaise) | <ul style="list-style-type: none"> • • present • present • present • present • present • • Present |
| | • |

INVESTIGATION:

Investigations – Patient Value:

| Investigations | Patient value | Reference value |
|--------------------|----------------|-----------------|
| Haemoglobin | 9.4% | 12-14gm% |
| Total count | 9,800 cells/mm | 4,000-11,000 |
| Differential Count | | cells/mm |
| Polymorphs | 74% | 50% - 70% |
| Lymphocytes | 20% | 30% - 60% |
| Eosinophils | 6% | 1% - 4% |
| Erythrocyte | 48 mts | 1 hr -10 mm |
| Sedimentation rate | | |
| PCV | 30% | 40-54% |
| Platelets | 1.85lakhs/cumm | 3.0-5lakhs/cumm |
| B. Urea | 80mg | 20-40mg |
| Sr. Creatinine | 1.5mg | 6-1.4mg |
| Blood Sugar | 60mg/dl | 80-120mg/dl |

ULTRASONOGRAM ABDOMEN

Liver sizes increases 8*8.5cm hyper echoic section noted in right lobe of liver segment

Spleen normal

Gall Bladder Normal

Pancreas normal

Both Kidney normal

Ascites +

USG CHEST

Right pleural effusion

EKG — Normal

CHEST X-Ray – increased broncho vascular markings.

MANAGEMENT:

MEDICAL MANAGEMENT:

Antibiotics such as metronidazole (Flagyl) or tinidazole (Tindamax) are the usual treatment for liver abscess. A medication such as paromomycin or diloxanide must also be taken to get rid of all the amoebas in the intestine, to prevent the disease from coming back. This treatment can usually be delayed until after the abscess has been treated.

In rare cases, the abscess may need to be drained to relieve some of the abdominal pain.

SURGICAL MANAGEMENT:

DIAGNOSTIC PERITONEAL LAVAGE (DPL) :

Diagnostic peritoneal lavage is a procedure where, after application of [local anesthesia](#), a vertical skin incision is made one third of the distance from the [umbilicus](#) to the [pubic symphysis](#). The [linea Alba](#) is divided and the peritoneum entered after it has been picked up to prevent bowel perforation. A catheter is inserted towards the pelvis and aspiration of material attempted using a syringe. If no blood is aspirated, 1 liter of warm 0.9% saline is infused and after a few (usually 5) minutes this is drained and sent for analysis

MANAGEMENT FOR MR.X:

| | | | |
|------------------|-----|----|-----|
| INJ. MEROPENOM | 1gm | IV | Tds |
| INJ.DERIPHYLLINE | | IV | Bd |
| INJ.ALBUMIN | | IV | Od |
| INJ. RANTAC | | IV | Tds |
| INJ. TRAMADOL | | IV | Sos |

COMPLICATIONS:

The abscess may rupture into the abdominal cavity, the lining of the lungs, the lungs, or the sac around the heart. The infection can also spread to the brain.

NURSING DIAGNOSIS:

1. Altered breathing pattern related to pressure on diaphragm secondary to ascites as evidenced by tachypnea
 - Assess the breathing pattern of the patient. Provide comfortable bed and position, Administer oxygen and tapping ascetic fluid send to cytology, Encourage the patient to take deep breath Q2H
2. Fluid volume excess related to impaired metabolism of aldosterone.

- Assess edema with edema scale. Maintain daily weight and abdominal girth, advice the patient to restrict fluid and salt. Administer diuretics, maintain intake and

Output chart.

II. SUMMARY:

Mr. X 67 years was co-operative with health personnel. Although his symptoms were well responding to treatment, it was recurring, but he did not develop further complications during hospital stay.

III. CONCLUSION:

Prevention of diseases is of fundamental importance, when travelling in tropical countries with poor sanitation, drink purified water and do not eat uncooked vegetables or unpeeled fruit. Without treatment, the abscess may break open (rupture) and spread into other organs, leading to death. People who are treated have a very high chance of a complete cure or only minor complications.

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Effectiveness of Small Group Instruction in Improving the Reading Skills of Grade Six Pupils: Basis for a Reading Intervention Program

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Abstract

The study aimed to determine the effectiveness of small group instruction as a reading intervention strategy to develop the reading performance of the Grade 6 pupils. It utilized the quasi-experimental design specifically, one group pre-test posttest design. The study used Revised Phil-IRI Group Screening Test as the baseline in determining the participants of the reading intervention which highlighted the use of small group instruction. Graded Passages Pre-Test and Posttest was employed to identify whether the use of the intervention strategy used was effective. The study hypothesized that there is no significant difference between the performance of the participants in the PHIL-IRI Graded Passages Pre-Test and Posttest. There were 26 participants of the study who took the graded passages tests. They were grouped according to their actual reading profile. They were given reading remediation according to their capability. Results show that in terms of the reading performance in word recognition and comprehension, grade 6 pupils with grade 3 reading level have improved after the conduct of small group instruction. The same result was found with the grade 6 pupils with grades 4 and 5 reading levels. Further, evidence show that the reading intervention strategy employed, was effective. Thus, it is recommended that a reading intervention program which highlighted the use of small group instruction will be used by teachers to improve the reading performance of their pupils.

Index Terms

comprehension, PHIL-IRI, reading intervention program, reading performance, small group instruction

I. INTRODUCTION

Reading is performed for both pleasure and information. Reading skills are important for the individuals since they foster comprehension in texts or symbols. If students do not have knowledge of reading skills, they cannot be expected to be successful readers. Thus, they cannot achieve as well the level of comprehension required to pass exams in their own departments (Kaya, 2015).

Reading is not just translating and decoding text into sounds and spoken words. It definitely includes understanding of the texts called comprehension. Reading comprehension involves taking what was just read and deriving meaning from those words. In simpler terms, reading comprehension is the ability to read, understand, process, and recall what was just read (Rutzler, 2017).

For an individual to survive in today's world, it is a requirement for him to know how to read with understanding. He should be capable of understanding simple text such as transportation documents which includes travel directions and road instructions, bills, and contracts. The effect of not being able to comprehend could be disastrous like in the case of understanding the instructions on a bottle of medicine or chemical warnings (Lastrella in Umali 2012).

With the ability to comprehend a text, people are able not only to live safely and productively, but also to continue to develop socially, emotionally, and intellectually (Umali, 2012).

According to McNamara (2007), comprehension is not always effortless and fast. When beginning readers struggle over individual words, reading is slowed to a near halt and deeper levels of comprehension are seriously compromised. Hence, word recognition can significantly affect reading comprehension. In addition, Blachmann as mentioned by Denton & Otaiba (2015) pined that at the most basic level, beginning readers must become aware of individual sounds and groupings of sounds within the oral speech stream. Spoken language consists of words composed of syllables that are in turn composed of individual sounds; however, when a person listens to oral speech, these words and word parts tend to run together. The beginning reader must become aware that oral language is made up of these components, a competency commonly referred to as phonological awareness.

In recent years, there has been an increased focus on reading instruction in primary, secondary, and higher education (Lei cited by Cekiso 2012). Literature has shown that comprehension strategy instruction, including multiple reading strategies, have been justified in being beneficial to helping learners become strategic readers and improve their reading comprehension (Klapwijk as cited in Cekiso,

2012). Thus, it is necessary for teachers to provide learners with a reading strategy instruction that can help them become strategic readers.

It is on these foregoing premises that the researcher aimed to determine the effectiveness of a small group instruction which intends to improve the reading performance of the pupils and the results of which may serve as basis in designing a sound reading intervention program.

Research Framework

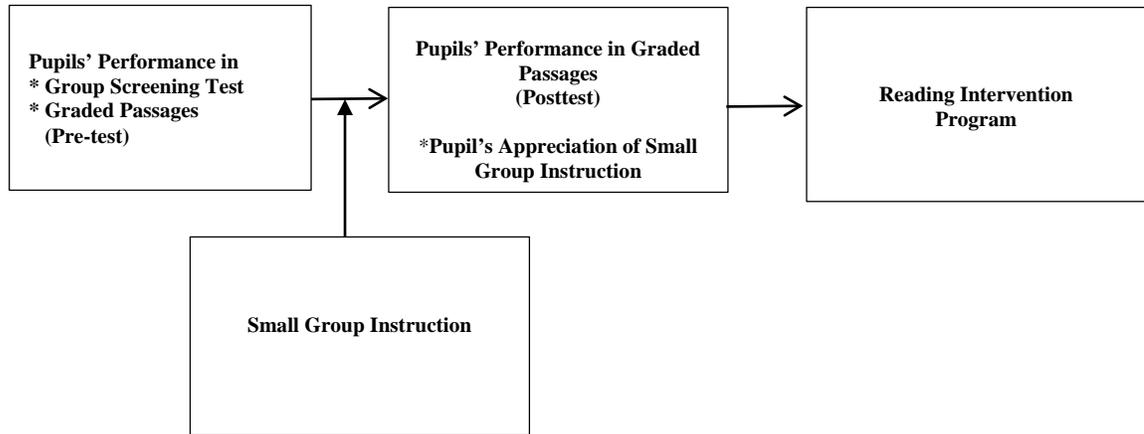


Figure 1: Schematic Diagram of the Study

Objectives of the Study

This study aimed to determine the effectiveness of small group instruction as a reading intervention strategy to develop the reading performance of the Grade 6 pupils. Specifically, it sought to achieve the following objectives.

1. To determine the level of pupils' reading performance in terms of:
 - 1.1 Phil-IRI Group Screening Test; and
 - 1.2 Phil-IRI Graded Passages before (pre-test) and after (posttest) the Small Group Instruction
2. To ascertain whether there is significant difference between the pre-test and posttest scores
3. To determine the level of pupils' appreciation to the small group instruction; and
4. To craft a reading intervention program.

Hypothesis

This null hypothesis is presented based on the result testes at 0.01 level of significance.

Ho1: There is no significant difference in the pupils' reading performance before and after the small group instruction.

II. METHODOLOGY

Research Design

This study utilized the quasi-experimental design, specifically, one group pre-test posttest design. The study used the Revised Phil-IRI Group Screening Test as its baseline in determining the participants of the reading intervention which was the small group instruction.

Sampling Design

The study employed the non-probability sampling technique particularly purposive sampling. The participants were chosen based on the Phil-IRI Group Screening Test. There were twenty-six (26) participants in this study wherein majority are female with 16 respondents or 62 % and 10 male respondents or 28% of the participants' population

Data Gathering Procedure

In the initial phase of the study, the researcher sought permission from the Public Schools District Supervisor, school principal, and head teacher was sought for the conduct the study. After the permission was granted, the researcher who at the same time a Grade 6 English teacher conducted the Phil-IRI Group Screening Test (STAGE 1) in her classes. Those pupils who scored 13 and below in the Test took the Graded Passages Pre-Test (STAGE 2) Individual Administration. The Word Recognition Scores of the pupils were identified. The teacher took note of the miscues of the pupil while reading the passage. The following miscues as described are noted. These were the mispronunciations, omissions, added words, substitutions, repetitions, insertions, and reversals. Aside from the word

recognition, the pupils' level of comprehension were also analyzed based on the pupils' answer after reading the passage. The grade level in which the pupil can register frustration, instructional, and independent level was recorded.

In the administration of the Phil-IRI Graded Passages (Pre-Test), Stage 2, the researcher was provided with four parallel sets (SETS A to D) from the Phil-IRI Manual that she can choose from. This stage of reading assessment further gave the teacher information not just on the weakness of the child in reading but also his or her strengths. It was conducted with the Oral Reading Test.

Also, using the graded passages, the teacher identified the grade level in which the pupil can register independent and frustration level as his or her reading profile. This aided the teacher in designing reading remediation activities that are suitable for developing the pupil's reading skills. Further, this served also as guide for the teacher in choosing instructional materials that would address the needs of the pupil in developing his reading comprehension.

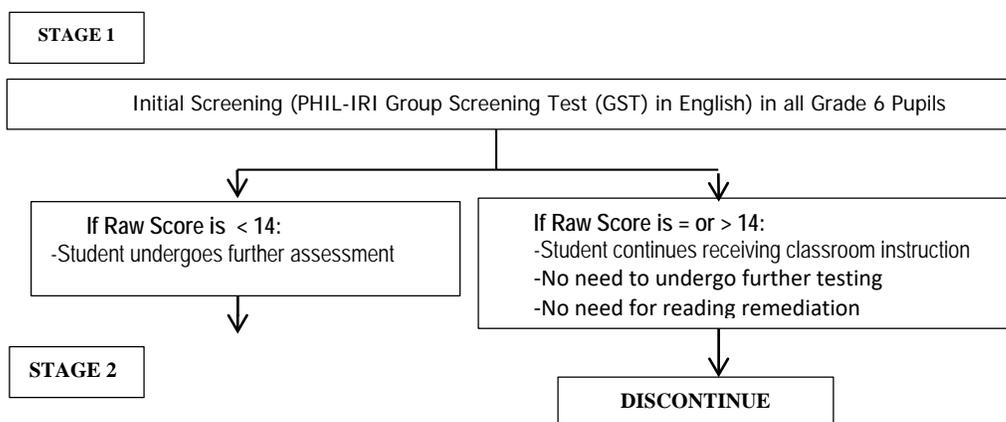
The first passage that the pupil had read aloud depended on the pupil's raw score. If the pupil's raw score in the GST is 0-7, he or she must be given a passage that is 3 grade levels below his or her current level. If the pupil's raw score in GST is 8-13, he must be given a passage that is 2 grades below his current level. Thus, if Pupil A is a Grade Six pupil and scores 6/20 in the GST, he or she must be given a passage at the 3rd grade level. If he or she scores 9/20 in the GST, he or she must be given passage from the 4th grade level. In the case of the participants of this study, all of the 26 pupils had score from 8 to 13 in the GST. Hence, the first graded passage introduced was the Grade 4 level.

Since in this stage the teacher already determined the grade level in which the pupil can register his or her reading profile in independent, instructional and frustration level, it is expected that the pupil has read two or more passages and answered the questions that follow. The number of passages the pupil has read was dependent on the result of each test. In finding the independent level of the pupil's reading profile, the teacher gave a selection that was one lower level than the given selection until the pupil registered performance at 97%-100% in the word recognition and 80%-100% in comprehension. In finding the frustration level, the teacher gave a selection that was one higher level than the level in which the child has registered instructional level until the pupil registered the performance at 89% and below for the word recognition and 58% and below for the comprehension. This is important in order for the teacher to know the kind of reading material that the pupil is already able to perform well in. Once all the data which can be used to describe the pupil's reading performance were gathered, the teacher designed an intervention program and choose instructional materials to address the needs of the pupils in improving their reading performance.

After getting the reading profile of the pupils in terms of word recognition and comprehension, the researcher then proceeded the employment of the reading remediation (STAGE 3) which was through small group instruction. The teacher used the Developing Reading Power Books issued by the Department of Education. It has reading passages and comprehension checkup questions for exercises.

Prior to actual reading, the vocabulary development was undertaken first. Motivation and motive question were also given to prepare the pupil in the selection. The schema (prior knowledge of the pupil on the subject) was activated to prepare the pupil in interacting with the text. The first two steps were done through small group instruction to develop learning through socialization and interaction. The teacher employed varied teaching techniques in improving the pupils' reading comprehension. Explicit teaching as a strategy in improving the reading comprehension was delivered. This means that the teachers read the difficult words first and the pupil took his or her turn in reading the terms. Then, the teacher read the entire text followed by the pupil. This was designed to attain oral fluency in order to help the pupil to give less effort in the word recognition and give full attention in connecting the meaning of the words in the context thus attaining comprehension of the text. As soon as the oral fluency of the pupil progresses, the teacher asked the pupil to read the text by himself or herself without the modelling of the teacher. Pupils were also asked to read aloud and in some other time individually. After the reading activity, the pupils were asked to answer comprehension check-up questions. During the checking, some questions were discussed and the teacher added questions that activate the higher order thinking skills of the pupils. The reading remediation lasted for two and a half months.

Graded Passages Posttest (STAGE 4) was then administered at the last quarter of the school year. There were four parallel sets of Graded Passages. The results of Graded Passages Pre-Test and Posttest were compared to monitor the progress of the pupils. After taking the Graded Passages Posttest, the level of pupils' appreciation on the small group instruction was assessed to identify whether the pupils had appreciated on the remediation activity that they underwent.



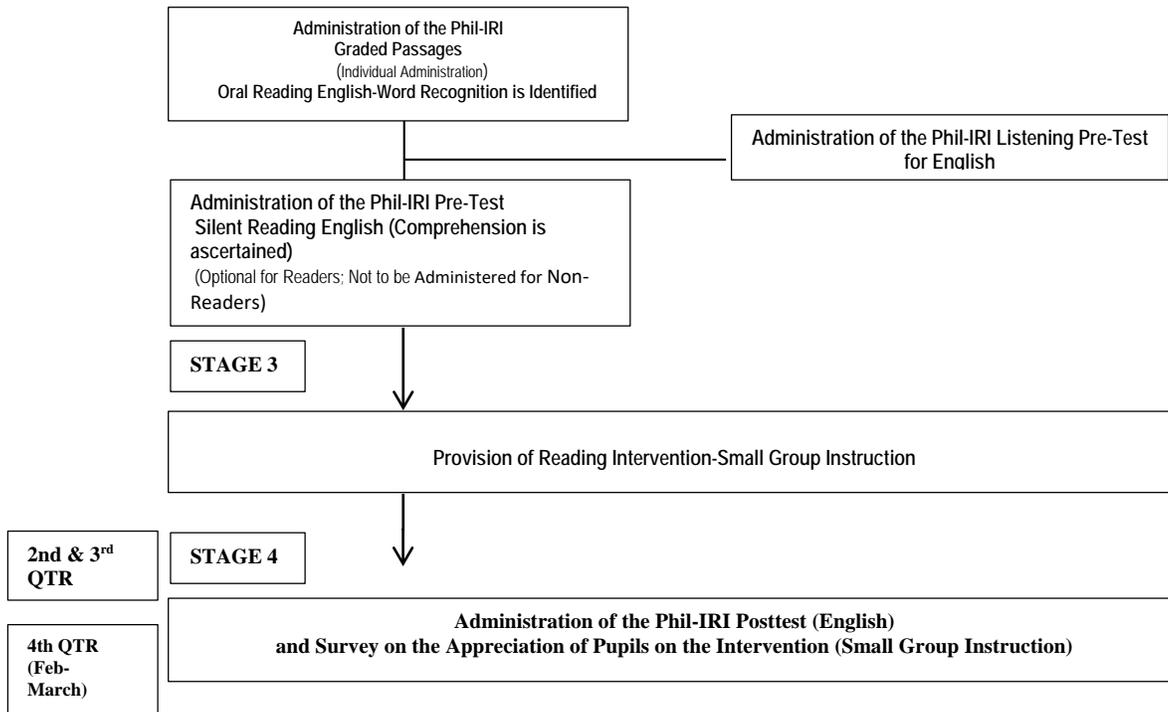


Figure 2. Stages of the Revised Phil-IRI Administration

III. RESULTS

Problem 1: The Level of Reading Performance of Pupils in terms of:

1.1 PHIL-IRI Group Screening Test

Table 1 Frequency Distribution of the Reading Performance of Grade 6 Pupils in PHIL-IRI Group Screening Test

| Reading Level | F | % |
|--------------------------|-----------|------------|
| At grade 6 level | 54 | 67.50 |
| Below level: Grade 5 | 9 | 11.25 |
| Below level: Grade 4 | 5 | 6.25 |
| Below Level : Grade 3 | 12 | 15.00 |
| Total | 80 | 100 |

As gleaned in the table, the results of the Group Screening Test, 54 pupils are at their expected level –grade 6 while 12 of them are at below level-grade 3, 5 are at below level-grade 4 and 9 of them are at below level-grade 5. This means that most of the pupils are at the grade-appropriate level while 26 of them still need intervention.

The Anne Casey Foundation (2010) explained that the ability to read in the elementary grade is critical to a child’s success in school, life-long learning potential and their ability to contribute to the nation’s economy and its security. Children can succeed at advancing to a higher grade reading level if policymakers focus on school readiness, school attendance, summer learning, family support and high-quality teaching.

Table 2 shows that during pre-test, out of 12 pupils who were given Grade 3 level reading material, 2 or 16.7 % of them are in instructional level and 10 or 83.3 % of them are in independent level. After the intervention, 12 or 100% are already registered in grade 5 independent level. This shows that the small group instruction has greatly improved the reading skill of the Grade 6 pupils with grade 3 reading level in terms of word recognition.

1.2 Graded Passages Before and After Small Group Instruction

Table 2. Pretest and Posttest Performance of Grade 6 Pupils with Grade 3 Reading Level in terms of Word Recognition

| Grade Level Reading Test | Frustration | | | | Instructional | | | | Independent | | | |
|-----------------------------|-------------|---|----------|---|---------------|------|----------|---|-------------|------|----------|-----|
| | Pretest | | Posttest | | Pretest | | Posttest | | Pretest | | Posttest | |
| | f | % | f | % | F | %f | F | % | f | % | f | % |
| Grade 3 | | | | | 2 | 16.7 | | | 10 | 83.3 | | |
| Grade 4 | | | | | | | | | | | | |
| Grade 5 | | | | | | | | | | | 12 | 100 |

This is supported by Tyner as mentioned by Wilson (2012) that beginning readers benefit most from being taught explicit skills during intensive group discussion. The small-group differentiated reading model enables teachers to focus on specific skills. By integrating strategy instruction into word-study lessons and engaging students into guided practice to use what they have learned, educators support pupils' early literacy learning. In addition, Li and Creamer in Wilson (2012) posited that active responses during small group reading instruction increase student engagement and motivation to participate. Children actively create multiple words to demonstrate their understanding of words.

Table 3. Pre-test and Posttest Performance of Grade 6 Pupils with Grade 3 Reading Level in terms of Comprehension

| Grade Level Reading Test | Frustration | | | | Instructional | | | | Independent | | | |
|-----------------------------|-------------|----|----------|------|---------------|----|----------|------|-------------|---|----------|------|
| | Pretest | | Posttest | | Pretest | | Posttest | | Pretest | | Posttest | |
| | f | % | f | % | F | %f | F | % | f | % | f | % |
| Grade 3 | 3 | 25 | | | 9 | 75 | | | | | | |
| Grade 4 | | | | | | | | | | | | |
| Grade 5 | | | 2 | 16.7 | | | 2 | 16.7 | | | 8 | 66.7 |

As displayed in the table, 3 or 25 % of the pupils are in frustration level, and 9 or 75 % are in the instructional level. After employing the intervention, 2 or 16.7% are registered in grade 5 frustration level, another 2 or 16.7% are in instructional and 8 or 66.7% are registered in grade 5 independent level. This suggests that the reading performance of grade 6 pupils with grade 3 reading level has greatly improved after the conduct of the small group instruction.

This result is supported by Wasik as mentioned by Wilson (2012) that with five or fewer children in a group, teachers can focus needed attention on individual children and make sure that each child has opportunities to participate. Additionally, small-group time enables children to have high-quality interaction with teachers.

Teachers are able to observe pupils as they are learning and modify instruction, clarify misconception, and discuss material to meet the specific learning needs of each child in a small group. Each group receives high-quality reading instruction and children can be engaged in meaningful tasks that are related to specific instructional level according to Kiley mentioned by Wilson (2012).

Table 4 Pretest and Posttest Performance of Pupils in Grade 4 Reading Level in terms of Word Recognition

| Grade Level Reading Test | Frustration | | | | Instructional | | | | Independent | | | |
|-----------------------------|-------------|---|----------|---|---------------|-------|----------|---|-------------|-------|----------|-----|
| | Pretest | | Posttest | | Pretest | | Posttest | | Pretest | | Posttest | |
| | f | % | f | % | F | %f | F | % | F | % | f | % |
| Grade 4 | | | | | 3 | 60.00 | | | 2 | 40.00 | | |
| Grade 5 | | | | | | | | | | | 5 | 100 |

As gleaned in the table, in terms of word recognition during pretest, 3 or 60% of the pupils with grade 4 reading level were in the instructional level while 2 or 40% of them were registered in the independent level. During posttest, 5 or 100% of the pupils were already in the grade 5 independent level.

This means that the reading performance of the grade 6 pupils with grade 4 reading level has improved after the conduct of small group discussion. In connection to the foregoing result, Moore (2000) posited that word recognition skill such as vocabulary

knowledge is a significant and constant predictor of overall reading comprehension irrespective of grade level. While significant, fluency effects diminish over grades, especially in the later grades.

As shown in table 5, in terms of comprehension during pretest, 4 or 80% of the pupils are in frustration level while 1 or 20% is in the instructional level. However, after the conduct of small group instruction, 5 or 100% of them are already in grade 5 independent level. This means that in terms of the reading performance particularly comprehension, the grade 6 pupils with grade 4 reading level has improved after the conduct of small group discussion

Table 5. Pre-test and Posttest Performance of Grade 6 Pupils in Grade 4 Reading Level in terms of Comprehension

| Grade Level Reading Test | Frustration | | | | Instructional | | | | Independent | | | |
|-----------------------------|-------------|----|----------|---|---------------|----|----------|---|-------------|---|----------|-----|
| | Pretest | | Posttest | | Pretest | | Posttest | | Pretest | | Posttest | |
| | f | % | f | % | F | %f | F | % | F | % | f | %f |
| Grade4 | 4 | 80 | | | 1 | 20 | | | | | | |
| Grade 5 | | | | | | | | | | | 5 | 100 |

The result above is in consonance with the Early Warning Executive Summary Report in The Anne Casey Foundation (2013) in which the assessment report affirmed that reading proficiency is crucial for continued academic success and to break the cycle of intergenerational poverty, and the key factors in addressing the problem. The knowledge base continues to grow. And with each new finding, one may gain more insight, resources and confidence for the challenge of helping more children, especially those from low-income families, read at their expected grade level by the end of the school year.

Table 6. Reading Performance of Grade 6 Pupils with Grade 5 Reading Level in terms of Word Recognition

| Test | Frustration | | | | Instructional | | | | Independent | | | |
|---------|-------------|-----|----------|---|---------------|---|----------|---|-------------|---|----------|-----|
| | Pretest | | Posttest | | Pretest | | Posttest | | Pretest | | Posttest | |
| | F | % | f | % | f | % | f | % | F | % | f | % |
| Grade5 | 9 | 100 | | | | | | | | | | |
| Grade 6 | | | | | | | | | | | 9 | 100 |

As displayed in the table, in terms of word recognition during pretest, 9 or 100% of the pupils in grade 5 reading level are registered in the frustration level while during posttest, 9 or 100% of the pupils are already in the grade 6 independent level. This means that in terms of their reading performance particularly word recognition, the grade 6 pupils with grade 5 reading level has improved after the conduct of small group instruction.

Anent to this result, Chard et.al. in Chaka and Booi-Ncetani (2015) mentioned that fluent oral reading in English is an essential skill for learners at any level of their learning career. In fact, most language teaching experts agree that efficient and effective word recognition skills are a *sine qua non* for becoming a successful reader.

In addition to the foregoing claim, word recognition is important in order for the learner to understand the text that he or she is reading. According to Granville in Chaka & Booi- Ncetani (2015), the meaning resides unproblematically in the text and the reader simply has to discover it as it is fixed and determined. The pupil therefore should master the mechanical reading skills such as word recognition, decoding, phonics, and reading aloud.

Table 7. Pretest and Posttest Performance of Grade 6 Pupils with Grade 5 Reading Level in terms of Comprehension

| Grade Level Reading Test | Frustration | | | | Instructional | | | | Independent | | | |
|-----------------------------|-------------|-----|----------|---|---------------|---|----------|------|-------------|---|----------|-------|
| | Pretest | | Posttest | | Pretest | | Posttest | | Pretest | | Posttest | |
| | F | % | f | % | f | % | F | % | F | % | f | % |
| Grade 5 | 9 | 100 | | | | | 1 | 11.1 | | | 5 | 55.56 |
| Grade 6 | | | | | | | | | | | 3 | 33.33 |

As seen in the table, in terms of comprehension during pretest, 9 or 100% of the pupils in Grade 5 reading level are registered in the frustration level while during posttest, 1 or 11.1% of the pupils belongs to the instructional level and 5 or 55.56% of the pupils are already in the grade 5 independent level and 3 or 33.33% are registered in the grade 6 independent level. This means that in terms

of reading comprehension, the grade 6 pupils with grade 5 reading level’s performance has improved after the conduct of small group discussion.

The result above is in accordance to the findings of the study Perfetti and Hogaboam (2019) entitled Relationship between single word decoding and reading comprehension skills. It was found out that unskilled comprehenders may have failed to develop automatic decoding skills and that this failure may lead to diminished comprehension skills sharing a common processing capacity with non-automatic decoding.

Problem 3: Significant Difference between Pretest and Posttest Results of the Grade 6 Pupils’ Reading Performance

Table 8. Paired t-test between Pretest and Posttest Scores of Grade 6 Pupils with Grade 3 Reading Level

| Test | Mean | SD | t | p-value |
|----------|-------|-------|---------|---------|
| Pretest | 10.91 | 1.375 | 3.546** | 0.005 |
| Posttest | 13.09 | 2.119 | | |

**significant at $p < 0.01$

It can be gleaned from the data that the analysis yielded t-value of 3.546 at $p = 0.005$, indicating a very significant difference of the scores. Thus, the null hypothesis is rejected. This means that there is a significant difference between the pretest and posttest scores of the pupils. Thus, the reading level of 6 pupils with Grade 3 reading level has significantly improved. The result also suggests that small group instruction is effective as a reading intervention strategy.

The result is supported by Amendum, et. al, in Wilson (2012) who posited that through social interaction and small-group learning activities, children begin to integrate and control specific knowledge and skills gradually, as they participate in meaningful, hands-on practice of those skills. Small-group reading instruction allows for this to happen with ease. Reading and literacy lessons provide a social context in which teachers and students meet and closely interact.

Table 9. Paired t-test between Pre-test and Posttest Scores of Grade 6 Pupils with Grade 4 Reading Level

| | Mean | SD | t-value | p-value |
|----------------|---------|---------|---------|---------|
| Post GST Score | 15.2000 | .83666 | | |
| Pre GST Score | 11.4000 | 1.51658 | 6.517** | 0.003** |

**significant at $p < 0.01$

The paired t-test between the pretest and posttest scores of the grade 6 pupils with grade 4 reading level resulted with a t-value of 6.517 at $p = 0.003$. Since the p-value is greater than the 0.05 level of significance set for analysis, the null hypothesis is rejected. This means that there is a significant difference between the pre-test and posttest scores of the pupils. Thus, the reading level of 6 pupils with grade 4 reading level has improved. The result also suggests that small group instruction is effective as a reading intervention strategy.

The foregoing result is backed by Tyner in Wilson (2012) who posited that small group differentiated reading model enables the teachers to focus specific skills needed by varied groups of children. Allington in Wilson (2012) also added that struggling readers are often asked to read text that is far more difficult for them to read than the texts their better reading peers are assigned. Hence, small group instruction is an avenue for these struggling pupils to improve their reading performance.

Table 10. Paired t-test between Pretest and Posttest Scores of Grade 6 Pupils with Grade 5 Reading Level

| | Mean | SD | t-value | p-value |
|----------------|--------|-------|---------|---------|
| Post GST Score | 14.556 | 1.878 | | |
| Pre GST Score | 11.444 | 1.235 | 5.776** | 0.000 |

**significant at $p < 0.01$

It can be noted that the t-value obtained is 5.776 at $p = 0.000$ indicating very significant difference between the pretest and posttest scores. Thus, the null hypothesis is rejected.

This finding reveals that the pupils were able to raise their scores after the intervention. Thus it can be said that the intervention was effective in its objective to improve the reading performance of the pupils.

In connection to the result above, Foorman and Torgesen (2002) found out from an evidence-based research that there is a dramatic reductions in the incidence of reading failure when explicit instruction in phonemic awareness and phonemic decoding skills, fluency in word recognition and text processing, construction of meaning, vocabulary, spelling, and writing components are provided by the classroom teacher. To address the needs of children most at risk of reading failure, the same instructional components are relevant but they need to be made more explicit and comprehensive, more intensive, and more supportive in small-group or one-on-one formats. The argument is made that by coordinating research evidence from effective classroom reading instruction with effective small-group and one-on-one reading instruction, one can meet the literacy needs of all children.

Problem 5: Level of Grade 6 Pupils’ Appreciation on Small Group Instruction

As presented on the table, indicators 8 and 9 which state that the pupil can improve his or her diction in reading since they (with group mates) are asked to read in a small group or individually and he or she prefers to be in a small group when doing reading activities and answering reading exercises got the highest rating of 4.58 described as strongly agree.

Table 11. Mean Distribution of the Responses on the Level of Pupils’ Appreciation to Small Group Instruction

| Indicators | Mean | VD |
|---|-------------|-----------------------|
| 1. I enjoy doing reading activities when I am in a small group. | 4.54 | Strongly Agree |
| 2. I can concentrate in doing reading activities in a small group. | 3.81 | Agree |
| 3. I learn more in small group since my classmates can share their ideas with respect to the topic. | 4.46 | Strongly Agree |
| 4. I get the chance to share my idea with my groupmates | 4.38 | Strongly Agree |
| 5. I can best interact with my teacher and classmates in reading activities and materials when I am in a small group. | 4.15 | Agree |
| 6. I am more prepared in reading when the teacher asks questions about the topic being read when I am in a small group | 4.27 | Strongly Agree |
| 7. I can improve my vocabulary through reading in a small group since we are sometimes asked to define the word in our own words. | 4.46 | Strongly Agree |
| 8. I can improve my diction in reading since we are asked to read in a small group or individually. | 4.58 | Strongly Agree |
| 9. I prefer to be in a small group when doing reading activities and answering reading exercises. | 4.58 | Strongly Agree |
| 10. The reading materials given in a small group are appropriate to my reading capacity. | 4.50 | Strongly Agree |
| Overall | 4.37 | Strongly Agree |

Range of Means: 1.00-1.80 (Strongly Disagree); 1.81- 2.60 (Disagree); 2.61-3.40 (Uncertain); 3.41-4.20 (Agree); 4.21-5.00 (Strongly Agree)

On the other hand, the indicator 2 which states that the pupil can concentrate in doing reading activities in a small group got the lowest mean of 3.81 which signifies that the pupil still agree with the statement. The overall weighted mean of the level of pupils’ appreciation to SGI is 4.37 which means that the pupils strongly agree with the statement. Thus, they outstandingly appreciate the small group instruction. This also suggests that the pupils realized the advantages of being in a small group and that they somehow acknowledge the improvement of their reading performance which brought about by their participation in the small group instruction.

With regards to the result above, Hughes and Moody as cited in Young (2008) found in their a meta-analytic review that students in small groups or in peer tutoring made impressive gains in decoding, suggesting that small group instruction may be as effective as individual tutoring. Peer tutoring, they pointed out, can be used with an entire class (e.g., classwide peer tutoring), limiting the amount of teacher time and resources needed.

Realizing the effects of small group instruction, National Research Council (2010) explained that stumbling obstacles such as absence or loss of motivation and failure to develop deep appreciation to the rewards of reading activity should be minimized if not eradicated in reading classes since these will forfeit the aims to improve the reading competence of the learners.

Problem 4: The Reading Intervention Program

The findings of the study indicate that a reading intervention program if effectively implemented, can improve the pupils’ reading performance. Attached is the proposed reading intervention program for the Grade 6 pupils whose reading levels are in grades 3-5.

LOCALIZED READING INTERVENTION PROGRAM

Rationale

Excellent reading skill is exceptionally indispensable in the diverse learning areas. It is a paramount avenue of an individual in acquiring basic knowledge and life skills. It allows the pupil to access the breadth of curriculum. Further, the pupil’s language and communication skills are greatly harnessed through skillful reading. Posing these, a pupil can likewise develop self-confidence. Thus, developing the reading skills both in word recognition and comprehension must be given due attention by the educators.

Annually, the Philippine Informal Reading Inventory is conducted to assess the reading level of the school children. Data show that there are pupils whose reading level is below from the grade level that they are in. It remains to be a challenge to the

classroom teachers on how to help these pupils attain good reading skills. To address this concern, reading intervention must be effectively done.

Based on researches, small group instruction is an effective strategy to respond to the pupils' difficulty in reading. In this strategy, the teacher can employ varied teaching techniques to carry out small group instruction. To mention, he can administer brainstorming, think pair and share, and cooperative learning activities. Pupils may be allowed to read aloud or silently, in a group or individually. Vocabulary-building can also be achieved through unlocking of difficulties. With this strategy, the pupil is given intervention based on his reading level with his classmates who belong to the same level. He will be given appropriate reading materials which can easily activate his schema making him ready to interact with the text.

Objective: To improve the reading performance of Grade 6 Pupils with Grade 3 Reading Level through Small Group Instruction

PROGRAMME MATRIX for Grade 3 Reading Level

| Activities | Persons Involved | Time Frame | Materials Needed | Source of Fund | Performance Indicator |
|---|--|--|---|----------------------------|--|
| Conduct of Group Screening Test | School Reading Coordinator, Teacher, Pupils | June | Printed Materials for Group Screening Test | School MOOE | 100% of the Pupils had taken the Group Screening Test for Grade Six in English |
| Conduct of Graded Passages Pre-Test | School Reading Coordinator, Teacher, Pupils | July | Printed Materials for Graded Passages Pre-Test | School MOOE | 100% of the Pupils who scored 0-13 in the Group Screening Test had taken the Graded Passages Pre-Test |
| Conduct of Reading Intervention Program through Small Group Instruction (Explicit Teaching) | Teacher, Pupils | August (Monday and Tuesdays) | CAI/Printed Materials from the Developing Reading Power 3, Skill A Noting Details Exercises 9-24 | HRPTA Fund, School MOOE | 100% of the Pupils had attended the Reading Intervention through Small Group Instruction and had answered 80% of the reading exercises |
| | Teacher, Pupils | September (Monday and Tuesdays) | CAI/Printed Materials from the Developing Reading Power 3, Skill A Noting Details Exercises 25-40 | HRPTA Fund, School MOOE | 100% of the Pupils had attended the Reading Intervention through Small Group Instruction and had answered 80% of the reading exercises |
| Conduct of Reading Intervention Program through Small Group Instruction (Think, Pair, and Share) | Teacher, Pupils | October (Monday and Tuesdays) | CAI/Printed Materials from the Developing Reading Power 3, Skill B Getting the Significance of a Selection Exercises 1-12 | HRPTA Fund, School MOOE | 100% of the Pupils had attended the Reading Intervention through Small Group Instruction and had answered 80% of the reading exercises |
| Conduct of Reading Intervention Program through Small Group Instruction (Brainstorming) | Teacher, Pupils | November Week 1 &2 (Monday and Tuesdays) | CAI/Printed Materials from the Developing Reading Power 3, Skill B Getting the Significance of a Selection Exercises 13-20 | HRPTA Fund, School MOOE | 100% of the Pupils had attended the Reading Intervention through Small Group Instruction and had answered 80% of the reading exercises |
| | Teacher, Pupils | November Week 3 &4 (Monday and Tuesdays) | CAI/Printed Materials from the Developing Reading Power 3, Skill C Predicting Outcome of a Given Event and Making Inferences Exercises 1-8 | HRPTA Fund, School MOOE | 100% of the Pupils had attended the Reading Intervention through Small Group Instruction and had answered 80% of the reading exercises |

| | | | | | |
|---|-----------------|---|--|-------------------------|--|
| Conduct of Reading Intervention Program through Small Group Instruction (Cooperative Learning) | Teacher, Pupils | December Week 1 & 2 (Monday and Tuesdays) | CAI/Printed Materials from the Developing Reading Power 3, Skill C Predicting Outcome of a Given Event and Making Inferences Exercises 9-16 | HRPTA Fund, School MOOE | 100% of the Pupils had attended the Reading Intervention through Small Group Instruction and had answered 80% of the reading exercises |
| Conduct of Reading Intervention Program through Small Group Instruction (Independent Reading) | Teacher, Pupils | January (Monday & Tuesdays) | CAI/Printed Materials from the Developing Reading Power 3, Skill D Reading to Follow Precise Instruction Exercise | HRPTA Fund, School MOOE | 100% of the Pupils had attended the Reading Intervention through Small Group Instruction and had answered 80% of the reading exercises |
| Conduct of Phil-IRI Graded Passages Post Test | Teacher, Pupils | February | Printed Materials on Graded Passages Post-Test | School MOOE | 100% of the Pupils had taken the Graded passages and had improved their reading skills. |

Objective: To improve the reading performance of Grade 6 Pupils with Grade 4 Reading Level through Small Group Instruction

PROGRAMME MATRIX for Grade 4 Reading Level

| Activities | Persons Involved | Time Frame | Materials Needed | Source of Fund | Performance Indicator |
|---|--|-------------------------------|--|-------------------------|--|
| Conduct of Group Screening Test | School Reading Coordinator, Teacher, Pupils | June | Printed Materials for Group Screening Test | School MOOE | 100% of the Pupils had taken the Group Screening Test for Grade Six in English |
| Conduct of Graded Passages Pre-Test | School Reading Coordinator, Teacher, Pupils | July | Printed Materials for Graded Passages Pre-Test | School MOOE | 100% of the Pupils who scored 0-13 in the Group Screening Test had taken the Graded Passages Pre-Test |
| Conduct Reading Invention Program through Small Group Instruction (Explicit Teaching) | Teacher, Pupils | August (Wednesdays) | CAI/Printed Materials from the Developing Reading Power 4, Skill A Noting Details Exercises 9-24 | HRPTA Fund, School MOOE | 100% of the Pupils had attended the Reading Intervention through Small Group Instruction and had answered 80% of the reading exercises |
| | Teacher, Pupils | September (Wednesdays) | CAI/Printed Materials from the Developing Reading Power 4, Skill A Noting Details Exercises 25-40 | HRPTA Fund, School MOOE | 100% of the Pupils had attended the Reading Intervention through Small Group Instruction and had answered 80% of the reading exercises |
| Conduct of Reading Intervention Program through Small Group Instruction (Think, Pair, and Share) | Teacher, Pupils | October (Wednesdays) | CAI/Printed Materials from the Developing Reading Power 4, Skill B Getting the Significance of a Selection Exercises 1-12 | HRPTA Fund, School MOOE | 100% of the Pupils had attended the Reading Intervention through Small Group Instruction and had answered 80% of the reading exercises |
| Conduct of Reading | Teacher, Pupils | November | CAI/Printed Materials from the Developing | HRPTA Fund, | 100% of the Pupils had attended the Reading Intervention through |

| | | | | | |
|---|-----------------|--|---|-------------------------|--|
| Intervention Program through Small Group Instruction (Brainstorming) | | Week 1 & 2 (Wednesdays) | Reading Power 4, Skill B Getting the Significance of a Selection Exercises 13-20 | School MOOE | Small Group Instruction and had answered 80% of the reading exercises |
| | Teacher, Pupils | November Week 3 & 4 (Wednesdays) | CAI/Printed Materials from the Developing Reading Power 4, Skill C Predicting Outcome of a Given Event and Making Inferences Exercises 1-8 | HRPTA Fund, School MOOE | 100% of the Pupils had attended the Reading Intervention through Small Group Instruction and had answered 80% of the reading exercises |
| Conduct of Reading Intervention Program through Small Group Instruction (Cooperative Learning) | Teacher, Pupils | December Week 1 & 2 (Wednesdays) | CAI/Printed Materials from the Developing Reading Power 5 Skill C Predicting Outcome of a Given Event and Making Inferences Exercises 9-16 | HRPTA Fund, School MOOE | 100% of the Pupils had attended the Reading Intervention through Small Group Instruction and had answered 80% of the reading exercises |
| Conduct of Reading Intervention Program through Small Group Instruction (Independent Reading) | Teacher, Pupils | January (Wednesdays) | CAI/Printed Materials from the Developing Reading Power 5, Skill D Reading to Follow Precise Instruction Exercise | HRPTA Fund, School MOOE | 100% of the Pupils had attended the Reading Intervention through Small Group Instruction and had answered 80% of the reading exercises |
| Conduct of Phil-IRI Graded Passages Post Test | Teacher, Pupils | February | Printed Materials on Graded Passages Post-Test | School MOOE | 100% of the Pupils had taken the Graded passages and had improved their reading skills. |

Objective: To improve the reading performance of Grade 6 Pupils with Grade 5 Reading Level through Small Group Instruction

PROGRAMME MATRIX for Grade 5 Reading Level

| Activities | Persons Involved | Time Frame | Materials Needed | Source of Fund | Performance Indicator |
|--|--|----------------------------|---|-------------------------|--|
| Conduct of Group Screening Test | School Reading Coordinator, Teacher, Pupils | June | Printed Materials for Group Screening Test | School MOOE | 100% of the Pupils had taken the Group Screening Test for Grade Six in English |
| Conduct of Graded Passages Pre-Test | School Reading Coordinator, Teacher, Pupils | July | Printed Materials for Graded Passages Pre-Test | School MOOE | 100% of the Pupils who scored 0-13 in the Group Screening Test had taken the Graded Passages Pre-Test |
| Conduct Reading Invention Program through Small Group Instruction (Explicit | Teacher, Pupils | August (Thursdays)) | CAI/Printed Materials from the Developing Reading Power 5, Skill A Noting Details Exercises 9-24 | HRPTA Fund, School MOOE | 100% of the Pupils had attended the Reading Intervention through Small Group Instruction and had answered 80% of the reading exercises |
| | Teacher, Pupils | September | CAI/Printed Materials from the Developing | HRPTA Fund, | 100% of the Pupils had attended the Reading Intervention through |

| | | | | | |
|---|-----------------|---|--|-------------------------|--|
| Teaching) | | (Thursdays) | Reading Power 5, Skill A Noting Details Exercises 25-40 | School MOOE | Small Group Instruction and had answered 80% of the reading exercises |
| Conduct Reading Invention Program through Small Group Instruction (Think, Pair, and Share) | Teacher, Pupils | October (Thursdays) | CAI/Printed Materials from the Developing Reading Power 5, Skill B Getting the Significance of a Selection Exercises 1-12 | HRPTA Fund, School MOOE | 100% of the Pupils had attended the Reading Intervention through Small Group Instruction and had answered 80% of the reading exercises |
| Conduct Reading Invention Program through Small Group Instruction (Brainstorming) | Teacher, Pupils | November Week 1 & 2 (Thursdays) | CAI/Printed Materials from the Developing Reading Power 5, Skill B Getting the Significance of a Selection Exercises 13-20 | HRPTA Fund, School MOOE | 100% of the Pupils had attended the Reading Intervention through Small Group Instruction and had answered 80% of the reading exercises |
| | Teacher, Pupils | November Week 3 & 4 (Thursdays) | CAI/Printed Materials from the Developing Reading Power 5, Skill C Predicting Outcome of a Given Event and Making Inferences Exercises 1-8 | HRPTA Fund, School MOOE | 100% of the Pupils had attended the Reading Intervention through Small Group Instruction and had answered 80% of the reading exercises |
| Conduct Reading Invention Program through Small Group Instruction (Cooperative Learning) | Teacher, Pupils | December Week 1 & 2 (Thursdays) | CAI/Printed Materials from the Developing Reading Power 5, Skill C Predicting Outcome of a Given Event and Making Inferences Exercises 9-16 | HRPTA Fund, School MOOE | 100% of the Pupils had attended the Reading Intervention through Small Group Instruction and had answered 80% of the reading exercises |
| Conduct Reading Invention Program through Small Group Instruction (Independent Reading) | Teacher, Pupils | January (Thursdays) | CAI/Printed Materials from the Developing Reading Power 5, Skill D Reading to Follow Precise Instruction Exercise | HRPTA Fund, School MOOE | 100% of the Pupils had attended the Reading Intervention through Small Group Instruction and had answered 80% of the reading exercises |
| Conduct of Phil-IRI Graded Passages Post Test | Teacher, Pupils | February | Printed Materials on Graded Passages Post-Test | School MOOE | 100% of the Pupils had taken the Graded passages and had improved their reading skills. |

IV. CONCLUSIONS

The central theme of the study is the effectiveness of the small group instruction as an intervention given to pupils who fell below their expected reading level. Evidence shows that a number of pupils in grade 6 level need reading remediation which as proposed in this study is the small group instruction.

Before the intervention, it was alarming to note that there were grade six pupils whose reading levels are still in grades 3, 4 and 5. However, after the intervention, the pupils' reading levels had improved in terms of their reading performance in word recognition and comprehension.

The participants of the reading intervention activity outstandingly appreciate the small group instruction. The pupils realize the advantages of being in a small group and they somehow acknowledge the improvement of their reading performance which brought about by their participation in the small group instruction.

Based on the results of the study, the researcher crafted a reading intervention program which highlighted the use of small group instruction activities. This program hopes to improve the reading performance of the pupils not just in grade six classes but it can also be used as basis in designing reading programs for all grade levels as its effectiveness was already confirmed.

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Phenomenon Work Problem Of Blind People Of Disability

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Abstract- This study purpose to explain the problem of labor disability. Disability as a minority has not received a decent job, despite having the ability, expertise in their field, as well as being regulated by law. This causes disability groups to have a low welfare level. The efforts made by the government for providing assistance to them have not been able to make them improve their lives significantly. Therefore, they are needs to be assistance, and then implementation of work programs. The target of this study is blind people. This study is using a phenomenological approach, the author has attempted to form a mentoring and doing implementation of entrepreneurship for blind people. The result is 39.5% of members are able to have jobs.

Keywords: Disability, Employment, Welfare, Assistance, Phenomenon, Target, Job

I. INTRODUCTION

Minority communities that have physical limitations to mentality which are always cultured by the majority normal community are those who cannot do anything. This view seems to be a guideline for people who feel themselves more normal to view disability from one perspective. The assumption about disability has an impact on the social construction of the community. The categorization of disabilities as persons with disabilities who are unable to carry out activities like other normal human beings makes a negative stigma for them. Obviously, the impact is on the limitations of accessibility for disability in various fields, such as education, employment, politics, social, economy and others.

Labor issues, for example, are one of the difficulties for disability in developing their potential to improve their welfare. Their low income level can be caused by limited employment. For example, disability classified as unable to see or can be called a blind person. Most of them only know their livelihood as a traveling masseur. Blind people are 43 members who are members of which almost 70% of them work as massage experts, 10% outside the work of massage experts, and the rest admire. Being a masseur is also not a steady income, they massage if there is only a call. That means they work only when needed, the income they get is not enough to meet their daily needs. Worse, plus the burden of benefits faced for those who are married and have offspring. Their cost of living is increasing. Therefore, the level of welfare of the blind people of disability is still very low.

Then, the causes that influence the problem are indicated in addition to the limited employment, there are actually fundamental factors that are so influential that the failure of an understanding

of the concept of disability from every level of society to the government. Such a concept does look easy to understand in a logical way, but it is difficult to apply in practice. The proof, first the government has not launched a regulation that is friendly to disability. Second, clear and accurate data collection has not been carried out by the local government. This causes the accommodation not to be accommodated for solving disability problems. If the disability is considered as one of the social welfare problems of 27 problems that exist, then the error lies whether it comes from the person with disability itself, or the community, or the government? Isn't it if there is a problem that arises means there is an error that appears? Simply put, our thinking comes from a phenomenon that occurs according to facts. The complexity of disability problems will actually feel lighter if the state's role is truly evenly distributed. Because the country is the right place to solve problems. Opinion "Miriam Budiardjo (2008) states that the state is a tool (agency) of the community that has the power to regulate human relations in society and regulate the symptoms of power in society. Humans live in an atmosphere of cooperation, as well as an antagonistic and contradictory atmosphere. Thus, the state deserves to be the main actor in providing solutions to problems.

Thus, the complexity of the problem of disability in one field is already complicated, not to mention if it is observed in other fields. Of course many are the contributing factors. Therefore, we feel this is interesting to discuss and observe. In this scientific work we describe it with explanations to explain the phenomena that occur. We used previous observations as a barometer to discuss the problem. Our facts can be obtained from the results of observations and interviews that we conducted in several government institutions and the secretariat of the foundation. In solving disability problems, of course, there needs to be a role for many parties not only the state, but non-governmental organizations that help the role of the government. There are several goals that we want to achieve in this regard:

a. Know and explore social problems in the field of disability; b. Identifying employment problems as a factor in the welfare level of disability groups; c. Helping government for solving social problems; d. Providing alternative solutions for resolving employment problems for blind people of disabilities.

II. METHOD

The method used in this study is a qualitative research method with a phenomenological approach. These methods and approaches are used to explore the problems that occur more

deeply. Our team tries to get into their daily lives. We see and observe real events. According to "Sugiyono (2017), explains that qualitative research methods are research methods based on positivism philosophy, used to examine the condition of natural objects, (as opposed to experiments) where the researcher is a key instrument, purposive sampling of data sources and snowbaal, a collection technique with triangulation, data analysis is inductive / qualitative, and the results of qualitative research more suppress the meaning than generalization".

According to the phenomenological approach according to "Yanuar (2014) states that researchers in the view of phenomenologists try to understand the meaning of events and their relationships to ordinary people in certain situations. Phenomenological sociology is basically very influenced by the views of Edmund Husserl and Alfred Schultz. Other influences come from Weber which emphasizes *verstehen*, namely the interpretive understanding of human understanding ". Our team observes issues that do affect aspects of the life of the disability at YMHIT which occur as events that will provide useful meaning. Through data collection techniques by interviewing the target of observation, then processing the results into theoretical facts to describe the meaning that occurs.

III. RESULTS AND DISCUSSION

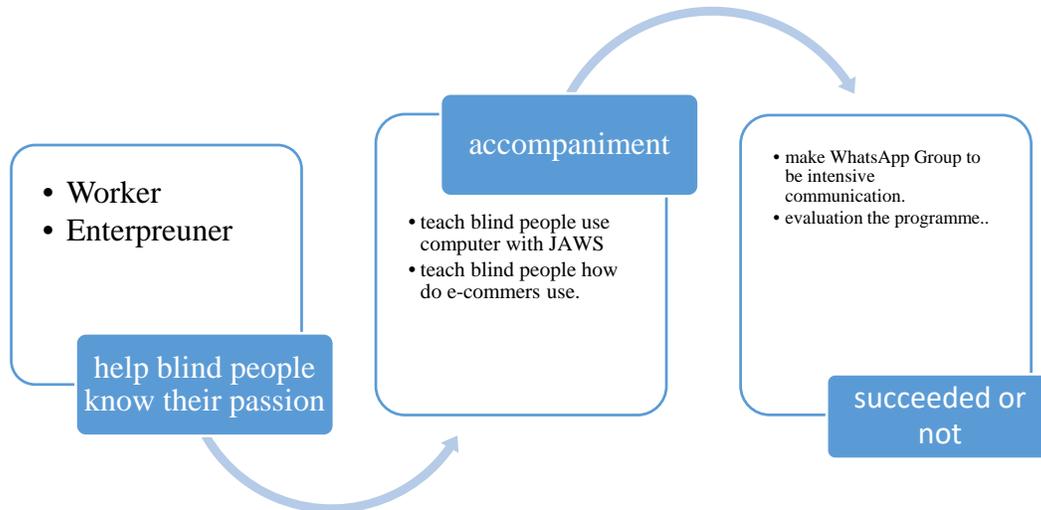
The concept of disability was introduced to strengthen the planting of views to the community. The concept is the process of interpreting someone who has physical and mental limitations that are considered the same by all circles. Disability has the right to have handling and service from various parties as well as non-disabled in general. Thus, the word defect must be replaced by the concept of the meaning of disability. This includes efforts to enable disability to carry out activities like humans that are considered normal. As a result of the notion that humans with disabilities are unable to do anything is very broad to their productivity performance. Not many of them are able to work well and generate enough income to support their families. It's a heavy burden to improve their standard of living.

Normally the equality of persons with disabilities is regulated in Law number 8 of 2016. Persons with disabilities have the right to get equal opportunities to obtain services and access in various aspects of life by obtaining special facilities and infrastructure without discrimination. For example, in employment. Persons with disabilities are required to receive guarantees in the process of recruitment, admission, job training, work placement, work continuity, and career development that is fair and without discrimination from the government. Job training institutions are inclusive and easily accessible. Then, employers in the recruitment process of workers with disabilities can take placement tests to find out their interests, talents and abilities, provide assistance in the process of filling out application forms and other processes needed, provide tools and forms of tests that are suitable for disability conditions, and provide flexibility in the time of the test operation in accordance with the conditions of persons with disabilities. Then, the government must guarantee equal access for persons with disabilities to the benefits and programs in the national social security system in the field of

employment. The Government, Regional Government, State-Owned Enterprises, and Regional-Owned Enterprises must employ at least 2% of persons with disabilities from the number of employees or workers. Private companies must employ at least 1% of persons with disabilities from the number of employees and workers. Obviously in the presentation, the right to get decent work is owned by every person with disabilities. In addition, people with disabilities have the right to access, special facilities and good infrastructure, such as buildings, are provided with elevators or sloping roads for persons with disabilities. Disability service units must be available at workplaces. This is to help strive for and optimize the productivity performance of persons with disabilities.

Actually the problem that arises is not only from the unavailability of jobs for people with disabilities, but the government's attention to them is lacking. Next we describe the results of the persons with disabilities are certainly regulated specifically by the Law, but for the regulation there is no Regional Regulation that regulates it, but this year entered the stage of the Regional Legislation Program in the House of Representative on empowerment from the aspect of employment and facilities for disability. Hopefully this year the regulation can be realized. Certainly all elements must support persons with disabilities. This means that the relationship is to make regulations in the form of regional regulations that have entered the *prolegda*. For the problem, the facility already exists in the Manpower Law. And the material has been specifically arranged to handle it, then if you want more details please ask the Social Service! Dinas Sosial is an institution that is more active in dealing with disability issues. "Then, we did an interview with the Office of Social Affairs again, along with the results of the interview." Here there are quite a lot of problems and about 27 problems. Disability included. Social services pay enough attention to disability issues by giving attention such as rehabilitation and provision of assistive devices.

Thus, it can be said that the state in the form of government has actually given attention to persons with disabilities, but it is not enough to solve labor problems. Regional regulations are still in the way, the government's attention is not only in regulatory matters, but in providing education to the general public that persons with disabilities are also able to work according to their interests and abilities. Then, the regulation is important to be realized to create a balanced life order. There is no discrimination, and respect for individual rights. The trust of the government will reach the community. The government needs to build several Integrated Service Units to provide services to persons with disabilities. Although, sometimes some circles are still confused about solving problems for disability, and one institution throws a handball at another institution, so that it can feel lightly needed by the participation of the community to help the government. There are many examples of some people with disabilities who have worked in Government Institutions or Private Companies. That is proof that state institutions, especially regional governments, play a very important role in the survival of persons with disabilities. Because what has been regulated in the law has not been implemented well, then with administrators carry out a mentoring and implementation of hands-on employment and entrepreneurship exercises. The implementation scheme is as follows:



As a result, 43 members managed to work as many as 5 people and opened as many as 12 people in the shop and online shop categories, becoming drop shipper, and marketing health products. Thus, disability does need more assistance and motivation to improve their standard of living.

IV. CONCLUSION

The human resources there cannot be optimally optimized. HR tends to choose to look for livelihoods outside the City, because it is more supportive and supportive. Although, Social Service has conducted poverty re-registration or verification of integrated social welfare data to clearly record the amount of poverty, one of the factors it is people with disabilities. The role of the state through the relevant agencies is expected to be able to work comprehensively.

The object of this study is the net disability group. Of the 43 members, 39.5% of them managed to have jobs and make their own businesses. This success is achieved due to factors: a. clear and directed procedures for implementing the program; b. increasing life motivation of training participants; c. periodic mentoring involving volunteers.

This implementation will continue until all members can get their jobs and businesses.

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Assessment of the Quality of Leather Footwear for School Children made by SMEs in Kariokor Kenya.

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Abstract- Footwear is the man-made outer covering of human foot. It is an assembly of top and bottom parts and each part is composed of various components. They are mainly produced from various materials such as textile fabric, leather and synthetics. Leather shoes contain an upper made of leather and the sole varies from leather, rubber, PVC, PU or other material. Various component plays a vital role in the quality and performance of the shoe and failure of one may affect the overall performance of the shoe. The quality of footwear is evaluated based on whether or not the shoe carries out its intended function, its effects on the wearer, and the extent to which it meets the requirements of the user. Poor quality shoe can result from poor quality of inputs, lack of quality control of the shoe during fabrication process and poor workmanship. The shoe made by SMEs in Kariokor are often not subjected to quality check hence their quality is unknown. A study was conducted to assess the quality of school children's leather shoes produced by SMEs of Kariokor market in Nairobi, Kenya. Shoe samples were collected from SMEs for laboratory analysis. Samples were analysed using IUP/IUC methods. The tests carried out were tensile and tear strength, elongation, flex endurance, thickness, distension and strength of grain, pH, sole hardness, abrasion resistance, total chromium among others. The findings indicated that the samples tested failed Kenya Bureau of Standards (KEBS) standards. Although the majority of the shoe uppers met KEBS requirements, the soles for the samples tested failed to meet the requirements. In conclusion, the shoes failed the quality tests as per the KEBS requirement. In line with the outcome, there is a need for a strategy to improve the quality of leather footwear fabricated by the SMEs in Kariokor Market.

Index Terms- KEBS, Leather, SMEs, Quality

I. INTRODUCTION

A shoe is an assembly of top and bottom parts as shown in Fig. 1 and each part is composed of various components [1]. The upper is the entire part of a shoe that covers the human foot. It consists of all parts of the shoe above the sole [2]. These parts are attached by stitches or more likely moulded to become a single unit then the insole and outsole are attached [2]. Shoe uppers are mainly produced from materials such as textile fabric, leather, synthetics among others.). A leather shoe contains an upper made of leather and the sole varies from leather, rubber, PVC, PU or other material [2]. The sole is an important part of the shoe. It is the part in contact with the ground and protects the foot from

injury thus required to have superior qualities. The quality of inputs used in the production of shoes affect the quality and hence performance of the shoe as each part plays a key role and failure of one may affect the overall performance of the shoe.

Footwear come in different kinds and for all purposes. They are used to protect human foot from injury, in fact the health of feet is largely affected by type and condition of shoes [3].



Figure 1: Anatomy of a Shoe

An accurate choice of a good quality shoes will be able to maintain the health and vitality of feet [4]. The quality of footwear is generally evaluated based on whether or not the shoe carries out its intended function, its effects on the wearer, and the extent to which it meets the requirements of the user.

Given the remarkable flexibility of the foot, it is essential that the foot be accommodated in a manner that enables it to function as designed [5]. Ergonomics dictate that good posture and other specific areas such as perception and biomimetics can be reasonably well integrated into the design and development of footwear therefore, shoe making requires high skills and diverse knowledge in many aspects that may affect the appearance, quality and the functions of a shoe. As a result, standardization of size and quality control measures are important aspects in the production of shoes [6].

Leather is flexible yet durable [7]. Its elastic, so it can be stretched yet it resists tearing and abrasion. It's a breathable material and it insulates heat, helping to regulate temperature of the foot [8]. These properties make leather shoes conform to the feet of the wearer like no other shoe material can. Hence making it widely used.

Generally, the performance properties of upper leather depend on the origin of the raw material, how it is prepared for chemical modification and how it's processed to make leather [9]. Comfort associated with a good quality leather shoe can be explained in terms of comfort provided by the structural formation of the leather together with its various physical and chemical properties [10].

Prolonged use of unsuitable shoe can lead to detrimental changes that alter the protective nature of the shoe into a barrier between the contact surface and the normal behavior of the foot [11]. These changes can lead to altered foot morphology, reduced or impaired postural stability, muscle imbalance and the development of a sensitive foot [12]. Failure to give due emphasis to footwear quality can have a negative health impact on the consumer and can also hurt the goodwill of the business organization and result in decline in market share [13]. Wrong shoes can also lead to longer lasting orthopedic problem [14]. There are common feet problems associated with poor quality shoes as shown in the subsequent figures below. Blisters and corns are as a result of ill-fitting shoes. Fit is a quality parameter in footwear technology [2].



Figure 2: Corns

II. EXPERIMENTAL PROCEDURES

A. Materials and Methods

Pairs of school children's shoes of sizes 7,8,9, 10, 12, and 13 were samples from SMEs of Kariokor market for laboratory testing. They were subjected to physical and chemical testing following IULTCS methods as outlined in the subsequent sections.

B. Visual Inspection of the Shoe

The shoe samples were visually inspected for the presence of any defects. The defects/problems were noted and pictures taken

C. Sample Preparation

The shoe samples were dismantled to obtain various clicked components. Whereby the upper parts of the shoes were separated from the bottom parts. Sampling of the upper parts was carried out in accordance with the official sampling method IUP 2, 2001 [15]. The obtained samples were subjected to physical and chemical analysis

D. Measurement of Thickness

The thickness was measured in accordance with the official method IUP 4, 2001[16].

The apparatus was placed on a flat, horizontal surface. The sample was placed in the gauge grain side up. The load was applied gently for a specified time and the thickness recorded after full loading was reached. The results were expressed in arithmetic mean. The thickness test was carried out on each of the following components of a shoe; Inner lining, insole, sock, stiffener, toe puff, upper material(leather)

E. Tensile Strength and Elongation at Break

Tensile strength was determined in accordance with IUP 6, 2001[17]. Half of the test pieces were taken in one direction and the other half at right angles to the initial directions on the upper parts of the shoes. The press knife cuts out the specimen and slot in one operation (template machine) with the angle formed at the cutting edge between the internal and external surfaces of the press knife being about 20°.

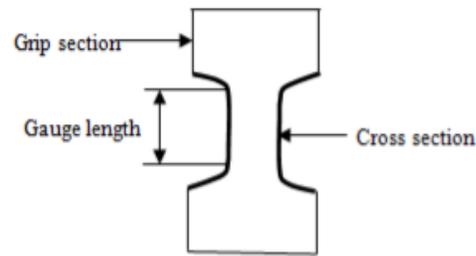


Figure 3: Dumb bell shape for Tensile Strength

The jaws of the tensile testing apparatus (Instron) was set 50 mm apart. The six test pieces were clamped in the jaws of the Instron instrument one at a time. The machine was run until the test pieces broke and the highest force exerted recorded as the breaking force.

F. Tear Strength

Tear strength was determined in accordance with IUP 8, 2001 [18].

The specimens were clamped in the jaws of a tensile test machine with the slit edge of each tongue centred in a manner that the originally cut edges of the tongue formed a straight line joining the centres. Six rectangular specimens were cut, each 5 cm long and 2.5 cm wide as shown in Figure 4. The tearing force and elongation were recorded by the machine

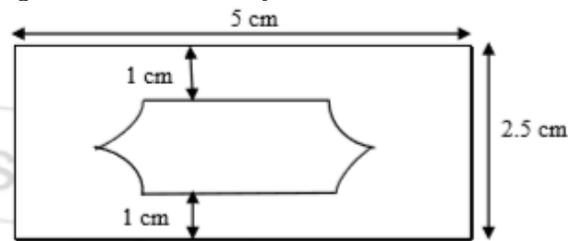


Figure 4: Dumb bell shape for Tear Strength

G. Flex Endurance

The experiment was carried out according to IUP 20, 2001[19]. The test piece was folded and clamped at each end to maintain it in a folded position in a flexometer machine. One clamp was fixed as the other moved backwards and forwards causing the fold in the test piece to run along it. The test piece was examined periodically to assess whether damage has been produced

H. Distension and Strength of Grain

This test was determined in accordance with IUP 9, 2001 [20]. A circular specimen was tightly clamped in the machine. The sample was bent, grain outwards around a mandrel of known diameter under minimum required force to keep the sample and mandrel in contact. The grain was kept under observation and any cracking noted. The machine was started by forcing the plunger at the rate of 0.2 ± 0.05 mm/s. The surface of the specimen was continuously observed at the center for initial crack on the grain. The maximum distance and force were recorded.

I. pH

The pH of the upper leather was determined in accordance with IUP 11, 2001 [21]. The ground samples were soaked in distilled water over a given period of time and the pH of the solution was be determined with a glass electrode pH meter.

J. Sole Hardness

Sole hardness was measured in accordance with ISO 7619-1. The hardness of a soling material was determined by measuring the penetration of a rigid ball into the test piece under specific condition by apparatus known as hardness tester.

K. Abrasion Resistance

Abrasion resistance of the sole was determined in accordance with IUP 26, 2001 [22]. A circular test specimen was rubbed against standard fabric abrasant under a constant force. The relative movement between the abrasant and specimen is a complex cyclic pattern which produces rubbing in all directions. The test was stopped after a prescribed number of cycles and the damage to the specimen was assessed subjectively.

L. Total Chromium Analysis

The leather uppers were ground by milling them into powder form in accordance with IUC3,2001.

Total chromium in leather was determined in accordance with IUC 18, 2001.

M. Data Analysis

The data was subjected to statistical analysis using the Statistical Package of Social Sciences (version 21.0; Inc, Chicago IL) software. One-way analysis of variance (ANOVA) was performed for all the data. Duncan's Multiple Range Test was used for the analysis to compare the mean values amongst samples. Results are presented as the mean and the standard deviation of the mean (\pm SD).

III. RESULTS AND DISCUSSION

A. Quality Analysis of the Leather Shoe

A number of quality tests were carried out on the shoe products obtained from the SMEs. The findings are discussed in the subsequent subsections below.

B. Visual Examination of Shoes

The shoe samples were visually inspected and were found to have a number of defects. The defects range from poor pattern cutting, poor finishing, poor edge treatment, poor sole attachment among others. Some of these defects are caused during production whilst others are as a result of poor-quality raw materials [1].

Fig 5. shows the defects captured on the shoe sampled and their possible causes. The defects observed were poor finishing, poor edge treatment, asymmetrical, poor sole attachment and wrinkles on the upper. The possible causes are poor workmanship during edge treatment, lasting, attachment of the sole, poor quality raw materials and accessories.



Figure 5: A pair of School Shoe

Fig. 6 shows the defects captured on the shoe sample and their possible causes. The defects observed were hole on the upper and holes on the sole. The possible causes are poor quality of sole and poor workmanship during sole attachment and finishing



Figure 6: Upper and Bottom parts of a School Shoe

Fig. 7 shows the defects captured on the shoe sample and their possible causes. The defects observed were poor edge treatment and poor stitching of upper and insole. The possible cause is poor workmanship during stitching and edge treatment.



Figure 7: Inner part of a School Shoe

Fig. 8 shows the defects captured on the inner part of the shoe sample and their possible causes. The defects observed were poor finishing on the inside of the shoe, poor attachment of insole and poor pattern cutting. The possible cause is poor workmanship during attachment of the insole and pattern cutting.

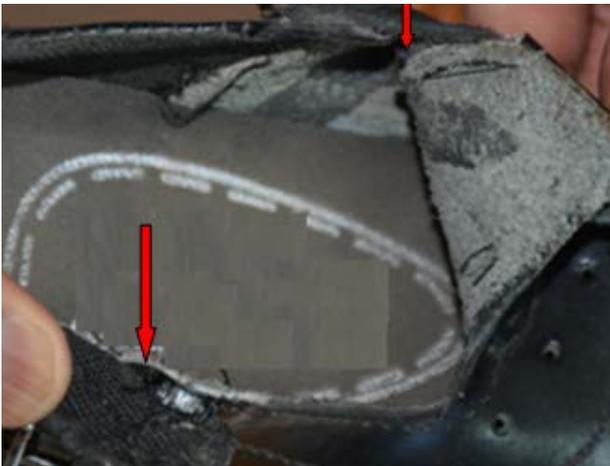


Figure 8: Inside part of a School Shoe

Fig. 9 shows defects captured on the inner part of the shoe and their possible causes. The defects observed were poor attachment of the insole, wrinkles on the insole, poor edge treatment and poor attachment of lining material. The possible causes are poor workmanship during attachment of the insole and poor edge treatment.



Figure 9: A School Shoe

Fig. 10 shows defects captured on the inner part of the shoe and their possible causes. The defects observed were poor attachment of lining material on the upper, holes on the insole and poor finishing. The possible causes are use of poor-quality adhesives and poor workmanship during attachment of the lining on the upper.



Figure 10: Inner part of a School Shoe

The above defects as shown in figures are associated with poor-quality raw materials, lack of necessary machinery and poor workmanship of the footwear SMEs with regard to unskilled or little training on shoe fabrication. The findings are in agreement with those obtained from the field survey where majority of the footwear SMEs in Kariokor use low quality adhesives and low-quality soles, they carry out hand lasting and use old machines. A number of them have not received formal training on footwear technology as they learnt the art through on job training [23].

C. Analysis of the Physical Properties of Leather Upper

The leather uppers were subjected to analysis. Triplicates were carried out for each sample and the average values are reported in subsequent tables below.

The shoe uppers were analysed and their thickness ranged between 1.78 ± 0.03 mm to 2.42 ± 0.23 mm as shown in Table 1. The results conform to the minimum required thickness of 1.00 mm recommended by KEBS. Therefore, all the leather upper for the shoe samples passed the thickness test as the values obtained were within KEBS minimum requirements. As shown in Table 1, the upper leather for shoe sample 4 presented slightly higher thickness of 2.42 ± 0.23 mm and shoe sample 1 showed a slightly lower thickness of 1.78 ± 0.03 mm than others. These results are similar to those obtained by Zengin et al. 2017 [24], whose values ranged between 0.78mm to 2.04 mm. The findings are also comparable with those of Ferrer et al. 2012 [25], whose findings were 2.2 mm. Thickness of upper leather ranges between 1.00 mm to 2.00 mm depending on the type of shoe to be made [22].

Table 1: Thickness of Upper Leather

| Sample | Thickness (mm) |
|------------------------|-----------------|
| 1 | 1.78 ± 0.03 |
| 2 | 2.02 ± 0.18 |
| 3 | 1.96 ± 0.18 |
| 4 | 2.42 ± 0.23 |
| 5 | 1.85 ± 0.20 |
| 6 | 1.82 ± 0.22 |
| KEBS standard* minimum | 1.00 |

*Kenya Bureau of Standards (KEBS) specification for thickness of leather upper

The results for tensile strength are illustrated in Table 2, and the outcome ranged from 6.26 ± 0.57 Mpa to 25.17 ± 1.23 Mpa. These values are within the minimum tensile strength requirement of 15.00 Mpa recommended by KEBS except for shoe sample 1 which recorded a significantly lower tensile strength of 6.26 ± 0.57 Mpa. These results were comparable with those Ferrer et al. 2012 [25] and their findings were 20.40 Mpa and Ali et al. 2013 [26] whose findings were 25.52 Mpa.

Tensile strength determines the structural resistance of upper leather to tensile forces hence its state and usability. During the lasting process, the footwear uppers are submitted to a tensile stress that occurs when they are pulled on the last and they have to maintain their spatial shape [27]. The variation in tensile strength among the upper leather across the shoe samples could be due to variation in origin of the raw materials, how the materials were prepared for chemical modification and how they were processed. Similarly, animal breed, sex and age, environmental conditions among others are among the factors that influence the quality of hide and the resulting leather [22].

Table 2: Tensile Strength of upper leather

| Sample | Tensile Strength (Mpa) |
|------------------------|------------------------|
| 1 | 6.26 ± 0.57 |
| 2 | 19.59 ± 0.54 |
| 3 | 23.50 ± 1.91 |
| 4 | 16.63 ± 2.55 |
| 5 | 25.17 ± 1.23 |
| 6 | 21.41 ± 1.55 |
| KEBS standard* minimum | 15.00 |

*Kenya Bureau of Standards (KEBS) specification for tensile strength of upper leather.

The results for elongation are reported in Table 3. From the results, the hedonic rating for the shoe samples ranged between $36.73 \pm 0.65\%$ to $45.39 \pm 1.41\%$. The percentage elongation for all the shoe samples were within KEBS requirement of 30-80% elongation. These results were comparable with those obtained by Ali et al. 2013 [26] and their findings were 65.48 ± 3.80 and 67.16 ± 9.42 . These findings are also similar to those of Habib, et al. 2015 [28] and their results ranged between 32.90 ± 11.72 and 46.14 ± 7.11 .

The behavior of upper leather in the manufacturing process and use is established through its elongation which determines its flexibility and elasticity and highlights the deformation capacity of upper leather during the lasting process. Upper leather should possess maximum flexibility to prevent the appearance of cracks and tears in the ball area due to prolonged motion. High elasticity allows the upper leather to withstand the elongation stresses to which it is subjected during footwear lasting, especially on the toe area [29].

Table 3: Elongation of upper leather

| Sample | Elongation (%) |
|----------------|------------------|
| 1 | 40.10 ± 0.36 |
| 2 | 37.60 ± 0.53 |
| 3 | 36.73 ± 0.65 |
| 4 | 45.10 ± 0.20 |
| 5 | 45.39 ± 1.41 |
| 6 | 43.39 ± 0.41 |
| KEBS standard* | 30-80 |

*Kenya Bureau of Standards (KEBS) specification for elongation of upper leather

The results for tear strength are shown in Table 4. Shoe sample 1 recorded the lowest value of tearing force 35.21 ± 0.72 N whereas shoe sample 5 recorded the highest value of tearing force 99.77 ± 1.21 N. As shown in Table 4, shoe samples 1 and 4 failed the tearing strength test as they recorded a tearing force of 35.21 ± 0.72 N and 38.31 ± 0.73 N respectively which is lower than the minimum tearing force of 50 N recommended by KEBS. These values are comparable with previously found results by Ali et al. 2013 [26], whose findings were 42.92 ± 7.56 N and 43.43 ± 3.56 N. However, there was a significance difference in tear strength among all the shoe samples. The observed variation could be attributed to the structural properties of the upper leather that vary depending on the origin, sex and chemical modification of the leather [30].

Table 4: Tear Strength of upper leather

| Sample | Tear Strength (N) |
|------------------------|-------------------|
| 1 | 35.21 ± 0.72 |
| 2 | 83.75 ± 2.10 |
| 3 | 70.47 ± 1.49 |
| 4 | 38.31 ± 0.73 |
| 5 | 99.77 ± 1.21 |
| 6 | 79.33 ± 1.32 |
| KEBS standard* minimum | 50.00 |

*Kenya Bureau of Standards (KEBS) specification for tear strength of upper leather

The results for pH of the leather upper are illustrated in the Table 5 below. The pH ranged from 4.08 ± 0.48 to 5.18 ± 0.60 for the

shoe samples. The upper leather for all the shoe samples had a pH within the range except sample 3 which recorded a pH higher than the recommended pH range of 4.0-4.5 by KEBS. However, the pH level of shoe samples 2 and 6 were within the range of 4.5-5.0 and in agreement with literature reports [22], where the recommended pH should be 4.8 to 5. pH indicates the acidity of the upper leather and possible oxidation of chromium oxide.

Table 5: pH of upper leather

| Sample | pH |
|----------------|-------------|
| 1 | 4.14 ± 0.33 |
| 2 | 4.57 ± 0.43 |
| 3 | 5.18 ± 0.60 |
| 4 | 4.08 ± 0.48 |
| 5 | 4.45 ± 0.54 |
| 6 | 4.6 ± 0.36 |
| KEBS standard* | 4.00-4.50 |

*Kenya Bureau of Standards (KEBS) specification for pH of upper leather

The results for distension at grain crack are shown in Table 6. From the results, shoe sample 1 recorded lowest value of 6.30 ± 0.19 mm whereas shoe sample 4 recorded highest value of 7.90 ± 0.07 mm. Shoe samples 1, 2 and 5 failed the distension at grain test as they recorded values of 6.30 ± 0.19 mm, 6.52 ± 0.17 mm and 6.91 ± 0.05 mm respectively, which are lower than the minimum value of 7.00 mm recommended by KEBS. Shoe samples 3, 4 and 6 passed the distension at grain test. These results are compared with those of Ali et al. 2013 [26] whose findings were 9.46 ± 0.42 mm and 10.22 ± 0.74 mm. These findings are also similar to those of Habib et al. 2015 [28], whose findings ranged between 6.60 ± 0.32 mm and 8.54 ± 0.30 mm.

The distension at grain crack test is intended particularly for use with shoe upper leather where it gives an evaluation of the grain resistance to cracking during top lasting of the shoe uppers. The resistance of the grain to cracking depends on the humidity content of the leather, the test is performed on conditioned leather, low results can give good information to the shoe manufacturer about the need to humidify, damp or wet the leather before lasting [22].

Table 6: Distention at Grain Crack of upper leather

| Sample | Grain Crack (mm) |
|------------------------|------------------|
| 1 | 6.30 ± 0.19 |
| 2 | 6.52 ± 0.17 |
| 3 | 7.06 ± 0.14 |
| 4 | 7.90 ± 0.07 |
| 5 | 6.91 ± 0.05 |
| 6 | 7.33 ± 0.55 |
| KEBS standard* minimum | 7.00 |

*Kenya Bureau of Standards (KEBS) specification for distension at grain crack of upper leather

The results for flex endurance of upper leather are illustrated in Table 7. From the results, all the shoe samples had no cracks at 50,000cycles which is the minimum required number of flexes before a leather upper cracks during flexing as recommended by KEBS. Flex resistance test determines the resistance of a material to cracking and other types of failure on flexing. The results imply that the upper leathers for the shoes sampled were potential for the

manufacture of footwear as they can withstand maximum flexes during walking.

These results are compared with those obtained by Ferrer et al. 2012 [25], whose leather had no cracks at 200,000 cycles.

Table 7: Flex Endurance of upper leather

| Parameter | Upper leather | | | | | |
|----------------|---|---|---|---|---|---|
| Sample | 1 | 2 | 3 | 4 | 5 | 6 |
| Flex endurance | No damage After 150,000 | No damage After 150,000 | No damage After 150,000 | No damage After 150,000 | No damage After 150,000 | No damage After 150,000 |
| KEBS Standard* | No damage after 50, 000 cycles | No damage after 50, 000 cycles | No damage after 50, 000 cycles | No damage after 50, 000 cycles | No damage after 50, 000 cycles | No damage after 50, 000 cycles |

*Kenya Bureau of Standards (KEBS) specification flex endurance of upper leather

D. Analysis of Dimensions of other Shoe Components

The shoe components were subjected to dimensional analysis. Triplicates were carried out for each sample and the average values are reported in subsequent tables below.

The results for thickness of lining material are illustrated in Table 8. The thickness ranged between 0.43±0.11 mm to 1.06±0.79 mm. A wide range of thickness of lining materials across the shoe samples was observed. However, all the linings for the shoe samples passed the thickness test as they recorded a thickness higher than the recommended thickness of 0.6 mm by KEBS except shoe sample 2. The variation in thickness of the lining could be attributed to the fact that the linings were made of different materials obtained from different sources

Table 8: Thickness of lining material

| Sample | Lining (mm) |
|------------------------|-------------|
| 1 | 0.87±0.09 |
| 2 | 0.43±0.11 |
| 3 | 0.75±0.12 |
| 4 | 0.62±0.09 |
| 5 | 0.98±0.27 |
| 6 | 1.06±0.79 |
| KEBS standard* minimum | 0.60 |

*Kenya Bureau of Standards (KEBS) specification for thickness of lining material.

The results for the thickness of insole are illustrated in Table 9. Shoe sample 1 recorded the highest value of thickness of 2.38±0.02 mm whereas shoe sample 2 recorded the lowest value of thickness of 1.04±0.06 mm. Shoe samples 2, 3 and 5 recorded a thickness lower than minimum thickness of 1.50 mm recommended by KEBS, while shoe samples 1, 4 and 6 recorded a thickness that is higher than the minimum requirement. Samples 1, 4 and 6 passed a thickness test. There was a significance difference in thickness of the insole across the shoe samples. This could be attributed to the fact that the insoles were obtained from

different sources hence processed differently and their thickness varied significantly.

Table 9: Thickness of Insole

| Sample | Insole (mm) |
|------------------------|-------------|
| 1 | 2.38±0.02 |
| 2 | 1.04±0.06 |
| 3 | 1.11±0.20 |
| 4 | 1.98±0.11 |
| 5 | 1.30±0.07 |
| 6 | 1.60±0.51 |
| KEBS standard* minimum | 1.50 |

*Kenya Bureau of Standards (KEBS) specification for thickness of insole.

Toe puff retains the last shape and solidify the toe portion of the shoe. As shown in Table 10, the thickness of the toe puff for the shoe samples ranged between 1.01±0.21 mm to 1.72±0.34 mm. The toe puff of shoe samples 5 and 6 passed a thickness test as they recorded a thickness that is higher than the minimum thickness of 1.30 mm recommended by KEBS. However, the toe puff of shoe samples 1, 2, 3 and 4 failed the thickness test as the toe puffs recorded a thickness lower than the minimum required thickness of 1.30 mm recommended by KEBS.

Stiffeners are usually inserted at the counter/seat portion of the shoe to keep the shape of the shoe intact. As illustrated in Table 10, the stiffener for shoe sample 2 recorded the lowest value of 0.56±0.20 mm for thickness whereas the stiffener for the shoe sample 1 recorded the highest value of 1.31±0.39 mm for thickness. The stiffener for shoe sample 2, 3, 5 and 6 failed a thickness test as they recorded a thickness lower than the minimum thickness of 1.00 mm recommended by KEBS. However, the stiffener for shoe sample 1 and 4 passed the thickness test as they recorded a thickness higher than the minimum thickness recommended by KEBS.

Table 10: Thickness of Toe puff and Stiffener

| Sample | Toe puff | Stiffeners |
|------------------------|-----------|------------|
| 1 | 1.01±0.21 | 1.31±0.39 |
| 2 | 1.25±0.40 | 0.56±0.20 |
| 3 | 1.22±0.10 | 0.84±0.14 |
| 4 | 1.03±0.18 | 1.20±0.22 |
| 5 | 1.32±0.16 | 0.97±0.18 |
| 6 | 1.72±0.34 | 0.78±0.08 |
| KEBS standard* minimum | 1.30 | 1.00 |

*Kenya Bureau of Standards (KEBS) specification for thickness of toe puff and stiffeners

The results for thickness of the sock are shown in Table 11. The values ranged from 0.98±0.10 mm to 2.01±0.2 mm. All the sock for the shoe samples passed a thickness test as they recorded a thickness higher than the minimum thickness of 0.8 mm recommended by KEBS. The variation in thickness of the insole across the shoe samples could be attributed to the fact that the materials are from different sources thus possess different properties

Table 11: Thickness of sock

| Sample | Sock (mm) |
|------------------------|-----------|
| 1 | 0.98±0.10 |
| 2 | 2.01±0.25 |
| 3 | 1.24±0.08 |
| 4 | 1.77±0.60 |
| 5 | 1.71±0.25 |
| 6 | 1.63±0.08 |
| KEBS standard* minimum | 0.80 |

*Kenya Bureau of Standards (KEBS) specification for thickness of sock

E. Analysis of Physical Properties of Soles

The shoe soles were subjected to physical analysis. Triplicates were carried out for each sample sole and the average values are reported in subsequent tables below.

The results for tensile strength of the soles are shown in Table 12. The outcome ranged between 4.80 ± 0.74 Mpa to 7.6 ± 1.19 Mpa. Shoe samples 3 and 5 failed the tensile strength test as they recorded as tensile force of 4.80 ± 0.74 Mpa and 7.6 ± 1.19 Mpa respectively which is lower than the minimum tensile strength of 6.00 Mpa recommended by KEBS. This indicates that based on the effectiveness of the sole to tensile force, the two samples were not fit for use. However, shoe sample 1, 2, 4 and 6 passed the tensile strength test as they recorded a value which is above the minimum tensile strength required by KEBS. The results for tensile strength reveal information about the mechanical properties of the sole material. When a sole material can no longer withstand the stress applied on it, it causes failure or excessive deformity [2].

Based on elongation of the sole as shown in Table 12. Shoe sample 3 recorded the lowest value of 149.00± 1.00% while shoe sample 1 recorded the highest value of 256.00 ±1.00%. However, all the soles for the shoes sampled passed the elongation test as they recorded a percentage elongation which is higher than the minimum required elongation of 100% recommended by KEBS. Elongation of a sole until it breaks helps to obtain the material's complete tensile profile. It highlights the deformation capacity of the sole material.

Table 12: Tensile Strength and Elongation of sole

| Sample | Tensile Strength (Mpa) | Elongation (%) |
|------------------------|------------------------|----------------|
| 1 | 6.26 ± 0.57 | 256.00±1.00 |
| 2 | 7.57 ± 1.20 | 187.00± 2.00 |
| 3 | 4.80 ± 0.74 | 149.00± 1.00 |
| 4 | 6.35 ± 0.90 | 212.00± 2.00 |
| 5 | 5.58 ± 0.53 | 203.33 ± 3.51 |
| 6 | 7.60 ± 1.19 | 220.67 ± 2.08 |
| KEBS standard* minimum | 6.00 | 100 |

*Kenya Bureau of Standards (KEBS) specification for tensile strength and elongation

The sole hardness ranged from 31.90 ± 1.73 to 52.87 ±2.30 as shown in Table 13. All the soles for the shoe samples failed the hardness test as they recorded hardness lower than the

recommended range of 50-60 by KEBS except shoe sample 6. This sample had a hardness of 52.87 ± 2.30 that is within the range of 50-60 recommended by KEBS. However, based on ISO requirements for the shoe soles, all the soles for the samples tested failed a hardness test as they recorded hardness lower than the recommended range of 58-74 by ISO standards [22]. The hardness of the sole influence the comfort and safety of the shoe. Flexing is also affected by hardness. A thin soft sole may not withstand mechanical irresolution whereas a hard-sole will be discomfort for flexing as well as tendency to slippery, it also relates to the durability due to variability in abrasion resistance which results to poor wear resistance [2]. As a result, hardness within the range is required

Table 13: Hardness of sole

| Sample | Hardness IRHD (N) |
|----------------|-------------------|
| 1 | 35.17 ± 1.07 |
| 2 | 31.90 ± 1.73 |
| 3 | 43.64 ± 0.68 |
| 4 | 46.76 ± 1.13 |
| 5 | 38.07 ± 1.68 |
| 6 | 52.87 ± 2.30 |
| KEBS standard* | 50-60 |
| ISO standard** | 58-74 |

*Kenya Bureau of Standards (KEBS) specification for sole hardness

The results for abrasion loss are illustrated in Table 14. All the soles for the shoe samples failed the abrasion resistance test as they recorded values higher than 450mm^3 maximum value recommended by KEBS. This indicates that, based on abrasion resistance parameter, the soles for the shoe sampled were not fit for use. However, the study reported a higher variation in abrasion resistance across the shoe samples as there was a significance difference in abrasion resistance among all the shoe sampled. Even

Table 15: Total chromium of upper leather

| Sample | Total Cr (mg/kg) |
|--------------------------------|------------------|
| 1 | 38.70 ± 0.86 |
| 2 | 2.80 ± 0.27 |
| 3 | 2.00 ± 0.33 |
| 4 | 8.60 ± 0.79 |
| 5 | 8.60 ± 0.79 |
| 6 | 38.50 ± 0.17 |
| KEBS standard* detection limit | 30.00 |

*Kenya Bureau of Standards (KEBS) specification for shoe uppers

IV. CONCLUSION

The sampled footwear fabricated by SMEs in Kariokor failed to meet the KEBS standards. The defects result from poor workmanship and poor-quality soles. Even though some leather upper passed the recommended values, the whole product did not.

IV. RECOMMENDATION

Owing to the failure of the shoe to pass the KEBS requirement

though the soles were obtained from the same company, the process modification involved during manufacturing is different [1]. Thus, leading to variation in the abrasion resistance across the soles.

Table 14: Abrasion loss of sole

| Sample | Abrasion Loss (mm^3) |
|------------------------|---------------------------------|
| 1 | 695.00 ± 2.00 |
| 2 | 570.00 ± 1.00 |
| 3 | 587.00 ± 2.00 |
| 4 | 765.00 ± 2.00 |
| 5 | 471.00 ± 2.00 |
| 6 | 909.00 ± 1.00 |
| KEBS standard* Maximum | 450 |

*Kenya Bureau of Standards (KEBS) specification for shoe uppers

Analysis of Total Chromium in Upper Leather

Total chromium was analysed in the upper leathers. Triplicates were carried out for each sample and the average values are reported in table below.

The findings for total chromium content are illustrated in Table 15. The upper leather for shoe sample 1 and 6 recorded a value of 38.70 ± 0.86 and 38.50 ± 0.17 respectively that exceeded the permissible limit of extracted 30 mg of chromium per kg leather material as recommended by KEBS. This indicates that the two shoe samples would pose potential risk to the wearer. These results are in partial agreement with the results reported by Rezig, et al, 2009 [30]. As the results obtained exceeded the permissible value of 50.00 mg/kg of total chromium in leather.

The presence of chromium in chromium-tanned leather represents a considerable health problem as indicated in literature [31]. For this reason, they may pose a serious health problem. It is recommended to avoid direct contact of shoes with the skin. Also, there is need for quality analysis of upper leather prior to shoe fabrication.

there is need for the SMEs to be sensitized on the need of quality checks and quality assurance mechanism on footwear manufacture. Also, a corrective measure and strategy to be instituted to help SMEs in producing quality products.

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The Effect of Social Science Learning Using Group Investigation Model On Critical Thinking Ability of Students at SMPN 13 Malang

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Abstract- This study aims to analyze the differences in critical thinking skills of students who follow the group investigation learning model with direct learning models. This is done to find the influence of group investigation learning model on students' critical thinking abilities. This study uses a quasi-experimental design. The study population was all students of class VII of SMP 13 Malang City 2018/2019 school year as many as 240 students. The research sample was students of class VII-H and VII-I (59 students). Research instruments are essay questions to measure students' critical thinking skills. The data analysis technique applied was the t-test on the SPSS 21 program. The results showed that the average critical thinking ability of students in the post-test in the control group was 79.88, while the experimental group was 85.97. In addition, the significance value obtained was 0.000 (<0.05) so that the research hypothesis was accepted. Thus, it can be concluded that there is a significant increase in critical thinking skills in students who follow the group investigation learning model with a direct learning model.

Index Terms- Group Investigation Learning Model, Critical Thinking Ability

I. INTRODUCTION

Social science (IPS) is a compulsory education which has an important role in improving the quality of education. In accordance with its sociological foundation, IPS education provides a system of fundamental ideas to determine the ideals, needs, interests, strengths, aspirations, and patterns of future life through social interactions experienced by students (Sapriya 2015). In this case, the consequence is that the social studies learning process must be able to help students build competence as an important provision in social life.

The process of social studies learning in schools so far is still dominated by memorization methods, which causes students to get bored with what they learn. In addition, the teacher still dominates learning by the lecture method rather than the skills to process and understand the material independently. Social studies learning consists of concepts and theories that examine the relationship between humans to develop responsibility in a democratic country, so that it requires critical thinking in analyzing it (Nasution, 2011). This means that the implementation

of social studies must be able to help students develop their potential and competencies, both cognitive, affective, or psychomotor potential. Thus, they will be able to face the environment in which they live today until later in the future.

One of the fundamental challenges in social studies learning at this time is to look for learning models that can motivate students to participate in learning, and develop their thinking skills (Sapriya, 2015). This is considered important to provide space for students to learn independently and develop their abilities. Based on Law No.20 of 2003, education is a conscious and planned effort to develop the abilities and potential of students to become human beings who believe and fear God Almighty, have a noble character, are healthy, knowledgeable, capable, creative, independent, and become a democratic and responsible citizen. This can be interpreted that in teaching and learning activities, children are the subject and object of teaching activities. The core of the teaching process is nothing but the learning activities of students in achieving one teaching goal. The purpose of teaching, of course, will be achieved if students play an active role with the help of teachers who are creative in creating a pleasant learning atmosphere.

Several studies on investigation group learning models have been carried out in various countries, both in Indonesia and in other countries. In Indonesia, previous research conducted by Laila (2010) found that there was a significant effect between group investigation learning models on mathematics learning achievement in the material of building flat side spaces. Furthermore, Hadi's research (2016) shows that there is a significant influence between the application of the group investigation learning model and audio-visual assistance to the social studies learning outcomes of grade VI elementary school. In other countries, research has been conducted in Singapore by Ivy Geok Chin Tan (2010), and the results show that there is a significant influence between group investigation learning models on student learning motivation. Some previous research studies can be used as a comparison so that this research is expected to be an empirical development related to students' critical thinking skills through the application of the Group Investigation model. Sutikno (2014) revealed that the investigation group learning model is a learning model that involves students, starting from planning, both in determining a topic to how to learn it through investigation. In addition, this learning model also emphasizes

students to search for topics through various problems that exist in society. The purpose of the group investigation learning model is to develop student participation in a democratic social process by combining attention to abilities between personal (group) and academic curiosity in the learning process. In the group investigation model, it is assumed that the atmosphere of a class is an analogy of the life of a society in which it has an order, order, and culture. Here students strive to maintain a developing order in the classroom, namely the standard of living and hope that grows in the class.

The investigation group learning model can be used by teachers to develop critical thinking skills and student learning motivation in groups to solve problems. Cooperative learning models are designed to help the distribution of responsibilities when students follow learning oriented towards the formation of social humans (Manufen, as cited in Rusman, 2012). In this case, the GI cooperative learning model was deemed by the researcher in accordance with the conditions of the problems experienced by Malang City Middle School 13 students. If examined, the study of social studies learning has a close relationship with the problems that occur in society. So, it is expected that the use of the experimental group learning model can make students more active in the learning process. As a result, in addressing a problem, students can make wise decisions now until later in the future.

Cognitive learning theory implies that different processes regarding learning can be explained by analyzing mental processes first. This suggests that with effective cognitive processes, learning becomes easier and new information can be stored in memory for a long time. On the other hand, ineffective cognitive processes result in learning difficulties that will be seen during a person's lifetime (Asri, 2012). The essence of cognitive learning theory is learning does not have to be teacher-centered, but students must be more active. Therefore, students must be guided so they actively find something they have learned. Consequently, the material studied must attract students' interest in learning and challenge it so that they are absorbed and involved in the learning process. This is in accordance with the group investigation learning model This study aims to describe the differences in critical thinking skills of students who take social studies with group investigation models with direct learning.

II. METHOD

This study uses a quantitative approach with a quasi-experimental method. The quasi-experimental method is a typical research method in education that examines the practical conditions in which it is impossible to control all relevant variables. The aim is to overcome difficulties in determining the control group used in the study (Sugiyono, 2010: 77).

In its implementation, this research will be divided into two groups, namely the experimental class and the control class. The experimental class group was a group of students who received treatment using the investigation group learning model while the control group was a group of students who received treatment using the direct learning model. The design of this study can be illustrated in Table 1.

Table 1.
Research design (pretest, posttest, non-equivalent control group)

| Group | Pretest | Treatment | Posttest |
|------------|----------------|-----------|----------------|
| Experiment | O ₁ | P | O ₂ |
| Control | O ₁ | Q | O ₂ |

(Source: Sugiono, 2008:116)

Note:

- O₁ = Pretest
- O₂ = Posttest
- P = Treatment using group investigation model
- Q = Treatment using direct learning Method

This research was conducted at Malang State Junior High School 13 which is located at Jl. Sunan Ampel 2, RT.9 / RW.2, Dinoyo, Kec. Lowokwaru, Malang City from February to March 2019.

The population in this study were all students of class VII of SMP 13 Malang City in the 2018/2019 school year which amounted to 240 students. The technique used in collecting samples is cluster random sampling because the selected groups represent the population and involve all individuals in the group as subjects. The samples in this study were students of class VII-I (30 students) as an experimental class and students of class VII-H (29 students) as a control class.

The data collection instruments used are observation and test sheets. The observation sheet was used as an observation guideline to measure the learning implementation of the group investigation learning model for the experimental class and the direct learning model for the control class. In addition, the test used in the form of a written test in the form of description to measure students' critical thinking skills at the time of the pretest and posttest. These test questions are based on indicators that are in accordance with the learning material.

Analysis of the data used is the t-test. Before the t-test is carried out, a prerequisite test is first performed, namely the test for normality and homogeneity. If both classes have normal and homogeneous data distribution, then the t-test is carried out with the SPSS 21 program. Testing criteria are, (1) If tstatistics is smaller than t_{table} ($t_{statistics} < t_{table}$) then the alternative hypothesis (H_a) is rejected. (2) If tstatistics is greater than t_{table} ($t_{statistics} > t_{table}$), the alternative hypothesis (H_a) is accepted.

III. RESULT AND DISCUSSION

Data on students' critical thinking skills taken from tests of critical thinking skills that have been validated and tested are then applied to class VII students of SMP N 13 Malang City. This research is an experimental study involving two classes, namely the experimental class that uses the group investigation learning model, and the control class with the direct learning model.

Data calculation or processing is carried out with SPSS 21 program. The data presented in this study are data from the results of tests of students' critical thinking skills with group investigation and direct learning model learning. The description of the data presented is in the form of a mean, standard deviation, minimum value and maximum value which includes the results of tests of students' critical thinking skills; pre-test results (control class), post-test results (control class), pre-test (experimental class), and post-test (experimental class). The results of the descriptive analysis are shown in table 2.

Table 2.
Descriptive analysis of students' critical thinking abilities

| Descriptive | Experiment | | Control | |
|-------------|------------|----------|---------|----------|
| | Pretest | Posttest | Pretest | Posttest |
| Total (N) | 30 | 30 | 29 | 29 |
| Min | 41,67 | 75,00 | 41,67 | 75,00 |
| Max | 91,67 | 95,83 | 91,67 | 91,67 |
| Mean | 63,61 | 85,97 | 64,08 | 79,88 |
| Std. Dev | 15,70 | 6,61 | 15,64 | 5,57 |

In the experimental class using the investigation group model, the average pre-test critical thinking ability was obtained by 63.61 with a standard deviation of 15.70. The minimum value on the pre-test critical thinking ability is 41.67 with a maximum value reaching 91.67. Critical thinking ability has increased after giving treatment (post-test) to reach an average of 85.97 with a standard deviation of 6.61. The minimum value of this post-test critical thinking ability is 75.00 with a maximum value reaching 95.83.

In the control class using the direct learning model, the average pre-test critical thinking ability was obtained by 64.08 with a standard deviation of 15.64. The minimum value on the pre-test critical thinking skills is 41.67 with a maximum value reaching 91.67. Critical thinking ability has increased after giving treatment (post-test) to reach an average of 79.88 with a standard deviation of 5.27. The minimum value of post-test critical thinking skills is 75.00 with a maximum value reaching 91.67.

Before the two mean similarity tests were carried out, first a test was conducted on the distribution of research data, namely the normality test using the Kolmogorov-Smirnov method. If the research data is normally distributed, then the data testing is done using parametric methods. Conversely, if the data is not normally distributed, then testing the research data using non-parametric methods.

The basis for decision making from the Kolmogorov-Smirnov test is to use a significance value (p-value) compared to the 0.05 significance level. If the significance value is < 0.05, then the data distribution is not normal. If the significance value is > 0.05, then the data distribution is normal. The results of the normality test of students' critical thinking skills are as follows:

Tabel 3
Normality test on the data of critical thinking ability

| Group | Data | Kolmogorov - Smirnov | Sig. | Interpretation |
|------------|----------|----------------------|-------|---------------------|
| Control | Pretest | 1,107 | 0,172 | Normal distribution |
| | Posttest | 1,203 | 0,111 | Normal distribution |
| Experiment | Pretest | 1,056 | 0,215 | Normal distribution |
| | Posttest | 0,866 | 0,442 | Normal distribution |

Based on the results of the normality test, obtained a significance value (p-value) greater than 0.05 in both the pre-test (0.215) and post-test (0.442) in the experimental group (group investigation learning model). In addition, the pre-test data in the control group (direct learning model) is 0.172, and in the post-test is 0.111. So that it can be concluded that the data of Critical Thinking Ability students have a normal distribution.

After the normality test is carried out, the homogeneity test is then carried out using the Levene test method to find out the variety of research data in each group that will be compared. The basis of decision making is using a significance value (p-value) with a real level of 0.05. If the significance value is < 0.05, then the two data are not homogeneous. If the significance value is > 0.05, then the data of the two groups are declared homogeneous. The homogeneity test results are presented as follows:

Tabel 4
Homogeneity test on the data of critical thinking ability

| Variabel | Levene Statistics | Sig. | Interpretation |
|----------|-------------------|-------|----------------|
| Pretest | 0,02 | 0,968 | Homogenous |
| Posttest | 1,160 | 0,232 | Homogenous |

Based on the results of the homogeneity test, get a significance value (p-value) on the comparison of pre-test critical thinking skills, namely 0.968, and post-test 0.232 (> 0.05), so it can be concluded that the research data has a variety of homogeneous values.

After testing the prerequisite for normality and homogeneity, the next hypothesis test is carried out, namely

Independent Sample t-Test. The basis for decision making is to look at the t-count and the significance value (p-value). The tstatistics greater than the t table or the significance value (p-value) smaller than alpha of 0.05 indicates that there is a significant difference between the experimental class and the control class. Testing the hypothesis of students' critical thinking skills is done to know whether there are differences in students' critical thinking skills between the experimental class using the investigation group learning model and the control class using the direct learning model. The t-Test results are explained in table 5.

Tabel 5
The result of t-Test on students' critical thinking ability

| Variabel | Kelompok | N | Mean | t _{hitung} | Db | Sig |
|--------------------------------------|------------|----|-------|---------------------|----|-------|
| Critical thinking ability (pretest) | Control | 29 | 64,08 | 0,115 | 57 | 0,909 |
| | Experiment | 30 | 63,61 | | | |
| Critical thinking ability (posttest) | Control | 29 | 79,88 | 3,818 | 57 | 0,000 |
| | Experiment | 30 | 85,97 | | | |

Note: t_{table} (5%; 57) = 2,002

Table 5 shows the results of the comparison of students' critical thinking skills in the control group using the direct learning model, and the experimental group using the group investigation learning model. Obtained a t_{statistics} of 0.115 (< t_{table}) with a significance value of 0.909 (> 0.05), so that it can be stated that there is no significant difference in students' critical thinking skills at the pre-test between the control group using the direct learning model and the experimental group with the group investigation learning model.

On the comparison of the post test critical thinking skills between the control class using the direct learning model and the experimental class using the investigation group learning model, the t_{statistics} was 3,818 with a significance value of 0.000. It is known that the value of t_{statistics} > t_{table} or significance value is smaller than the real level of 5%, it is concluded that there is a significant difference in post test critical thinking skills between the control class using direct learning models and experimental classes that use group investigation learning models.

Based on the constructivism theory revealed by Vigotsky, students have Zone of Proximal Development, which means that students will be much more developed if they interact with other people. Students will never develop formal operational thinking without the help of others or find out for themselves. The investigation group learning model places more emphasis on actual development which encourages students to think critically. Actual development emphasizes how a student can do something without the help of a teacher. In other words, the teacher is only a facilitator and students themselves are looking for solutions to the problems faced. In this principle, several indicators of critical thinking ability can be seen in the group investigation model. In indicators analyzing arguments, students can express their arguments with relevance, coherent (logical) lines of thought, to

be able to analyze cases of Entrepreneurship Roles in Building Indonesian Economy based on their opinions (based on what they understand). This shows that in analyzing arguments, students have been able to express their own opinions. In addition, on indicators solving problems on the topic of "falling milk prices and decreasing apple prices in Malang", students have been able to express the ways of problems solving through various references and provide solutions by discussing with group members. This shows that actual development is very visible, where students have been able to provide solutions to the problems discussed.

Unlike the group investigation learning model, the direct learning model is more directed at potential development. In this case, a student will be able to do something or solve a problem with the teacher's instructions. In the indicator analyzing the argument, students express their arguments relevantly in analyzing the case of the Entrepreneurship Role in Building the Indonesian Economy with the help of a textbook. In indicators of problem-solving, students have been able to express the ways of solving the topic of discussion "Falling milk prices and decreasing apple prices in Malang" according to his opinion, each with a textbook guide and asking the teacher. Thus, it can be concluded that the learning model directly leads to potential development. This can be seen from the way students solve problems, where students have been able to express the ways of solving based on textbook guidelines and ask the teacher.

IV. CONCLUSION

Based on the description of the results of the study, data analysis, and hypothesis testing, it can be concluded that there are significant differences in the critical thinking skills of students who follow the group investigation learning model with the direct learning model. This is evidenced by the value of t_{statistics} > t_{table} or significance value < 5% real level. The acquisition of t_{statistics} on critical thinking skills is 3.818 with a significance value of 0.000. In the matter of critical thinking skills, there are several indicators developed to measure the level of students' critical thinking skills, namely arguing, analyzing arguments, solving problems, analyzing problems, and concluding. This is in accordance with the opinion of Vigotsky, that students must build their own knowledge in their minds. Students should learn through interaction with adults or peers who are more capable. These interactions will help form new ideas and improve children's intellectuality.

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Phytochemical, Nutritional and Antioxidant Activity Evaluation of Seeds of Almond (*Terminalia catappa* L.)

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Abstract- In the present work, the almond seeds (*Terminalia catappa* L.) of nutritional, phytochemical content and antioxidant activity were investigated. The antioxidant activity of ethanol extract was evaluated using free radical scavenging, metal chelating, ferric reducing antioxidant power and reducing power assays. Secondary metabolites including alkaloids, saponins, flavanoids, reducing sugar and phenolic content were determined in the almond seeds. Nutritional properties including moisture, ash, carbohydrates, proteins and fats content and metal content in the seeds were also estimated. The antioxidant property of ethanol extract of almond seeds was found to be high results indicated almond seeds to be a good source of nutritional and antioxidant components and hold their potential for value addition and nutraceutical development.

Index Terms- Almond, Nutrients, Antioxidant, Phytochemical

I. INTRODUCTION

All human beings require sufficient food for their growth and development and to lead an active and healthy life and it depends upon the quality and quantity of foodstuffs included in their regular diet. The quality of a food depends upon the presence of relative concentrations of various nutrients such as proteins, fat, carbohydrates, vitamins and minerals. Carbohydrates, fat and proteins are sometimes referred to as proximate principles and form the major portion of the diet while minerals play an important role in the regulation of the metabolic activity in the body. It has been established that antioxidants found in large quantities in the crude extracts of fruits, herbs, vegetables, cereals and other plant materials act as reducing agents and thereby improve the quality and nutritional value of the food. The importance of the antioxidant constituents of plant materials has also been established in the maintenance of health by acting against stress related diseases such as infections, diabetes, cancer and coronary heart disease.

Almonds come in two varieties, sweet and bitter. Sweet almonds are used in many Asian dishes, as well as dessert pastes and garnishes. A popular use for crushed sweet almonds is a European candy base called marzipan. Sweet almonds can also be processed into essential oils or extracts. The almond is very

popular tree nut. Almonds are a very good source of vitamin E, manganese, biotin and copper. Almonds are a good source of magnesium, molybdenum, riboflavin (vitamin B₂), and phosphorus. Almonds are high in healthy monounsaturated fats, fiber, protein and various important nutrients. The main aim of this research is to find out the some nutritional values, minerals and antioxidant activity of Almond (Badan) seeds.

Aim and Objectives

Aim

The aim of this research work is to determine the minerals, nutritional values and antioxidant activity of almond (*Terminalia catappa* L.) seeds.

Objectives:

- To collect almond seeds from Mandalay Township
- To determine physicochemical properties of almond seeds (pH, moisture content, ash content)
- To determine elemental analysis
- To determine the nutritional values of almond seeds (carbohydrate, protein and fat content)
- To determine the antioxidant activity of almond seeds

Botanical Description of Almond



Figure (1) Almond Tree, Fruit and Seeds

- Family name - Combretaceae
Botanical name - *Terminalia catappa* L.
English name - Almond
Myanmar name - Badan

Part used - Seeds

II. MATERIALS AND METHODS

Sample Collection

Almond seeds were collected from Mandalay Township, Mandalay Region. They were cut into small pieces and dried in air. They were stored in well stoppered bottles which were used throughout the experiment.

Preliminary Phytochemical Test of Almond Seed

The phytochemical studies of the almond seed has been tested according the standard procedure. Some of chemical compounds such as tannin, flavonoid, phenolic, alkanoid, spanning and reducing sugar were found in this almond seed

Determination of Some Nutritional Values of *Terminalia catappa* L.

The ash content, moisture content, carbohydrate content, fat content by AOAC method and protein content by macro Kjeldahl method were determined.

Investigation of Antioxidant Activity of Almond Seed

The DPPH radical scavenging activity of ethanol extracts from seed of almond was compared with ascorbic acid. DPPH radical scavenging test is based on the exchange of hydrogen atoms between the antioxidant and the stable DPPH free radical. The reduction capability of DPPH radicals was determined by the decrease in its absorbance at 517 nm, which is induced by antioxidants. The significant decrease in the concentration of the DPPH radical is due to the scavenging ability of ethanolic extract of seed of almond. Determination of radical scavenging by DPPH method based on the change in absorbance of crude extracts solutions in various concentrations. Six kinds of concentrations 2µg / mL, 1 µg/mL, 0.5 µg/ mL, 0.25µg/ mL, 0.125µg/ mL and 0.0625 µg/mL were prepared by dilution with ethanol as solvent. Ascorbic acid was used as standard sample and ethanol was employed as control. These values are used to calculate the percentage inhibition of DPPH radical against the samples. The IC₅₀ values of various extracts were calculated from the percentage inhibition at various concentrations. The results of the free radical scavenging activity of seed of were assessed by DPPH assay was summarized by IC₅₀ using method of linear regression.

Analysis of Semi Quantitative Elements

The semi- quantitative elemental analysis of *Terminalia catappa* L. (almond seed) was performed by EDXRF method.

III. RESULTS AND DISCUSSION

The phytochemical tests revealed that tannin, flavonoid, phenolic compound, alkaloid, saponin and reducing sugar were present in the sample. The observed phytochemical constituents are essential compounds for the metabolism and nutrition of human body.

The nutritional compositions of almond seeds (ash, moisture, carbohydrate, protein and fat contents) were determined and the results were shown in Table 1.

The results of the free radical scavenging activity of seed of almond were assessed by DPPH assay was summarized by IC₅₀ using method of linear regression. The lower the value of IC₅₀ the higher is the antioxidant property. It was observed that the ascorbic acid and ethanol extract of seed of almond have been illustrated in Table 2 and 3.

The elemental compositions of almond seed sample by EDXRF method results were tabulated in Table 4.

Table 1 pH, Ash Content, Moisture Content and Nutritional Compositions of Almond Seeds

| No. | Content | Analytical Method | Value |
|-----|--------------|---|--------|
| 1. | pH | pH meter | 7.4 |
| 2. | Ash | Loss of weight in ignition | 4.16 % |
| 3. | Moisture | Gravimetric method | 4.57 % |
| 4. | Carbohydrate | Phenolsulphuric acid Colourimetric method | 4.86 |
| 5. | Protein | Kjeldahl method | 24.18 |
| 6. | Fat | Petroleum Ether Extraction method | 49.75 |

From the determination of almond seeds, it was found that the amount of fat content was highest in the samples.

Table 2. Absorbance, DPPH % Radical Scavenging of Various Concentration and IC₅₀ Value of Ascorbic Acid

| Tested Sample | Concentration (µg / mL) | Absorbance (517 nm) | DPPH % Radical Scavenging | IC ₅₀ (µg / mL) |
|---------------|-------------------------|---------------------|---------------------------|----------------------------|
| Ascorbic acid | 0.0625 | 1.9969 | 44.3078 | 0.031 |
| | 0.125 | 1.7828 | 50.2761 | |
| | 0.25 | 1.6269 | 54.6268 | |
| | 0.5 | 1.4826 | 58.6513 | |
| | 1 | 1.2721 | 64.5220 | |
| | 2 | 1.1242 | 68.6468 | |

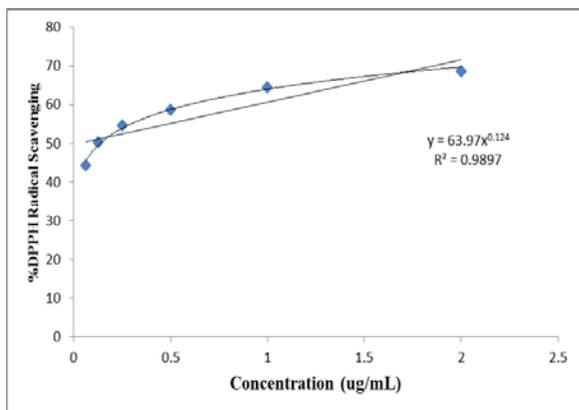


Figure (2) The Plot of DPPH % Radical Scavenging Vs Concentration (µg/mL) of Ascorbic Acid

Table 3. Absorbance, DPPH % Radical Scavenging of Various Concentration And IC₅₀ Value of EtOH Extract of Almond Seeds

| Tested Sample | Concentration (µg / mL) | Absorbance (517 nm) | DPPH % Radical Scavenging | IC ₅₀ (µg /mL) |
|---------------|-------------------------|---------------------|---------------------------|---------------------------|
| Almond seed | 31.25 | 2.0259 | 43.5000 | 35.782 |
| | 62.5 | 1.7982 | 50.0200 | |
| | 125 | 1.6440 | 54.1536 | |
| | 250 | 1.3653 | 61.9227 | |
| | 500 | 1.2756 | 64.4244 | |
| | 1000 | 0.9252 | 74.1968 | |

Figure (4) IC₅₀ Value of Almond Seeds with Ascorbic Acid

According to the results of antioxidant screening, the IC₅₀ value of ethanolic extract was found to be 35.782 µg/mL. IC₅₀ value is inversely related to the free radical scavenging activity. As the almond seed possesses the rich antioxidant properties, it may be consumed for the human health.

Elemental Compositions of Almond Seed by EDXRF Method

Elemental compositions of almond seeds samples by EDXRF method results were tabulated in Table (4).

Table 4. The Results of Mineral Compositions of Almond Seeds

| No | Name of Element | Symbol | Result (%) |
|----|-----------------|--------|--------------|
| 1 | Potassium | K | 0.8907 |
| 2 | Phosphorus | P | 0.7810 |
| 3 | Calcium | Ca | 0.3460 |
| 4 | Magnesium | Mg | 0.3420 |
| 5 | Sulphur | S | 0.2310 |
| 6 | Chlorine | Cl | 0.0743 |
| 7 | Iron | Fe | 0.0089 |
| 8 | Zinc | Zn | 0.0079 |
| 9 | Manganese | Mn | 0.0030 |
| 10 | Copper | Cu | 0.0028 |
| 11 | Strontium | Sr | 0.0010 |

According to EDXRF method results, the high content of potassium is effective for the persons with hypertension. Calcium helps the teeth and bones to be strong for human.

V. CONCLUSION

In this research paper, the almond seeds were determined the physicochemical properties, mineral content, nutritional values and antioxidant activity. The values of pH, ash and moisture content were 7.4, 4.16 % and 4.57 % respectively. Carbohydrate, protein and fat contents were 4.86 %, 24.18 % and 49.75 % respectively. In the study of elemental analysis, the high contents of potassium (0.890 %), phosphorus (0.7810 %), calcium (0.3460 %) and magnesium (0.3420 %) were observed.

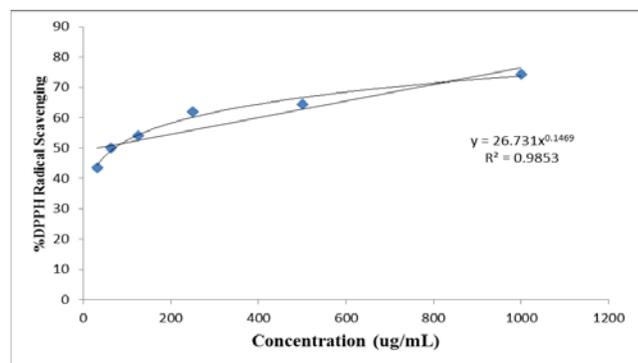
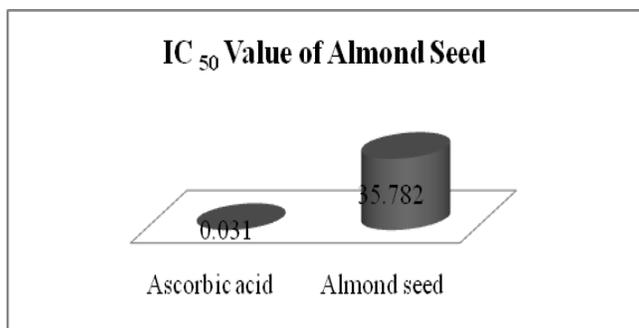


Figure (3) The Plot of DPPH % Radical Scavenging Vs Concentration (µg/mL) Of EtOH Extract of Almond Seeds



The high content of potassium is effective for the persons with hypertension. Calcium helps human's teeth and bones to be strong. From the determination of nutritional composition of almond seeds, it was found that the amount of fat and protein were high in the samples. The antioxidant activity of ethanol extract was also screened. IC₅₀ value of ethanol extract was 35.782 µg/mL. According to the results of antioxidant screening, almond seeds possess antioxidant property, it may be used for human health.

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Approximately 33 g of proteins are lost each day by the average adult male and can be replaced in the diet. Also growing children need more protein than adult per unit weight since more protein is needed for growth. The result show that consumption of almond will contribute significantly on healthy benefits. The health benefits of almonds included blood pressure and sugar levels, reduced blood pressure and lower cholesterol levels. In this regard, attention should be drawn to cheap sources of protein like almond seeds proven to be edible, available and affordable, and which contain most of the nutritional requirement in large proportion.

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Analysis of Lyrics Values Ebiet G Ade's Song with The Titled "Berita Kepada Kawan" As A Source of Character Education Values

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Abstract- This research aims to describe of lyrics values Ebiet G Ade's song with the title berita kepada kawan as a source of character education values. This research uses a qualitative approach using Levi-Strauss structural analysis and Paul Ricoeur hermeneutics to find the ceritheme and episodes in every lyrics Ebiet G Ade's song titled berita kepada kawan and later will be used as a source of character education values. The results of the research show that there are several character values in the lyrics Ebiet G Ade's song that value is the character value in relation to God; Religious. Character values in relation to yourself; Hard Work, Discipline, Responsibility, Independent; Curiosity. Character values in relation to others; Friendly/ Communicative. Character values in relation to the environment; Care for the Environment, Care for Social.

Index Terms- lyrics Ebiet G Ade's song, berita kepada kawan, character education

I. INTRODUCTION

Character education in Japan and Malaysia is included in the learning of citizenship education. Citizenship education in Japan and Malaysia successfully engages students in practical activities that lead them to internalize the importance of responsible and caring members of society, this can encourage students in their sociocultural ways to discover the needs of the country, their culture and their religion, as well as change in the community globally (David, 2008; Vishalache, 2010).

The source of value education in Indonesia is integrated into learning, especially social studies learning, among others, national character values (Anik, 2010). The importance of national character values is integrated into social studies because of the low value of tolerance, mutual respect and mutual help. Another source of value integrated into social studies is the value of humanity by exploring the value of local wisdom (Masdar, 2015). Besides these values, environmental monitoring as a source of social studies learning has also been carried out, the results of which students become active and easier to receive lessons (Mardhotillah, 2017). This research uses the lyrics Ebiet G Ade's song as a source of character education values that are integrated into Geography subjects that have never been appointed by previous researchers.

Music has various benefits for human life, including in the field of music health can help recovery therapy in elderly patients after surgery that reduces pain and anxiety and can help relaxation during recovery, helps reduce anxiety in pregnant women who are undergoing vertilization, music also used in a hospital concept at certain times that music is played comfortably in treatment rooms so as to reduce anxiety and stress, and make patients feel comfortable and safe (Hanneke et al., 2018; Yilda et al, 2017; Timothy, 2016). Music as one of the media is the harmonization of various kinds of sounds of musical instruments and song lyrics that are packaged in such a way that it becomes a thing that gives a certain effect in human beings.

Besides being influential in human health, music as an aesthetic creation is believed to contribute positively to the process of character building (Yeni, 2010). Many research on music as a media of education especially character education, in Japan character education is done through the same music media but is played for different age groups, namely adults and children results show differences in character despite using the same type of music (Etsuko, 1996) . That proves that music is something that can be accepted by all ages.

Different the research conducted by Angela Lee in Taiwan (2016), Angela's research deals with music activities or using musical instruments to build a character of caring, respect, courage, honesty, responsibility, and cooperation. Angela Lee raised certain themes including "Caring for Others"; "Judging Courage"; "Cooperation"; "Respect"; "Responsible"; and "Honesty." The result is a positive change in the interaction and social behavior of student fostered when six personal character values are included in classroom learning.

Several research about the use of music media as character education have been carried out in Indonesia. Sundanese people use angklung instruments that are rich in values, such as economic, social, cultural, educational, ethical, moral values as a vehicle for creative industries and national character formation (Deni et al., 2013). As a musical instrument (physical form), Angklung has meaning, including: philosophical meaning and religious meaning, which can be a material source in the formation of nationalist character, both at school and outside of school. Both of these meanings need to be informed to students so that way they know and realized of how important the position, function, value, and meaning of Angklung in society lives. The use of struggle songs and national songs to forming the character of the love of country through passionate lyrical and musical analysis turned out

to arouse nationalist enthusiasm and love for the country (Wisnu et al., 2014; Dwi., 2016).

In addition to using character formation musical instruments can also be done with an analysis of music that has the music genre Rock. This research was conducted by Prety Ayu (2015), in carrying out character education through one of the famous band groups in Indonesia that has a stream of rock music namely the SLANK Band Group. The way of cultivation nationalism characters contained in Slank songs can be used as a learning media *power point slide or meme picture*. The Slank song that was analyzed for character education is that Indonesia must win and be happy, both of songs have meaning lyrics to love the nation and state, and the Indonesian homeland, placing the interests of the nation and state above the interests of individuals and groups.

In addition to the flow of music rock, character education is also carried out through the media of *tembang campursari* and children's songs. *Tembang Campursari* is expected to be able to growing love and instill character for fans because it contains moral values and beauty which are important for their role in character education (Yudi, 2013). Children's song is a song created specifically for children. Simplicity of the song, lyrics, and melody are the hallmarks of children's songs. In the end, the existence of children's songs is important to always be developed and updated. For character education, it is necessary to revitalize modified children's songs, and create new ones in accordance with current developments (Heni, 2013).

Ebiet G. Ade is a universal musician in music (Edi, 2012). Various themes are packaged nicely in each song. The musician who was born on April 21, 1954 has songs that are widely known to the public. Songs with love themes such as *Camellia 1, Elegi Tomorrow Morning, Missing Song, Songs for a Name* are some of the most well known songs. The songs that have human, social and religious themes are also always played when natural disasters hit the country. This research trying to reveal the meaning of the lyrics in depth from Ebiet G Ade's songs to be used as a source of values character education in subjects that have never been appointed by previous researchers.

This research is important because previous researches only built meaning, the use of music tones and rhythms, the use of traditional musical instruments, and the expression of the meaning of songs Rock, *campursari* and children's songs and not followed by the use of lyric texts and song meanings as a source of value for instill character values presented in a reality or present a concept in social studies learning (Yeni, 2010; Etsuko, 1996; Angela Lee, 2016; Deni et al, 2013; Wisnu Mintargo et al, 2014; Dwi, 2016; Prety Ayu, 2015; Yudi, 2013; Heni, 2013).

II. RESEARCH METHODS

This research uses a qualitative approach using Levi-Strauss structural analysis and Paul Ricoeur's hermeneutics to find the values in the lyrics Ebiet G Ade with a title *berita kepada kawan*. Levi-Strauss structuralism theory and Paul Ricoeur hermeneutics are used to study and express deeper meanings and dynamic processes behind the components of a literary work. The technique of collecting data uses documentation studies or literature studies, in this case the study of the lyrics Ebiet G Ade's song. Hermeneutically, Paul Ricoeur sees hermeneutics as a

process of interpretation that trying to bring understanding and disclosure of phenomena through language. Besides that hermeneutics is the study of the activities of human culture as a text with the intention of interpretation to find the desired or reveal meaning (Kvale, 1996). The meaning is not only taken according to the author's life view, but also according to the understanding of the viewpoint of the reader.

The Text is understood includes things such as written or verbal communication, visual arts and music. This text study is carried out with direct appreciation and rational understanding of meaning. To do this, developed signs of documentation studies that function as research. the first step the analysis shown by Levi-Strauss is to cut the lyrics of the Ebiet G Ade's song in several episodes. Each episode contains a description of something that is considered important in the lives of Indonesian society. Following in the footsteps of linguists, it is necessary to obtain units called *mytheme* or *ceritheme*. *Cerithemes* is then arranged syntagmatically and paradigmatically. *Ceritheme* can be tangible of words, phrases, sentences, parts of paragraphs that show certain meanings with other *cerithemes*.

This *Ceritheme* can describe an experience, traits, interactions, etc. which are considered important for analysis. From this method the *ceritheme* will contain the same and not the same relation. The interpretation of the meaning of the next myth depends on the overall relationship between the *ceritheme* that has been obtained, as well as the referential and contextual meaning of the elements in the *ceritheme* with the socio-cultural context of the Indonesian society. After reading and understanding the whole text, the myth is divided into several episodes. The meaning of each episode depends on the whole text. Therefore *interpretation of meaning according to analysis structural hermeneutics* in an episode refers to something that is outside the story regardless of the position of this episode in the whole story.

III. RESULTS AND DISCUSSION

Ebiet G Ade (Berita kepada kawan): Structural Analysis-hermeneutics Paul Ricoeur.

Before finding *ceritheme* from lyrics Ebiet G Ade's, the following is presented lyrics Ebiet G Ade's song titled *berita kepada kawan* : Perjalanan ini terasa sangat menyedihkan Sayang engkau tak duduk di sampingku kawan Banyak cerita yang mestinya kau saksikan Di tanah kering bebatuan Tubuhku terguncang dihempas batu jalanan Hati tergetar menatap kering rerumputan Perjalanan ini pun seperti jadi saksi Gembala kecil menangis sedih ... Kawan coba dengar apa jawabnya Ketika ia kutanya mengapa Bapak-ibunya telah lama mati Ditelan bencana tanah ini Sesampainya di laut kukabarkan semuanya Kepada karang kepada ombak kepada matahari Tetapi semua diam, tetapi semua bisu Tinggal aku sendiri, terpaksa menatap langit

REFF:

Barangkali di sana ada jawabnya Mengapa di tanah ku terjadi bencana Mungkin Tuhan mulai bosan melihat tingkah kita Yang selalu salah dan bangga dengan dosa-dosa Atau alam mulai enggan bersahabat dengan kita Coba kita bertanya pada rumput yang bergoyang

After describing the lyrics Ebiet G Ade's song with a title *berita kepada kawan*. The following an example of analysis and

the interpretation of Levi-Strauss structuralism and Hermeneutic Paul Ricoeur in the division of cerithemes in one episode as follows:

Episode I (Ebiet life journey)

In this episode Ebiet tells of his sad life journey and many obstacles and obstacles. The life journey of every human being is different but in this song Ebiet wants to share the story of his life journey as a child of the nation who witnessed his land begin to dry and many rocks that could block his journey at any time. The country they occupy is Indonesia now starting to face a dry season that dries grass and plants.

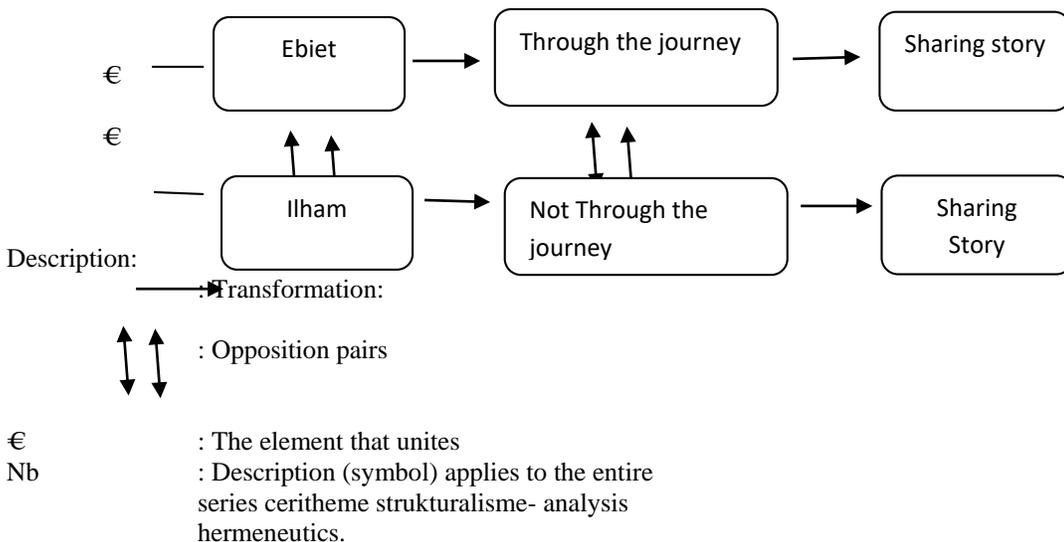
The dryness of the grass as told by Ebiet can also be concluded that the poverty and misery experienced by some people in this country is something that he encountered in his life journey. Ebiet tells of a small shepherd who wept bitterly because of the dry grass that became his animal feed as a result of the lack of fertility of Indonesian soil.

Ebiet wanted to tell all the stories of his journey to his friend. But the friend was no longer beside him, either because he died or just left temporarily. The meaning of friendship Ebiet wants to appear in this episode. he wants his friends to know for themselves what they are going through. Starting from his sad journey full of twists and turns, to the things he found in his journey, namely his country which began to be hit by drought and poverty.

In this episode the meaning of a character can only be captured or understood if it is aligned with other figures (Sarmini, 2002). The Ebiet figure as a person who travels can only be understood if it is associated with the figure of Ilham (as Ebiet's friend) and Fuad (as a small herder) whom Ebiet met during his life journey. Ebiet with Ilham (friend) has a strong emotional bond that can be seen from the following song lyrics;

*Perjalanan ini terasa sangat menyedihkan
Sayang engkau tak duduk disampingku kawan
Banyak cerita yang mestinya kau saksikan...*

The series of ceritheme in Ebiet's episodes carried out the life journey of the person in question, can be seen in the series as follows;



From this series, there are known transformations in the ceritheme-ceritheme. In the ceritheme about the trip Ebiet made, it was found to be paired opposition and the elements that united the pair. Ebiet travels life and finds that his journey is sad, but always shares stories with Ilham (his best friend). Ebiet's attitude is in opposition to Ilham, namely his best friend and reunited with the same elements, namely they share stories.

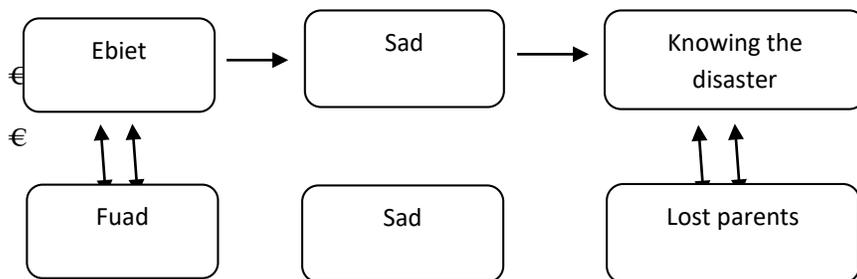
Ebiet's attitude of always sharing stories indicates that Ebiet has a friendly nature, because Ebiet shows a sense of pleasure in socializing, telling stories with other people. Besides that Ebiet also has an attitude of love for the homeland, because he feels sad to see his homeland begin to dry out from the lyrics of "Heart trembling staring at the dry grass".

Episode II (Ebiet finds out about the disaster)

This episode tells of the time when Ebiet traveled, he met a child who lost his parents because of the disaster in his country, Indonesia. Over the past few years, Indonesia has often faced

disasters, not only in the regions but also national scale disasters that have happened in Indonesia some time ago and caused a lot of damage. Apart from causing damage, the disaster also claimed many lives.

The country of Indonesia is indeed one of the countries that are often hit by natural disasters, because in addition to Indonesia it is on the route *Ring of Fire*, also because many large rivers pass through dense settlements in certain areas. Geological and climatological natural disasters often occur in Indonesia. Whether it's erupting mountains, earthquakes, tsunamis, floods, tornadoes or tornadoes. This kind of disaster caused a lot of damage and casualties, so Ebiet felt sad for the victims as told by a small child who cried sadly because his parents died as victims of natural disasters that had occurred in Indonesia. The series of ceritheme in episodes Ebiet find out about disasters that occur from the characters discussed, can be seen in the following series (Sarmini, 2002).



From this series there are known transformations in the ceritheme-ceritheme. In the ceritheme about Ebiet's life journey and finding out about the disaster that occurred, it was found to be paired opposition and the elements that united the couple. Ebiet and Fuad had the feeling of sadness, but their sadness was different Fuad was sad because his parents died because of the disaster, but Ebiet was sad to see the disaster that occurred in Indonesia and tried to find out why the disaster happened.

Ebiet's caring attitude about the sadness of others is a social caring attitude. In addition Ebiet also has an attitude of love for the country because he is trying to find out why disasters often occur

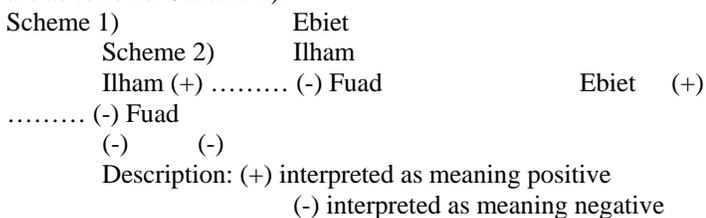
in Indonesia. Ebiet is aware that the disaster that occurred is the will of God YME, therefore Ebiet also has a religious nature which is annature obedientin carrying out the teachings of his religion, because religion always teaches to believe in the power of God YME.

From the existing series of ceritheme, to facilitate the understanding of the lyrics of the Ebiet G Ade song, the structure behind the storytelling can be described. The structure is as follows;

Table 1 : Structure behind a berita kepada kawan

| situation | Ebiet's | Ilham | Fuad |
|--|---|---|---|
| Episode I (Ebiet makes a life journey) | Friendly and caring about the sadness of others | Always a good listener and willing to give advice to his friend | |
| Episode II (Ebiet finds out about the disaster) | social care and always had a curiosity | | sadness can not detained because of the loss of parents |
| ending | care | to care | Sad |

Sequence of this episode show kindness Ebiet who always cares for others affected by the disaster. In the structure, it can be seen that the existence of Ebiet's figure cannot be separated from Ilham as his best friend, because during Ebiet's trip he wanted to always have inspiration beside him to accompany him to travel and find out the story that happened. On his way Ebiet met a small shepherd who was crying sadly at the loss of a parent due to a disaster. Ebiet, has the nature of social care, curiosity, friendship and responsibility, while inspiration as his friend has a social and friendly nature, but there is an opposition opposite Fuad who is shown sad because his parents died of the disaster. So it can be concluded that the position of Ebiet, Ilham and Fuad figures is based on binary triangles and Levi-Strauss's consonants are as follows. Scheme 1).



In scheme 2) if seen from the interpretation Ebiet travels to find the cause of the disaster that often occurs in his country. Ebiet

and Ilham occupy the structure while Fuad is anti-structure, Fuad can be said to be in the position of Ebiet and Ilham.

IV. CONCLUSION

Lyrics Ebiet G Ade's song with the title berita kepada kawan, can be used as one of the sources of character education because there are 10 character values from 18 character values in the 2013 curriculum. The character values are character values in relation to God; Religious. Character values in relation to yourself; Hard Work, Discipline, Responsibility, Independent; Curiosity. Character values in relation to others; Friendly/ Communicative. Character values in relation to the environment; Care for the Environment, Care for Social.

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Beyond Financial Performance of Microfinance Banks In Nigeria: The Balanced Scorecard Exposition

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Abstract- The purpose of this study was to evaluate the performance of Microfinance Banks in Nigeria using Balanced Scorecard. The study used a mixed method by combining both historical data and primary data respectively sourced from published reports which covered the period 2013 -2017 as well as questionnaire used to obtain opinions of staff and customers of LAPO Microfinance Bank, a foremost microfinance bank in Nigeria. It was hypothesized that customer, internal business process, learning and growth and financial perspectives have no significant influence on the performance of microfinance banks in Nigeria. Multiple regression analysis was employed in testing the study's hypotheses. Results of test of hypotheses showed that three independent variables, namely, financial perspective (Beta = 0.036, $t = 2.1176$, $P < 0.05$ customer perspective (Beta = 0.801, $t = 2.0486$, $P < 0.05$) and internal business process perspective (Beta = 0.074, $t = 3.2174$, $P < 0.05$ have significant effect on performance of microfinance banks in Nigeria while learning and growth perspective (Beta = 0.161, $t = 1.6186$, $P > 0.05$) have no significant influence on the business performance of microfinance banks in Nigeria. The regression model reported an adjusted R^2 of 0.503. The F value (17.311) was significant at 0.05 level with its P value = 0.000. Based on the outcome of analysis, it was recommended that MFBs look beyond their financial performance by incorporating into their performance analysis, other aspects of their operations which facilitate their profitability and sustainability; that MFBs develop customer related and internal business process focused strategies for improved business performance; MFBs in Nigeria should formulate policies and develop strategies to reposition its learning and growth perspective which is currently underperforming. .

Index Terms- Balanced Scorecard, Financial Perspective, Customer Perspective, Internal Business Process Perspective, Learning and Growth perspective, Microfinance Banks, Nigeria

I. INTRODUCTION

Business organizations face fierce competition in their environment of operation. Their survival requires developing appropriate strategies. Hence, it is no wonder that businesses strategize in charting a direction considered apt in their circumstance. In line with this, a number of models have been evolved by scholars and practitioners alike aimed at facilitating the capacity of an organization to confidently face

environmental realities. These methods include, SWOT analysis (Strengths, Weaknesses, Opportunities and Threats), Boston Matrix, PESTLE (Political, Economic, Socio-cultural, Technological, Legal and Ecology/environmental issues), Porter's Five Forces, Scenario Planning, Balanced Scorecard (BSC) and the like. Amongst the listed models, BSC is the newest. Developed by Norton and Kaplan in the 1990s, the BSC was considered ideal as the authors believed that relying completely on financial performance metrics used to be suitable for organizations during industrialization era but that with current age where no knowledge and ability are commonplace, financial measures are no longer sufficient for use in determining organizational performance. The idea behind BSC invention was for it to provide the compass needed by organizations to manage strategically. This is made possible as strategic goals are translated into metrics to aid assessment (Kaplan and Norton, 2001). Equally, the BSC offers needed metrics in the planning, establishment of targets as well as getting feedback (Kaplan and Norton, 1996).

The BSC serves a number of purposes. It facilitates translation of mission and strategy into tangible objectives and metrics (Niven, 2002). Continued, Niven (2002) sees BSC as an evaluation model, a tool for communicating with employees and stakeholders; and a system for strategic management. Morard (2013) posited BSC was a novel approach introduced to strategic management field. As noted by Umoh (2018), the BSC holds a lot of promise in determining the balanced performance of an organization, providing for its direction and the strategies needed to improve its performance and achieve its long-term goals.

The concern for balanced organizational performance, provision of direction and strategies to improve performance as well as actualize long-term goals should be of interest to both private and public organizations. For the microfinance sub-sector, this interest is much more pronounced in view of its crucial role of supporting micro enterprises and fighting poverty in an economy. Several countries of the world especially the developing ones adopt a microfinance policy as a key component of its strategy on sustainable development. Hence, the introduction of community banks in Nigeria which later transformed to microfinance bank (MFB).

The MFBs are involved in micro and small scale lending to co-operatives and individuals, who cannot afford the high-level transactions of the conventional banks. At present, there are three categories of MFBs in Nigeria. These are Unit, State and National MFBs. The Unit MFBs have a mandate to operate in

one centre. The State MFBs are licensed to carry on operations state-wide. The National MFBs have authority to operate in all states of the federation. The supervisory authorities of these institutions have put in place an appropriate regulatory and supervisory framework (CBN, 2005). Traditionally, the MFBs like other organizations limit their performance evaluation to financial analysis. This practice distorts actual performance as it is not comprehensive, thus misleading. While the financial health of an organization is desirable, Kaplan and Norton (1992) caution that this is not enough. Instead, they propose a wider focus by combining financial perspective and three other perspectives, namely, internal business process, customer and learning and growth perspectives through application of Balanced Scorecard (BSC). Nanayakkara and Iselin (2012) argues that both financial and non-financial performance perspectives are important in the performance of MFBs. According to the author, financial performance is important if MFBs are to survive and non-financial performance is important if donors and borrowers are to be served well. This study deploys the BSC philosophy in assessing and presenting the performance of LAPO microfinance bank, a key player in the microfinance sub-sector in Nigeria.

II. OBJECTIVES OF THE STUDY

The general objective of this study is to apply BSC in evaluating the performance of LAPO microfinance bank in Nigeria.

The specific objectives are to;

- i. assess the effect of financial perspective on business performance of LAPO microfinance bank.
- ii. investigate influence of customer perspective on business performance of LAPO microfinance bank.
- iii. examine impact of internal business process perspective on the business performance of LAPO microfinance bank.
- iv. investigate the influence of learning and growth perspective on the business performance of LAPO microfinance bank.

III. HYPOTHESES OF THE STUDY

The following hypotheses are formulated for this study:

H₀₁. Financial perspective has no significant effect on the business performance of LAPO microfinance bank.

H₀₂. Customer perspective has no significant influence on business performance of LAPO microfinance bank.

H₀₃. Internal business process perspective has no significant impact on the business performance of LAPO microfinance bank.

H₀₄. Learning and growth perspective has no significant influence on the business performance of LAPO microfinance bank.

IV. THEORETICAL FOUNDATION AND CONCEPTUAL ISSUES

The BSC is strengthened by several theories. In this work, the Stakeholder theory was considered the most relevant. The Stakeholder theory was propounded by Edward Freeman in 1984. The theory makes an attempt at justifying why enterprises make efforts at achieving competitive advantage that will enhance their sustainability. According to the theory, there are groups and individuals whose interests must be protected in view of the fact that their goals are being affected by operations carried out by the organization. In the context of current research effort, stakeholders include shareholders, customers, employees, government, creditors and the like. The theory explains the clear linkage among stakeholders such that plans should be formulated to facilitate achievement of the corporate objectives and satisfaction of stakeholders' goals. Shareholders are interested in profitability of the business as reported by ROA and ROE. Customers are concerned with their experience in such areas as prompt service delivery, empathy, convenience and the like. Employees have concerns in such areas as welfare, training and development, job security among others. Government and creditors are interested in the soundness, effectiveness and efficiency of organizations as represented by the internal business process perspective. The stakeholder's theory argues for a holistic development and management of strategies along different stakeholder dimensions in order to successfully manage and report performance in line with different goals. The balanced scorecard facilitates achievement of a balanced evaluation of performance using its perspectives (Umoh, 2018).

V. BALANCED SCORECARD (BSC)

The BSC was developed as part of an attempt at improving the measurement of organization's performance. This is because, relying solely on financial component of performance analysis has been seen as inadequate in presenting a true picture of organizational performance. Furthermore, this approach no longer suits measuring today's businesses (Kaplan and Norton, 2001).

The BSC is considered to be capable of addressing issues confronting managements such as unreliable performance measures coupled with the need to measure intangibles and integrate same with tangibles in order to improve the performance of organizations (Kaplan and Norton, 2001). By inventing the BSC, the idea was for it to serve as a strategic management compass that guides businesses into translating their strategic goals into appropriate metrics for ease of evaluation (Kaplan and Norton, 2001). It is a system used by a firm to describe and manage its strategies. Using the BSC enables organizations achieve strategy clarification, communication and linkage with long-term goals. It also provides the metrics to be

used in planning, setting targets for the organization and also having feedback (Kaplan and Norton, 1996).

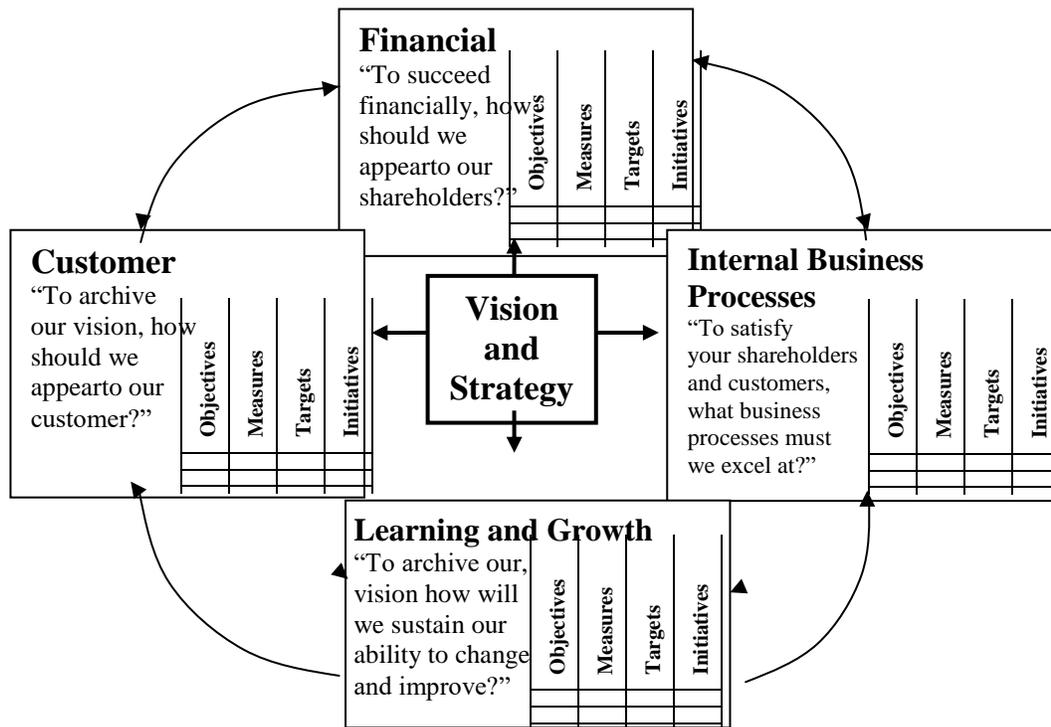


Figure 1: BSC perspectives
Source: Kaplan and Norton (1996)

Details on each of the perspectives are given below:

i. The Financial Perspective

This perspective enables an organization conduct an assessment of its strategies and how they are being translated into profit for the business. Goals that are financial in nature include: Return on investment, profitability, growth in revenue, return on assets, shareholders' value (Kaplan and Norton, 1992). While financial indicators are considered indispensable for assessing business performance, their main shortcoming is that they reflect the results of managerial decisions made previously and do not indicate what the organization is doing presently towards improving its performance in future.

The financial perspective considers metrics representing the ultimate long-term goal of the firm. Every organization targets giving returns which meet and exceed the expectations of shareholders. The BSC does not contradict this goal but stresses the need to manage and address all issues capable of influencing the realization of financial goal. Using financial information which are historical is a major issue leading to criticism of traditional performance analysis as it does not provide sufficient data concerning future performance of the firm. In this study, ROA, ROE and clients funding to total asset are considered under financial perspective.

ii. The Customer Perspective

The customer perspective tracks customer related issues such as satisfaction, attitudes and market share goals. This perspective is

aimed at ascertaining the needs of the customers which as reported by Kaplan and Norton (1992) include service, time, quality, performance and costs. Metrics in this dimension of performance are considered leading indicators of future performance. Zeithaml and Bitner (2003) see customer satisfaction as the customers' judgment of service enjoyed or product used as meeting their needs. When customers are satisfied they behave in a positive manner by repeat patronage for the business.

Kaplan and Norton (1996) advise that for the firm to meet and satisfy the expectations of its clients and so meet its own long-run financial goals, it has to deploy its services or products in meeting clients' expectations. Under this perspective, measures used as it concerns MFBs are customer satisfaction, personalized service and customer retention.

iii. The Internal Business Process Perspective

The concern of this perspective is the internal operational goals needed to meet customer objectives. It enables an organization to evaluate the performance and extent to which its offerings to the market are meeting customers' envisioned expectations. This perspective is concerned with measures such as service measures, quality measures, costs reductions, efficiency measures, lead times, innovation rates and the like. The basic premise of the internal business process perspective is that it recognizes the importance of customer-based targets but stresses that they should be converted into such metrics that indicate those things that are being done by firms so as to realize

expectations of clients. (Kaplan and Norton, 1992). Internal business process issues treated in respect to MFBs are cost to income ratio, portfolio-at-risk, efficiency in loan processing.

iv. The Learning and Growth Perspective

This perspective is aimed at determining an organization’s ability to continually improve and innovate. It examines how an organization learns and grows (Wong, Kuek and Ong, 2013).It focuses on intangible drivers of future success including human capital, employee capabilities, organizational capital, employee productivity, training, growth in number of employees, employee turnover, work force diversity, education and development, informational systems and the like.

This perspective of the BSC sets priorities required to engender at atmosphere which facilitate organizational change, growth and innovativeness. This is where the firm is concerned with defining resources, skills and atmosphere supportive of its strategies. This perspective creates a strategy map which provides a link across the four perspectives of the BSC. The important areas of the perspective are those of employees- their skills and competencies in strategy execution, the information technology (IT) that is required for process improvement; alignment of organization and culture. For Kaplan and Norton (1996), learning and growth perspective has three categories: Capabilities of employees, information systems resources and motivating employees, aligning its activities and units. For the MFBs, issues considered under this perspective are employee satisfaction, training opportunities and growth in number of employees

A number of studies using balanced scorecard in assessing organizational performance have been conducted by various researchers. Relevant researches are presented below:

Odera, Ombuna, Omido, Garashi and Okaka (2013) applied BSC to assess 18 banks’ performance in Kenya. The study established a relationship between learning and growth, customer and internal business process concerns and bank performance. Umar and Olatunde (2011) conducted a study which evaluated the results of operations of banks that were involved in consolidation by indentifying metrics that were not financial in nature. In the test of hypotheses, findings indicated influence of non-financial metrics on surveyed banks’ performance. Moghaddam (2012) was interesting to find out the effect of BSC implementation on financial performance transparency in the case of firms on Tehran Stock Exchange. Results of the study showed that implementing BSC has an effect on company value as well as financial performance transparency. Rostami, Goudarzi and Zaj (2015) conducted bank evaluation in Iran using the Balanced Scorecard approach. The researchers were interested in the significance of all BSC perspectives and associated metrics. The study revealed that the perspectives were ranked in order of importance as follows: Customer, financial, internal business process, then learning and growth. Chen and Chen (2007) evaluated business performance of semiconductor industry in Taiwan via BSC. Results of the study indicated that the most important perspective was financial perspective. Next was internal process perspective, followed by learning and innovation perspective, then customer perspective.

Ahmed, Bahamman and Ibrahim (2015) assessed non- financial metrics of commercial banks’ performance in Nigeria. The study discovered that Nigeria’s commercial banks disclosed some

aspects of non-financial metrics in their performance report. Ibrahim and Murtala (2015) conducted a study on importance of BSC in assessing the performance of banks in Nigeria. Findings of the study indicated that while some banks did recognize the need to use BSC in evaluation, they did not deploy all perspectives. Nanayakkara and Iselin (2012) adopted the balanced scorecard model in their exploratory study to investigate the critical performance measures that MFBs need to emphasize in their performance. The result indicated that both financial and non-financial aspects of performance were needed by MFB to both continue in operations and also delight their customers. Durgham and Abufaddah (2009) investigated the effect of using BSC metrics to enhance strategic financial performance of national Palestinian banks in Gaza Strip. Outcome of the study indicated that banks that used BSC improved their performances.

VI. METHODS AND MATERIALS

This study employed a mixed research design by combing both historical data sourced from progress reports of LAPO MFB and survey data sourced from administration of questionnaire on staff and customers of the studied MFB. The historical data covered a –five year period (2013-2017). Copies of the survey instrument were administered to staff and customers of the studied MFB at the branches. LAPO MFB was so selected because of its national spread being national MFB and its rating among the topmost MFBs in Nigeria by business volume and performance. The BSC was decomposed into is four perspectives: Financial perspective, customer perspective, internal business process perspective; and learning and growth perspective. The method of analysis was by multiple regression which related the dependent variable, MFB’s performance with BSC perspectives as presented below:

$$Y = a + \beta_1 \text{FNP} + \beta_2 \text{CSP} + \beta_3 \text{IBP} + \beta_4 \text{LGP} + e$$

Where,

Y= Microfinance banks’ performance

FNP =Financial Perspective

CSP = Customer Perspective

IBP = Internal Business Process Perspective

LGP = Learning and Growth Perspective

a = Y intercept

$\beta_1 \beta_2 \beta_3 \beta_4$ = the regression coefficients of the four independent variables.

e = Error

Data Presentation and Analysis of Empirical Results

Table 1: LAPO Financial performance

| Profitability measure/Year | 2013 | 2014 | 2015 | 2016 | 2017 |
|----------------------------|-------|-------|-------|-------|-------|
| Return on Assets | 6.01% | 7.90% | 7.15% | 8.36% | 7.24% |
| Return on | 26.28 | 38.10 | 36.23 | 41.29 | 36.43 |

| | | | | | |
|--------|---|---|---|---|---|
| Equity | % | % | % | % | % |
|--------|---|---|---|---|---|

Source: LAPO MFB

Table 1 displays LAPO MFB's performance by two key financial performance indicators, ROA and ROE for the period 2013 -2017. While these figures indicate the MFB is doing well financially, how it is performing in other dimensions of its operations is not known.

ndent variables. The adjusted $R^2 = 0.503$ indicates that the four independent variables together explained 50.3% of variation that exist in the dependent variable. The F value (17.311) is significant at 0.05 level with its P value = 0.000.

Table 2 shows results of regression analysis between BSC perspectives and MFBs' performance in Nigeria. The R^2 of 0.542

shows the relationship between independent and indepe

Table 2: Results of Multiple Regression Analysis between BSC and MFBs' Performance

| Model | R | R Square | Adjusted Square | RStd. Error of the Estimate | ANOVA F-Value | Sig |
|-------|-------------------|----------|-----------------|-----------------------------|---------------|-------|
| 1 | .736 ^a | .542 | .503 | 12.091 | 17.311 | 0.000 |

a. Predictors: (Constant), Financial Perspective, Learning And Growth Perspective, Customer Perspective, Internal Business Process Perspective
b. Dependent Variable: MFBs Performance

Source : SPSS Computation

Table 3: Coefficient of Multiple Regression Model for BSC Variables

| Model | Unstandardized Coefficients | | Standardized Coefficients | T | Sig. |
|---------------------------------------|-----------------------------|------------|---------------------------|--------|------|
| | B | Std. Error | Beta | | |
| (Constant) | 63.209 | 12.027 | | 3.316 | .000 |
| FINANCIAL PERSPECTIVE | .012 | .017 | .036 | 2.1176 | .039 |
| CUSTOMER PERSPECTIVE | .173 | .391 | .801 | 2.0486 | .016 |
| INTERNAL BUSINESS PROCESS PERSPECTIVE | .302 | .023 | .074 | 3.2174 | .028 |
| LEARNING AND GROWTH PERSPECTIVE | .214 | .103 | .161 | 1.6186 | .106 |

a. Dependent Variable: MFBs PERFORMANCE

Source: Computed from SPSS

From Table 3, it is observed that three perspectives, financial perspective (Beta = 0.036, t= 2.1176, P< 0.05) customer perspective (Beta = 0.801, t= 2.0486, P< 0.05) and internal

business process perspective (Beta =0.074, t= 3.2174, P< 0.05) have significant influence on business performance of MFBs in Nigeria. Learning and growth perspective (Beta = 0.161, t= 1.6186, P> 0.05) has no significant effect on the business performance of studied MFBs.

Arising from the results of analysis in Table 3, hypothesis one, hypothesis two and hypothesis three of the study are rejected. This implies that financial perspective, customer perspective and

internal business process perspective significantly influence the business performance of MFBs in Nigeria. Furthermore, hypothesis four is accepted, implying that learning and growth perspective does not significantly determine the business performance of MFBs in Nigeria.

VII. DISCUSSION OF THE FINDINGS

The outcome of analysis shows that financial perspective, customer perspective and internal business process perspective significantly contribute to the business performance of MFBs in Nigeria. Findings indicate as well that learning and growth perspective does not significantly contribute to MFBs' performance in Nigeria.

The financial perspective had a Beta value of 0.036 and t value of 2.1176 which implies that financial perspective has a significant influence on business performance of sampled MFBs'. The finding supports Al-Mawali, Zainuddin and Ali (2010) whose findings showed a significant relationship between financial perspective and performance of banking organizations. It also strengthens Panicker and Seshadri (2013) whose study indicated that financial performance was interwoven with other aspects of performance that combine to produce organizational performance. The finding however, contradicts Umoh(2018) whose study outcome indicated financial perspective was not significant in the context of deposit money banks in Nigeria.

The Customer perspective had a Beta value of 0.801 and t value of = 2.0486. This implies that customer perspective has a significant effect on the business performance of sampled MFBs in Nigeria. It indicates that a unit improvement in customer related aspect of deposit money banks' operations, will lead to an improvement in MFBs' performance. The finding corroborates Rostami, Goudarzi and Zaj (2015) and Umoh(2018) whose respective studies revealed customer perspective as having significant influence on banking institutions' performance, Okoye, Odun and Odun (2017) whose related study indicated that customer perspective had a significant influence on the performance of manufacturing firms and Sharabati and Fuqaha (2014) who reported that customer perspective had a direct effect on the business performance of Jordanian manufacturing organizations. MFBs will do well by properly managing the customer perspective and translating same to profitability.

Internal business process perspective had Beta value of 0.074 and t value of 3.2174. This implies that internal business process perspective significantly impacted the business performance of MFBs in Nigeria. The implication of this finding is that as MFBs improve upon their internal business process perspective it results in improved business performance. The result strengthens the earlier results of scholars such as Okoye, Odun and Odun (2017) whose findings established a significant effect of internal business process on the performance of manufacturing companies, Umoh(2018) whose study produced similar result in the case of deposit money banks and Teker, Teker and Kent (2011) whose study indicated that non-financial indicator such as internal business process had become more important in measuring the performance of any firm in recent times.

Learning and growth perspective had a Beta value of 0.161 and a t value of 1.6186. The outcome implies that learning and growth perspective has no significant effect on the business

performance of MFBs in Nigeria. It may further imply MFBs in Nigeria may not be doing well in this perspective. This finding strengthens earlier finding by Okoye, Odun and Odun (2017) whose study reported an insignificant effect of learning and growth perspective on the performance of manufacturing firms and Umoh(2018) who reported similar result involving deposit money banks in Nigeria. This finding however, contradicts earlier findings of Odera, Ombuna, Omido, Garashi and Okaka(2012) whose study revealed a relationship between learning and growth perspective and bank performance, Panicker and Seshadri(2013) whose related research showed a relationship between learning and growth perspective and banking institutions' performance.

VIII. RECOMMENDATIONS

Based on the findings of this study, the following recommendations are made:

- i. There is need for MFBs to look beyond their financial performance by incorporating aspects of the operations which strengthen their profitability and sustainability.
- ii. Customer perspective and internal business process perspective are crucial to the business performance of MFBs in Nigeria an indication that MFBs develop customer related and internal business process issues for improved business performance.
- iii. MFBs in Nigeria would have to formulate policies and develop strategies to reposition its learning and growth perspective which is currently underperforming.

IX. CONCLUSION

Microfinance banks play an important role in an economy through provision of micro and small credits to individuals and groups. For them to be profitable they have to manage their operations well. Their complete performance should go beyond financial performance.

Through the application BSC, the study has shown the performance of LAPO MFB in several dimensions of its business. In particular, revelations were made that customers' and internal business process perspectives significantly contributed to the business performance of MFBs in Nigeria while learning and growth perspective was seen to be disappointing. These revelations indicate that MFBs performance evaluation would need a comprehensive model such as offered by the BSC. Furthermore, the revelations have both academic and practical relevance. However, studying a single institution limits generalization of findings. More studies with wider coverage are needed.

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Relationship Between Principals' Adversity Quotient and Leadership Styles in Secondary Schools in Delta State, Nigeria

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Abstract- The study investigated the relationship between principals' adversity quotient and leadership styles in secondary schools in Delta State. Five research questions guided the study. Correlation research design was utilized for the study. The population of the study comprised 414 principals from 414 public secondary school in Delta State. The sample was made up of 290 principals from 414 secondary schools. The sample was composed through systematic sampling technique. Two instruments were used for data collection for the study. The instruments are: Questionnaire on Principals' Adversity Quotient (AQP) and Multifactor Leadership Questionnaire (MLQ). The instruments were validated using three experts. Reliability indexes of 0.88 for AQP and 0.85 for MLO were obtained using Cronbach's Alpha. Out of the 290 pairs copies of Questionnaire (AQP and MLO) distributed, 282 copies were duly completed and retrieved representing 97.2% return rate. Data were analyzed using Pearson's Product Moment Correlation Co-efficient. The results of the study showed that adversity quotient of secondary school principals were significantly related to democratic, autocratic, laissez-faire, transactional and transformational leadership style. It was also reported the need for a leadership training and development design by management of secondary education board to enhance leaders who have been found with low adversity quotient since adversity quotient is positively related to the leadership styles discussed. Based on the findings of the study it was recommended, among others, that secondary school principals should be made to be aware of the relevance of having high adversity quotient as it will likely facilitate their adoption of appropriate leadership styles.

Index Terms- Principals, Leadership styles, Adversity, Adversity Quotient and Secondary Schools.

I. INTRODUCTION

Basically educational institutions are often forced to deal with numerous internal and external adversities in their operation. The way and manner these adversities are responded to can be determined by the leadership style of the principal who is the recognized head of the school. Leadership is the process of interactive influence that occurs when, in a given context, some people accept someone as their leader to achieve common goals

(Alberto, 2016). As the recognized leader in a school, the principal has a lot of responsibilities and accountability in the organization. The principal's position is critical to the organizational development, and academic growth of the students, because he is usually the main source and the driving force that sustains the welfare of the school (Kotirde, Yunos & Anaf, 2014).

The principal is concerned with the quality of instruction as well as the students' welfare, moral and spiritual tone of the school, maintenance of discipline, working with teachers to meet curriculum standards and set goals and objectives, academic achievement and improvement of the school, communicating the school's mission, goals and policies to teachers, students, parents and community, directing and delegating (where necessary) school operation, overseeing staff performance and supervising students' behaviour (Habegger, 2008). The above duties associated the position of principal bring him into contact with teachers, students, parents, education ministry and the society at large.

The constant interaction principals have with different people, stakeholders and situations within and outside the walls of their school and the constantly changing environment provide many adversities for them to contend with. Advances in technology, changes in educational policy, financial limitations, changes in student demographics, and the increased call for accountability are some factors that require responses in the field of education by education managers in this case the principals (Abdullahi & Onasanya, 2010; Peter, 2017 and Uzoma, 2010). In the same vein, Canivel (2010) argues that poor funding, academic achievement, high risk behaviour among students, and violence are some of the issues that provide assortment of adversities in education.

Dohrenwend (1998) refers to adversity as a calamitous or disastrous experience and a condition of suffering, destitution, or affliction. He further pointed out that adversity may apply to conjunction of events that is the cause of unhappy change of fortune or to an ensuing state of distress. Johnston and Scholler-Jacquish (2007) precisely define adversity as great trial, hardship and tribulation. Stoltz and Weihenmayer (2010) categorize adversity into two: (a) inner adversity which is the internal, physical, mental, emotional, and spiritual states that cause hardship; (b) outer adversity in their view are things that occur externally that cause difficulty like militancy, terrorism, kidnapping and accident during excursion or field trip. In view of

the above definitions, the researchers are of the view that adversity is difficult situation, affliction, misfortune or tragedy which emanate from within and outside the school that confront the principals in the course of performing their duties.

The challenges engendering adversities in education, to a reasonable extent, apply to the Nigerian situation and Delta State in particular. Adeoti (2012) and Edokpolo (2011) opine that currently secondary schools are faced with many issues and emergent adversities which educational leaders must contend with, namely; poor academic performance of students that affects the performance of the school as a whole, increasing dropout rates, drug addiction, early marriage, parental problems, bullying, indiscriminate use of mobile phones and indiscipline are the most common. Wallington (2004) asserts that how a leader responds to these adversities not only affects the leader's performance but also the performance of those being led. Learning to deal with adversity in the school in one's life career is an essential element of effective leadership.

To overcome the adversities internal and external to the school, it then becomes imperative for school administrators to possess the relevant qualities necessary to be successful despite adversities. One of such qualities is high adversity quotient. According to Stoltz (2000), adversity quotient is the measure of one's ability to prevail in the face of difficulty, misery and misfortune. It explains how one responds to adverse situations, and how one rises above them. He asserts that life is like mountain climbing and that people are born with a core human drive to ascend. Ascending means moving toward one's purpose no matter the challenges. Adversity quotient is the underlying factor that determines one's ability to ascend in the face of misfortune, suffering and difficulty. Stoltz (1997) model indicates that one's adversity quotient, the ability to prevail in the face of adversity, comprises four interrelated constructs embodied by the acronym, CORE: C stands for control, O for ownership, R for reach and E for endurance.

Stoltz asserts that these four dimensions will determine a person's overall adversity quotient. Control measures the ability of the person's perceived control over adverse situations. It is how one exercises control over difficulties in life. People who respond to adversity positively will most likely have a greater performance over those who take adverse situations as a worse scenario to encounter. The more control one has, the more likely one has to take positive actions. This implies that the more control principals have over adverse situations, the more likely they will take positive actions that will enhance the achievement of the school goals and objectives.

Ownership is the extent to which the person owns, or takes responsibility for the outcomes of adversity or the extent to which the person holds himself accountable for improving the situation. People with low adversity quotient in the ownership dimension are most likely to blame others rather than take responsibility for whatever negative outcome of a given adverse situation. Therefore principals with high adversity quotient in the ownership dimension will enhance their accountability, control the school situation and motivate positive actions among the staff (academic and non-academic) and students despite adversities for the smooth running and overall improvement of the school rather than trade blames.

Reach evaluates the degree to which adversity gets into other areas of one's life. A person with high adversity quotient in

the reach dimension will keep adversity in its place, make adverse events and difficulties more manageable. Those people with low adversity quotient will allow adversities affect other aspects of their life leading to frustration, bitterness, failure, misfortune and may lead to poor decision making. Principals' ability to keep the fallouts under control and limit the reach of adversity is essential for efficient and effective problem solving in a school situation.

Endurance is the perception of time over adverse situations and how their consequences will last or endure. This implies how long the effect of an adverse event endures and so will likely impact negatively on the principal in the future. Seeing beyond even enormous difficulties is an essential skill for maintaining hope. Principals with high adversity quotient in the endurance dimension have the uncanny ability to see past the most seemingly interminable difficulties and maintain hope and optimism despite adversities encountered in the past. They will not be afraid to venture into areas where they have failed in the past.

Educational leader's (in this context, the principal) adversity response plays a crucial role in the development of successful school climates and student achievement (Rosenholtz, 1989 & Stoltz, 2000). A principal who possesses sufficient adversity quotient will more likely respond positively to educational adversity and lessen the negative impact it may have on teacher performance, student achievement and the overall development of the school. Therefore, failure of school administrators to face the adversities associated with their duties may result in more serious problems that can have detrimental effects on the success of students, teachers, parents, other stakeholders and even the whole educational institution. For this reason, adversity quotient is an important quality in principals' performance of their leadership roles and their choice of leadership styles.

Leadership styles have been defined in diverse ways. Abu-Hussein (2012) refers to leadership style as something that characterizes a specific person throughout different situations. However, Cherry (2015) provides a more detailed definition which views leadership style as a leader's characteristic behaviour when directing, motivating, guiding and managing groups of people. Consequently, leadership style, in this study, is seen by the researchers as the manner and approach of providing direction, implementing plans, and motivating people.

Clark (2015); Johannson (2014); Murray (2015); Raza (2015) and Turnock (2012) among others have identified different leadership styles. One of the most comprehensive reviews was that provided by Johannson (2014) and Raza (2015) who discussed fifteen different leadership styles namely transformational leadership, autocratic leadership, transactional leadership, bureaucratic leadership, democratic leadership, laissez-faire, facilitative/ participative leadership, situational leadership, charismatic leadership, visionary leadership, servant leadership, coaching leadership, strategic leadership, cross-cultural leadership and team leadership. Scholars have identified some leadership styles adopted by secondary school principals. Prominent among them are: democratic, autocratic, laissez-fair, transactional and transformational leadership styles which among others are used by leaders in educational institutions (AlFahad, AlHajri & Alqahtani, 2013). Wilson (2017) upholds the view that democratic, autocratic, laissez-fair, transactional and transformational leadership styles are commonly used by principals of secondary schools.

The democratic leader builds consensus through participation. If this style were summed up in one phrase, it would be "What do you think?" The democratic style is most effective when the leader needs the team to buy into or have ownership of a decision, plan, or goal, or if he or she is uncertain and needs fresh ideas from qualified teammates (Benincasa, 2012). Principals who are democratic in their style of leadership tend to build consensus in decision-making by consulting the staff, students and parents during Parents Teachers Association (PTA) meetings in administering the school. Autocratic leadership refers to a system that gives full empowerment to the leader with minimal participation of the followers. Power and decision-making reside in the leader (Mulisa, 2015). Principals with autocratic styles tend not to consult before entrenching new reforms or making decision in schools. Laissez-faire Leadership is used to describe leaders who leave their employees to work on their own; leaders are hands-off and allow group members to make the decisions.

Abu-Hussain (2012) sees transactional leadership as one that uses rewards and incentives to effect motivation. It involves an exchange process between leader and subordinate. It views the leader-follower relationship as a transaction. By accepting a position as a member of the group, the individual has agreed to obey the leader. In most situations, this involves the employer-employee relationship, and the transaction focuses on the follower completing required tasks in exchange for monetary compensation.

Transformational leadership allows for the development and transformation of people. It is the process in which the leader and employee support each other to reach a high level of moral and supportive spirit (Spahr, 2015). Cherry (2006) observes that some of the key characteristics of transformational style of leadership are the abilities to inspire followers and to direct positive changes in groups. Transformational leaders tend to be emotionally intelligent, energetic, and passionate. Principals who are transformational leaders are not only committed to helping the school achieve its goals, but also to helping group members (staff and students) fulfil their potential.

Principals being the recognized leader of the school play significant roles in adopting leadership styles as they tend to build highly aligned teams who have high levels of motivation and enthusiasm in the face of emergent and growing adversities plaguing secondary schools in Nigeria and Delta State in particular. In northern Nigeria, terrorism (Boko Haram sect), herdsmen attack, abduction of students (particularly females), teachers and outright killing of some, suicide bombing of schools leading to destruction of school facilities and the likes are issues of adversities principals contend with. In the south, particularly Delta state, herdsmen attack, militancy, violence, cultism, kidnapping are some of the adversities principals contend with. Duze and Ogbah (2013) and Ogbugo-Ololube (2016) have identified aggressive attitudes, engagement in high risk behaviour such as weapon carrying, drug and alcohol use by students, gang involvement, physical violence and poor academic achievement as issues of adversities principals in Delta State have to deal with as they provide leadership for the school.

Adversity quotient is the measure of one's ability to prevail in the face of difficulty, misery and misfortune. Stoltz advocates that these four dimensions will determine a person's overall adversity quotient. Somebody who responds to adversity

positively will most likely have a greater performance over one who takes adverse situations as a worse scenario to encounter. The more adversity quotient one has, the more likely one has to take positive actions. This implies that the more adversity quotient principals have over adverse situations, the more likely they will adopt leadership styles that will enhance the achievement of the school goals and objectives in the midst of adversities confronting the schools. Given the growing concern about the level adversities bedeviling schools in Delta State, it seems as if principals have not considered their adversity quotient in relation to the style of leadership they adopt as they work daily towards attainment of the school goals in the face of adversities. Hence, this study aims to ascertain the relationship between principals' adversity quotient and leadership styles in secondary schools in Delta State.

II. STATEMENT OF THE PROBLEM

Today's school environment seems to be plagued with numerous adversities. For instance, schools in Delta State are known to have cases of insecurity, teenage pregnancy, cultism, poor academic performance, poor funding, use of prohibited drug substance, physical violence and herdsmen attack. These are issues of adversities that principals of secondary schools in Delta State seem to constantly contend with. There is need for schools to evaluate the capacity of their principals to remain focused and strong in the midst of adversity. Previous studies carried out in foreign countries have shown that personal qualities such as adversity quotient of principals influence leadership styles. Therefore certain personal qualities of the principals such as high adversity quotient are required to adopt leadership styles for the school's success, particularly in the face of emerging adversities which principals have to contend with. There seems to be lack of existing knowledge in secondary schools in Delta State of a conceptual model that takes into consideration the relationship between the principal's personal qualities, expressed in degree of control over adverse situations and his leadership styles. Hence, this work sets out to investigate: principals adversity quotient and its relationship with leadership styles among secondary school principals in Delta State.

III. PURPOSE OF THE STUDY

The main purpose of this study was to determine the relationship between principals' adversity quotient and leadership styles in secondary schools in Delta State. Specifically, the study determined the following:

1. The relationship between principals' adversity quotient and democratic leadership style in secondary schools in Delta State.
2. The relationship between principals' adversity quotient and autocratic leadership style in secondary schools in Delta State
3. The relationship between principals' adversity quotient and laissez-faire leadership style in secondary schools in Delta State
4. The relationship between principals' adversity quotient and transactional leadership style in secondary schools in Delta State

- The relationship between principals' adversity quotient and transformational leadership style in secondary schools in Delta State.

IV. RESEARCH QUESTIONS

The following research questions guided this study:

- What is the relationship between adversity quotient scores and democratic leadership style scores of principals in secondary schools in Delta State?
- What is the relationship between adversity quotient scores and autocratic leadership style scores of principals in secondary schools in Delta State?
- What is the relationship between adversity quotient scores and laissez-faire leadership style scores of principals in secondary schools in Delta State?
- What is the relationship between adversity quotient scores and transactional leadership style scores of principals in secondary schools in Delta State?
- What is the relationship between adversity quotient scores and transformational leadership style scores of principals in secondary schools in Delta State?

V. METHOD

Correlation survey was adopted for the study. The area of the study is Delta State. Delta State is one of the states in the South- south geo-political zone of Nigeria. The study population comprised 414 principals in the 414 public secondary schools in

Delta State. Systematic sampling technique was used to draw the sample of 285 principals for the study. Two sets of questionnaire titled "Adversity Quotient Profile (AQP)" and "Multifactor Leadership Questionnaire (MLQ)" were used for data collection. The instruments were subjected to face validation by experts. The reliability of the instrument was established. The data used for computing the reliability indices were obtained from copies of the questionnaire administered on a sample of 20 principals in Anambra State. The data obtained were subjected to test for internal consistency using Cronbach Alpha. The reliability indexes yielded 0.88 for AQP and 0.85 for MLQ respectively. The administration of the instruments was done by the researchers together with three research assistants who are secondary school teachers in Delta State using direct administration method. Pearson's Product Moment Correlation Coefficient was used to answer the research questions. In answering the research questions, the coefficient (r) and the size of the relationship was interpreted using the interpretation of correlation coefficient by Best and Kahn (2003, p.388) as shown: .00 to .20 for negligible; .20 to .40 for Low; .40 to .60, for moderate, .60 to .80 for substantial; .80 to 1.00 for high to very high respectively.

VI. RESULTS

Research Question One:

What is the relationship between adversity quotient scores and democratic leadership style scores of principals in secondary schools in Delta State?

Table 1. Pearson's Correlation between adversity quotient scores and democratic leadership style scores of principals

| | N | Adversity Quotient | Democratic Leadership | Remark |
|-----------------------|-----|--------------------|-----------------------|---------------------------|
| Adversity Quotient | 282 | 1 | .390 | |
| Democratic Leadership | 282 | .390 | 1 | Low Positive Relationship |

The above table shows that the Pearson's Correlation Coefficient, $r(282) = .390$. This indicates that there is a low positive relationship between adversity quotient scores and democratic leadership style scores of principals in secondary schools in Delta State.

Research Question Two

What is the relationship between adversity quotient scores and autocratic leadership style scores of principals in secondary schools in Delta State?

Table 2. Pearson's Correlation between adversity quotient scores and autocratic leadership style scores of principals

| | N | Adversity Quotient | Democratic Leadership | Remark |
|-----------------------|-----|--------------------|-----------------------|---------------------------|
| Adversity Quotient | 282 | 1 | .359 | |
| Autocratic Leadership | 282 | .359 | 1 | Low Positive Relationship |

As shown in table 2, the Pearson's Correlation Coefficient, $r. (282) = .359$. This is an indication that a low positive relationship exists between adversity quotient scores and autocratic leadership style scores of principals in secondary schools in Delta State.

Research Question Three

What is the relationship between adversity quotient scores and laissez-faire leadership style scores of principals in secondary schools in Delta State?

Table 3. Pearson's Correlation between adversity quotient scores and laissez-faire leadership style scores of principals

| | N | Adversity Quotient | Laissez-faire Leadership | Remark |
|--------------------------|-----|--------------------|--------------------------|--------------------------------|
| Adversity Quotient | 282 | 1 | .437 | Moderate Positive Relationship |
| Laissez-faire Leadership | 282 | .437 | 1 | |

As shown in table 3, the Pearson's Correlation Coefficient, $r. (282) = .437$. This shows that there is a moderate positive relationship between adversity quotient scores and laissez-faire leadership style scores of principals in secondary schools in Delta State.

Research Question Four

What is the relationship between adversity quotient scores and transactional leadership style scores of principals in secondary schools in Delta State?

Table 4. Pearson's Correlation between adversity quotient scores and Transactional leadership style scores of principals

| | N | Adversity Quotient | Transactional Leadership | Remark |
|--------------------------|-----|--------------------|--------------------------|---------------------------|
| Adversity Quotient | 282 | 1 | .289 | Low Positive Relationship |
| Transactional Leadership | 282 | .289 | 1 | |

Table 4 shows the Pearson's Correlation Coefficient, $r. (282) = .289$. This is an indication that a low positive relationship exists between adversity quotient scores and transactional leadership style scores of principals in secondary schools in Delta State.

Research Question Five

What is the relationship between adversity quotient scores and transformational leadership style scores of principals in secondary schools in Delta State?

Table 4. Pearson's Correlation between adversity quotient scores and Transformational leadership style scores of principals

| | N | Adversity Quotient | Transformational Leadership | Remark |
|-----------------------------|-----|--------------------|-----------------------------|--------------------------------|
| Adversity Quotient | 282 | 1 | .417 | Moderate Positive Relationship |
| Transformational Leadership | 282 | .417 | 1 | |

Data analysis in Table 5 shows the Pearson's Correlation Coefficient, $r. (282) = .417$. This indicates that a moderate positive relationship exists between adversity quotient scores and transformational leadership style scores of principals in secondary schools in Delta State.

VII. DISCUSSION OF FINDINGS

The result of this study showed that there was a significant positive relationship between adversity quotient and democratic leadership style of principals. This findings is not consistent with the findings reported by Napire (2013) who found that there was no significant relationship between adversity quotient and democratic leadership style of elementary school principals. The difference in the findings may be due to limited sample size, Napire used 49 elementary school principals while this present study used 282 principals.

It was also found out that there was a significant positive relationship between principals' adversity quotient and their use of autocratic leadership style. This is finding is not in agreement with previous findings reported by Napire (2013) and Canivel (2010). The difference may be due to the use of small sample sizes while Napire used 49 elementary school principals and Carnivel used only 40 principals of private schools. The geographical disparity may also be a factor as cultural differences may also account for the differences in principals rating and perceptions of their adversity quotient and their leadership style.

The analysis of findings revealed that there was a significant positive relationship between principals' adversity quotient and their laissez-faire leadership style. This does not agree with previous studies carried by Napire (2013) who found no significant relationship between adversity quotient and principals leadership styles. The current finding was also at variance with the findings reported by Tigchelarr and Khaled (2015) who found no significant relationship between adversity quotient and transactional leadership among Egyptian businessmen. Issues of small size may have accounted for the difference in findings as they also used only 80 businessmen.

Another finding was that there was a significant positive relationship between principals' adversity quotient and transactional leadership style. This finding is in line with the previous results presented by Aquino (2013) who reported a significant positive relationship between adversity quotient and transactional leadership style. This suggests that when leaders exhibit adversity quotient trait, their use of transactional behaviour increases. This finding is also consistent with the finding recently reported by Bautista, Pascua, Tiu and Vela (2016) who found that adversity quotient is significantly related to leadership styles of student leaders. However, the current finding contrasts with the finding by scholars such as Canivel (2010) and Napire (2013).

It was also found that there was significant positive relationship between adversity quotient and principals' transformational leadership style. This finding is in agreement with the findings reported by some scholars, Bautista, Pascua, Tiu and Vela (2016) who found that adversity quotient is significantly related to leadership styles of student leaders. This suggests that there is the likelihood that principals' display of adversity quotient will increase their use of transformational leadership style. However, this study contrasts with the findings of other scholars: Aquino, 2013; Canivel, 2010; Napire, 2013; Tigchelarr and Khaled, 2015 who reported that there is no significant relationship between the two variables.). One of the possible reasons for this difference may be the small sample sizes used by these researchers.

VIII. CONCLUSION

The aim of this study was to ascertain the relationship between principals adversity quotient and democratic, autocratic, laissez-faire, transactional and transformational leadership styles. From the findings derived from the analysis of data, it was concluded as follows:

1. Adversity quotient of secondary school principals was significantly related to their democratic leadership style.
2. Adversity quotient of secondary school principals was significantly related to their autocratic leadership style.
3. Adversity quotient of secondary school principals was significantly related to their laissez-faire leadership style.
4. Adversity quotient of secondary school principals was significantly related to their transactional leadership style.
5. Adversity quotient of secondary school principals was significantly related to their transformational leadership style.

IX. IMPLICATIONS OF THE STUDY

The findings of this study have implication for leadership development in secondary schools in Delta State and beyond. Considering that adversity quotient is positively related to democratic, autocratic, laissez-faire, transactional and transformational leadership styles, leadership development efforts both in the secondary schools and by the secondary school management board may need to adapt strategies for the development of adversity quotient in school leaders.

X. RECOMMENDATIONS

In line with the findings that emerged from this study, the following recommendations are made:

1. Secondary School principals in Delta state should be made to be aware of the relevance of having high adversity quotient as it will likely facilitate their adoption of appropriate leadership styles. This can be done through a symposium or seminar on the need for increased adversity quotient in the management and leadership of secondary school.
2. Policy makers should develop policies relative to training of prospective principals before ratifying their appointment in the area of adversity quotient, since adversity quotient is associated with leadership styles, to prepare them for the task and difficulties inherent in their work and in-service training of Secondary school principals should be incorporated into it also.

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Employability of university graduates; Investigation of graduate's and employer's perspectives on employability

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Abstract-

The skill gap among the graduates is a common problem in Sri Lanka, where the skill levels of the graduates and the skill level perceived and required by the employers does not match when the graduates enter in to the corporate sector. Although this is a pertinent issue, in the extant body of literature investigations are lacking. This paper aims to investigate the factors affecting the employability of graduates in the Sri Lankan context. Particularly, investigates the factors from both graduate's and employer's perspectives. For this purpose, 175 recently graduated graduates and employers engaged in recruitment were considered from the Sri Lankan universities and corporate sector. Structural equation modelling was used to test the hypotheses through AMOS statistical package. The findings of this study provide significant insights for the academics and university administrators to facilitate graduates with requires skills and competencies to enhance the employability of graduates. The originality of this paper is on its contribution to the extant body of literature by examining the factors affecting employability of graduates from both graduate's and employer's perspective in one model.

Index Terms- *employability, graduates, employer's perspective, graduate's perspective*

I. INTRODUCTION

Before world war two secondary education was restricted to the elite parties who had the economic affordability (Sutherland, 2008). Due to the demographics and social shifts the number of enrolments for higher education has increased. In Sri Lanka, at the end of 2014, 8892 undergraduate enrollments recorded only for the private degree awarding institutes (Census and Statistics Sri Lanka, 2014). Although higher education has increased, a survey by McKenzie (2012) revealed that 40% of the employers

emphasize on the skill gap which prevails among the graduates. It is identified that among the graduates who obtain the degrees, significant percentage is overqualified for the job. From every graduate, one out of five possess skills more than required for the job they are performing (Li et al., 2006). Wickramasinghe and Perera (2010), also highlighted that among the Sri Lankan graduates who obtain the degrees, significant percentage is overqualified for the job. Thus, it can be identified that the education system has failed to produce graduates with required skills for the job market (Wickramasinghe & Perera, 2010). Therefore, within this context it is a puzzle that warrants a comprehensive study on why there is a skill gap among the graduates.

Though much attention has been paid for enhancing the graduate skills and education, still there is a lacuna in studies on efficiently transferring graduates to workplace. Finch et al. (2012) highlighted that identifying the factors which determine employability and its relationship is important, mainly to reduce the number of overqualified graduates and to select well equipped graduates by employers to achieve competitive advantage. According to Teichler (2009) previous studies examined how education success relate with career success but lacks focus on how the graduates can be transitioned well to the workplace. Holden and Hamblett (2007) also emphasized the need for additional research to examine how the new graduates can be transitioned to the workplace.

Extensive amount of research has been done on employability of graduates (Ball, 2003; Cotton, 1993; Davies, 2000; Ranasinghe, 1992; Raybould & Sheedy, 2005). Most of the studies on employability examines determinants of employability from graduate's perspective (Van der Heijden et al., 2009). Such studies revealed the education related achievement determines employability. Therefore, in most of the studies the theoretical context for employability is developed based on the factors which influence for the educational success of the graduates.

Further, as per the literature available current theories explores only one aspect. Either graduate's perspective of employability or employer's perspective of employability. Human capital theory (Schultz 1961 & Becker 1964) and Job market signaling theory (Stiglitz 1975; Arrow 1973; Spence 1973) examines the relationship between education credentials and employability of graduates. However, Both the theories do not focus on impact of employer's beliefs on employability of graduates. Bailly (2008), Non substantialist approach and New institutionalism theory (Meyer & Rowan 1977; Di Maggio & Powell 1983) addresses impact of employer's beliefs on employability. However, as per the literature available on employability theories, education credentials and employer belief's on employability has not been investigated in one model. Thus, current study addresses this lacuna in the theory by taking both the aspects into consideration. This study provides a theoretical contribution by integrating "non-substantialist" model of Bailly (2008) and Key to employability model of Pool and Sewell (2007). Thus, current study contributes to the existing literature by developing a model which includes both the graduate's and employer's perspectives on employability o graduates.

Further, this study provides an empirical contribution. It is highlighted that most of the studies which investigates factors which influence for employability gives more theoretical perspective and no much empirical evidence is provided (Wickramasinghe & Perera, 2010). Although, case studies available, lacks generalizability (Wickramasinghe & Perera, 2010). Therefore, comparing and extrapolating the findings is challenging. As per the literature available a study has been carried out in Sri Lanka by Wickramasinghe and Perera (2010) on the perceptions of graduates' and lecturers' towards employability skills within the computer science field. However, their study does not focus on both employers' and graduate's perspectives on employability of graduates and the study is limited to the field of computer science. Thus, the current study empirically examines the factors which decides employability of graduates from both graduates' and employers' aspects in the Sri Lankan context.

The main objective of the current study is to investigate the issue of efficiently transferring graduates to the workplace from the employer's and graduate's perspective, through investigating the factors influencing employability of graduates.

II. LITERATURE REVIEW

Extant literature defines employability in several ways. As identified by Hillage and Pollard (1998, p. 2), "Employability is the ability to get a job and keep fulfilling the required work". Further, employability refers to "realizing the sustainable employment by moving self-

sufficiently in the labor market". Yorke (2004, p. 8) defined employability as "a set of achievements skills, understandings and personal attributes that make graduates more likely to gain employment and be successful in their chosen occupations, which benefits themselves, the workforce, the community and the Economy".

Previous studies examine employability at two levels. First level condenses specific Employability factors such as listening skills, writing skills, academic performance. Second level consists higher order factors such as soft-skills, functional skills (Bhaerman & Spill, 1988; Longest, 1973). In Finch et al.'s (2012) study, the higher order category "meta-skills" contained specific employability factors such as listening skills, professionalism, and interpersonal skills.

As per the previous researches USEM model suggests four determinants of employability. Understanding, skills, efficacy beliefs and metacognition (Knight & Yorke, 2004, p 37). Hillage and Pollard (1998, p. 2) identified 4 factors which influence for employability. Employability assets which consists graduate's knowledge, skills and attitudes, Deployment assets which consists career management skills, presentation skills and external factors. According to the study of Bennett et al. (1999) five elements of employability of graduates can be identified. They are disciplinary content knowledge, disciplinary skills, workplace awareness, workplace experience and generic skills. Further Law and Watts, (1977) DOTS model suggests Decision learning, Opportunity awareness, Transition learning, Self-awareness (Watts, 2006) as employability prospects of a graduates.

A. Degree subject knowledge and understanding skills

Researchers have explored that graduates are judged based on the success of the completion of the degree and the knowledge that they gain in a particular discipline (Dacre & Sewell 2007). In that, problem solving is a major determinant of employability of a graduate (Reid & Anderson, 2012; Stiwne & Jungert, 2010). Range of competencies applied for synthesizing, cognition, analysis and judgement is considered as problem solving skills. (Halpern, 1998, p. 451). Problem solving skills considered as a major determinant of job performance. (Schmidt & Hunter, 1998, 2004).

B. Career development learning

Career developmental learning enables graduates to become more self-aware about things that they are really interested in and which best fit to their personalities (Gabris & Mitchell, 1989).

C. Experience

Pre-graduate work experience such as experiential learning opportunities and informal career related work experience shows higher job acquisition skills. (Hopkins et al., 2011; Gault et al., 2010; Callanan & Benzing, 2004; Gault et al., 2000)

D. Emotional intelligence

As Goleman (1998) outlines emotional intelligence is managing emotions well in the relationships and interactions. Moynagh and Worsley (2005) suggest emotional intelligence plays vital role in jobs where human interaction is high especially in the knowledge-based economy. People with emotional intelligence build good relationships, motivate themselves and achieve better career success (Cooper, 1997)

E. Generic skills

As per Pedagogy for Employability group (2004 p.5) list of generic skills are introduced as the transferrable skills of a graduate such as creativity, adaptability, willingness to learn, autonomy and working in a team.

F. Employer's belief

According to Cai (2012) Employer's belief refers to the value that employers gives to the employees and how they think about the graduates who have similar educational credentials. As Cai (2012) stated employer's belief about employment of graduates influenced by 3 factors including exogenous factors, initial signaling effects and private and public learning.

III. THEORETICAL UNDERPINNING

This study is based on the theories which influence for the graduate employability such as Human capital theory (Schultz 1961 & Becker 1964), Job market Signaling theory (Stiglitz 1975; Arrow 1973; Spence 1973) and New institutionalism theory (Meyer & Rowan 1977; DiMaggio & Powell 1983). One of the main theories which underpins the study is the Job market signaling theory (Stiglitz 1975; Arrow 1973; Spence 1973). This theory postulates that employers evaluates the employability of the graduates based on the signals send by the employees. Cai (2012) mentioned that employees send the signals about their ability and capacity by obtaining education credentials. Therefore, as per the Job market signaling theory education credentials of an employee becomes a main determinant of employability.

Human capital theory (Schultz 1961 & Becker 1964) postulates that employers have the ability to evaluate employee performance on rational basis. As Schultz (1961)

and Becker (1964) stated, education provides skills and capabilities that can be marketed. Thus, highly educated people tend to have more employment opportunities and perform well in their job. Non substantialist approach (Bailly. 2008) conceptualizes that to process information individuals use cognitive frameworks, shared norms and belief systems. According to Bailly 2008 belief systems of employers governs employment decisions and decides the employability of employees.

IV. CONCEPTUALIZATION AND OPERATIONALIZATION

On the basis of theoretical and empirical studies which are discussed and presented in the literature review, the study draws the following hypotheses and conceptual framework for this research:

H1: Degree subject knowledge has an impact on the employability of a graduate.

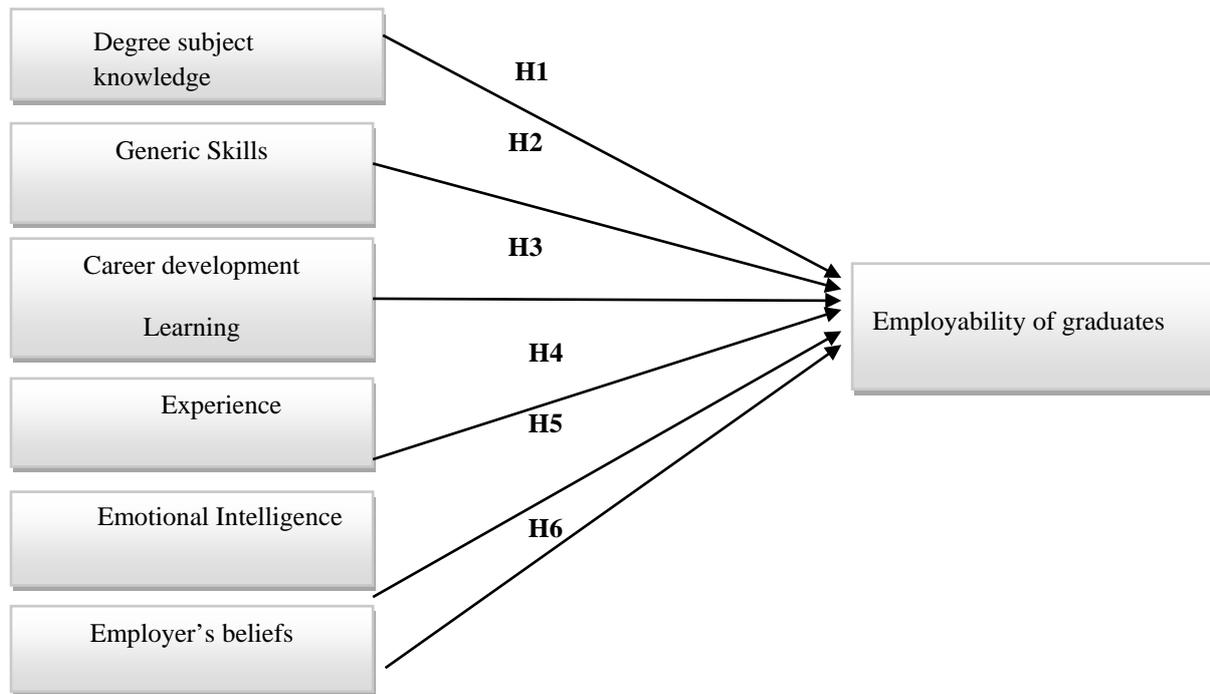
H2: Generic Skills has an impact on the employability of a graduate.

H3: Career development Learning has an impact on the employability of a graduate.

H4: Experience has an impact on the employability of a graduate.

H5: Emotional Intelligence has an impact on the employability of a graduate.

H6: Employer's beliefs and cognitive frameworks has an impact on the employability of a graduate.



Source: Author

Table 1: Sources of Measures

| Variables | Source |
|-----------------------------|--|
| Degree subject knowledge | (Johnes, 2006) |
| Generic skills | (Johnes, 2006) (Ng et al., 2010) |
| Career development learning | (Law & Watts, 1977) |
| Experience | (Pool & Sewell, 2007) |
| Emotional intelligence | (Goleman, 1998) (Golderg, 1990,1992) (Pool & Sewell, 2007) |
| Employer's beliefs | (Meyer & Allen, 1991) (Pool & Sewell, 2007) |

Source: Author compiled based on literature

V. Methodology

Present study follows quantitative method which is suggested by several scholars (Bryman, 2011; Creswell, 2014; Edmondson & McManus, 2007) and governed by the positivistic research philosophy. The operationalization of the study is presented above.

Sample selection was done in two stages. In the initial stage a purposeful sample of 175 employers were selected. Specially the employers and managers who directly influence and make recruitment decisions. Following Creswell (2009) managers who are involved in recruitment decisions were selected from a diverse background to make the entire population more representative. In the second stage sample of graduates were selected. Sample frame was

the list of graduates who passed out within less than 12 months in government and private universities in Sri Lanka. Sample was selected using stratified random sampling technique. Since there are so many faculties only the faculties which has significant employability issues were selected. This is done to avoid the faculties like medical, where the job is guaranteed by the government after the graduation. Therefore, for the present study 175 graduates from the faculties of humanities and social sciences were considered. Sampling was done for the study based on the same sampling technique followed by Wickramasinghe and Perera (2010) in their study on perceptions of Graduates', lecturers' on employability skills. Following Wickramasinghe and Perera (2010), the questionnaire was administered among the graduates sample to collect the data.

VI. Data Analysis

Prior to initiating the analysis, data was screened to assess and fix missing values, univariate and multivariate outliers, data normality, homoscedasticity, homogeneity and data linearity (Tabachnick & Fidell, 1996). According to Malhotra and Dash (2011), random missing values were replaced with 'neutral values' or 'imputed values. Further, Herman's single factor test (Podsakoff et al., 2003) was conducted to ensure that there were no common method biases in the study.

The data was analysed using the structural equation modeling approach to examine the model and test the hypothesized relationships with AMOS. Goodness of measures was performed to test the validity of measurement instruments, and a structural model was analysed to empirically establish the relationships between the constructs and test the model fit of the hypotheses. Construct validity, convergent validity and discriminant validity was assessed and assured in the present study to ensure the goodness of measures. Cronbach's alpha was tested to ensure the reliability of the measures.

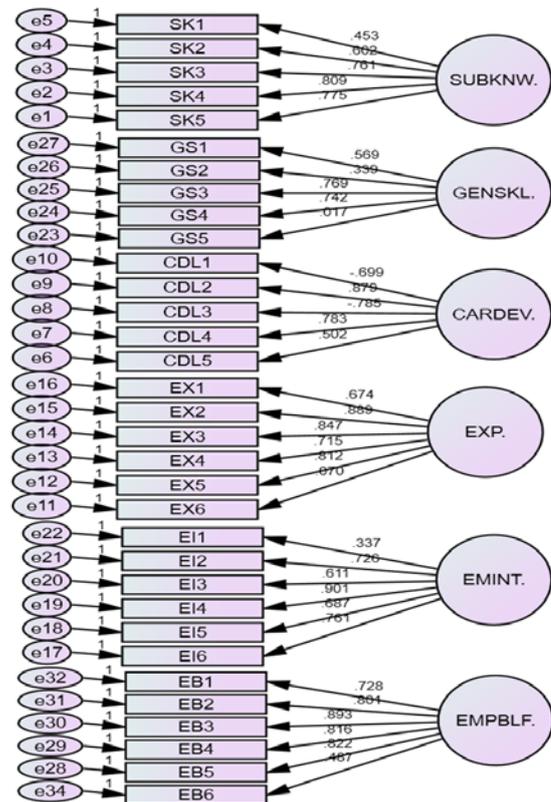


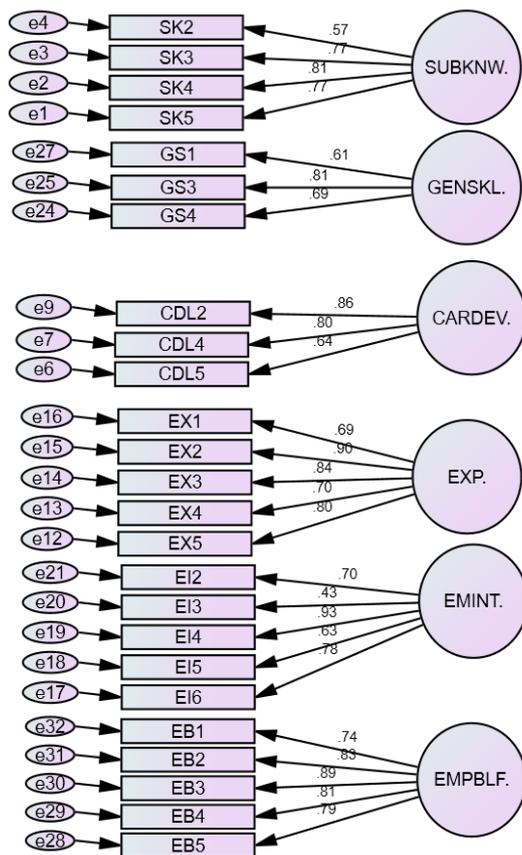
Figure 1: First order measurement model

Table 2: Validity and Reliability of measures

| Variables | Cronbach's Alpha | Std Factor loading (Min-Max) |
|--|------------------|------------------------------|
| Degree subject knowledge | 0.822 | 0.453-0.809 |
| General skills | 0.754 | 0.344-0.847 |
| Career development learning | 0.782 | 0.502-0.879 |
| Experience | 0.831 | 0.070-0.889 |
| Emotional intelligence | 0.723 | 0.337-0.901 |
| Employer's beliefs and cognitive framework | 0.811 | 0.487-0.893 |

According to table 2, except for few items, all the variables have equaled or surpassed the minimum factor loading. Each variable was examined and the items which did not meet the threshold level were removed. Since certain items (SK1, GS4, GS5, CDL1, EI1) did not show satisfactory level of validity such items were not taken for the refined model. As per Matsunga (2010) items with the standardized regression weights which are less than 0.5 needs to be removed. After the removal of the items, the modified measurement model did not exhibit standardized regression weight issues and all the indices of GOF were met satisfactorily as recommended by Hair et al. (2010). All the variables met the minimum cut off value of the Cronbach's Alpha ≥ 0.7 (Hair et al., 2010), thereby indicated a satisfactory level of reliability.

Figure 2: Refined model



Source: Survey data

Table 3 GOF Indices for the Final order measurement

| Incremental Fit | | Parsimony-Adjusted measures | | | | |
|-----------------|------|-----------------------------|------|------|------|------|
| CMIN/D | GFI | RMSE | IFI | TLI | CFI | PRA |
| F | | A | | | | TIO |
| 5.997 | .668 | .139 | .660 | .652 | .659 | .980 |

Source: Survey

Structural model and hypotheses testing

Structural Equation Modelling (SEM) was used to test the hypotheses. The overall structural model was assessed for the model fit, and it produced the following value indices. Some researchers (Paswan, 2009) allow values as high as 5 to consider a model adequate fit (Lomax & Schumacker, 2004). Therefore, the structural model in the present study indicated a moderate level of fit.

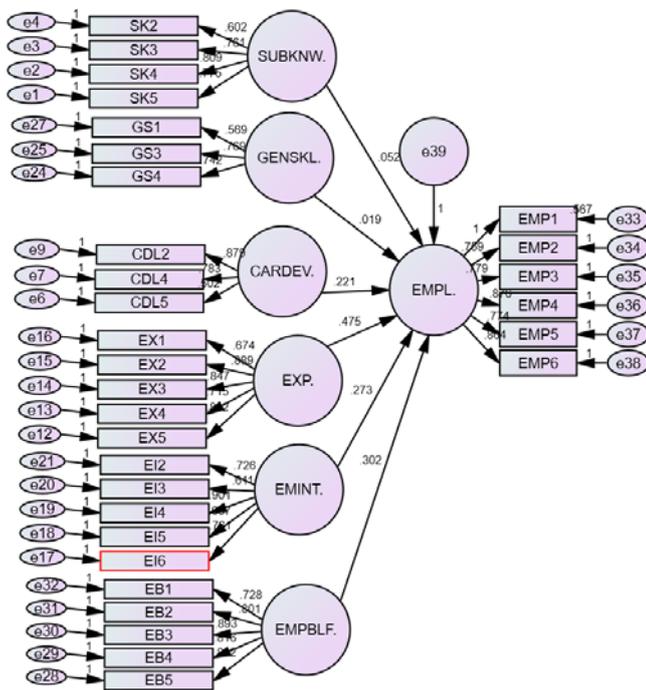
Table 4: GOF Indices for the Structural Model

| Incremental Fit | | Parsimony-Adjusted measures | | | | |
|-----------------|------|-----------------------------|------|------|------|--------|
| CMIN/DF | GFI | RMSEA | IFI | TLI | CFI | PRATIO |
| 5.477 | .630 | .132 | .642 | .626 | .641 | .961 |

Table 5: Hypotheses (H1-H6)

| Hypotheses | Beta Value | P value | Decision |
|---|------------|---------|-----------|
| H1: Degree subject knowledge has an impact on the employability of a graduate. | 0.052 | 0.000 | Supported |
| H2: Generic Skills has an impact on the employability of a graduate | 0.019 | 0.000 | Supported |
| H3: Career development Learning has an impact on the employability of a graduate | 0.221 | 0.034 | Supported |
| H4: Experience has an impact on the employability of a graduate | 0.475 | 0.000 | Supported |
| H5: Emotional Intelligence has an impact on the employability of a graduate | 0.273 | 0.000 | Supported |
| H6: Employer's beliefs and cognitive frameworks has an impact on the employability of a graduate | 0.302 | 0.000 | Supported |

Figure 3: Structural model for direct relationships



Source: survey data

VII. Discussion

Findings of the present study relating to the factors which has an impact on employability of graduates confirms previous empirical evidence. As per the findings of the present study, graduate’s subject knowledge to a certain extent decide his/her employability. As Johnes (2006) revealed the qualified graduates have more employment opportunities (as cited in Pool & Sewell, 2007). According to the findings of the present study generic skills such as transferrable skills of a graduate, creativity, adaptability, willingness to learn, autonomy and working in a team has an impact on their employability. Harvey et al. (1997) also confirmed that employers are seeking for well-developed generic skills from the graduates. Also, findings of the present study suggested that career development learning has an impact on the graduate’s employability. Which is confirmed by previous studies where career developmental learning enables graduates to become more self-aware about things that they are really interested in which best fit to their personalities (Gabris & Mitchell, 1989). Further, as stated by Foster (2006, p. 5) career development learning enables students to present themselves effectively and to make better career decisions which enhances employability of the graduates. Career development Learning may directly relate with the Employability of graduates. Moreover, according to the findings of the present study, experience has a

significant impact on the employability of graduates. It confirms the previous empirical findings where pre-graduate work experience such as experiential learning opportunities and informal career related work experience shows higher job acquisition skills. (Hopkins et al., 2011; Gault et al., 2010; Callanan & Benzing, 2004; Gault et al., 2000). Further, it confirms the findings of Pedagogy for Employability Group (2004), which stated that graduates who gain experience enhances their employability than graduates without the experience. Andrews and Higson, (2008) also confirmed that career related experience enhances the workplace readiness of a graduate. Findings of the present study further suggested that graduate’s emotional intelligence play an important role in determining his/her employability. This confirms the findings of Moynagh and Worsley (2005) which emphasized that emotional intelligence plays a vital role in jobs where human interaction is high, especially in the knowledge-based economy. People with emotional intelligence build good relationships, motivate themselves and achieve better career success (Cooper, 1997). This also confirms the study of Yorke and Knight (2002), which stated that well developed emotional intelligence competencies required by graduates to strengthen their employability. Moreover, from employer’s perspective, the value that employers gives to the employees and how they think about the graduates who have similar educational credentials determines the employability of graduates. Several previous studies confirms this which stated that employers’ perceptions such as belief and cognitive frameworks influence the graduate employability (Bailly, 2008; Cai, 2012).

VIII. Limitations, Implications and Future research

The results of the study must be interpreted in light of its limitations. Since the present study is a cross-sectional study, findings must be interpreted cautiously as employability varies as time passes. In order to overcome such limitations, it is suggested for future researchers to consider a longitudinal study. Study is limited to graduates who passed out within less than 12 months in universities in Sri Lanka. Thus, future researchers are encouraged to investigate how employability would vary among the graduates who have graduated more than one year.

This study contributes to the extant body of literature in several ways. Present study addresses the lacuna in the theory by taking both graduate’s perspective of employability and employer’s perspective of employability into consideration. As per the literature available on employability theories, education credentials and employer belief’s on employability has not been investigated in one model. Further, this study provides an empirical contribution by studying the factors affecting the employability of graduates in the Sri Lankan context, as

lack of empirical findings available in the extant literature in the Sri Lankan context.

The findings of the present study have significant managerial implications. Particularly, for the university administrators and academics to facilitate the graduates with the required skills and competencies which makes them easily employable after their graduation. As the finding of the study revealed that the career development learning and experience has a significant impact on graduate's employability, it is suggested for university administrators to establish more links and networks with various organizations in the industry to provides undergraduates with valuable internships and training opportunities. Further, academics need to provide training and development programmes for graduates to develop their emotional intelligence. As Central Bank of Sri Lanka and National Science foundation reveals there is a gap in the skill levels of the graduates and the skill level perceived and required by the employers, the findings of the present study would provide significant insights for universities to provide solutions to this pertinent issue by introducing changes to curricular, facilitating graduates for developing their employability skills and career advisors to provide proper career guidance.

IX. Conclusion

The findings of the study shed lights on the factors affecting the employability of the graduates. Accordingly, it can be concluded that employability is affected by the graduates' subject knowledge, generic skills, career development, experience, emotional intelligence and employer's beliefs. The findings of this study are much significant as the factors affecting graduate's employability have not been sufficiently investigated, from both graduate's and employer's perspective, even though the skill gap among the graduates is a pertinent issue in Sri Lanka. This study has significant managerial implications particularly, for the university administrators and academics in preparing graduates who have high employability in the future.

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Traffic Light Security Alarm Control System Using Pic Microcontroller

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Abstract- The more developing the country, the higher the living standard of the people, and the denser the traffic will be. So, there are a lot of traffic congestions and the monitoring and control of city traffic is becoming a major in many countries. The idea of intelligent traffic system is that drivers will not spend time waiting for the traffic light to change.

PIC controlling system is widely used and very popular around the world. Microcontroller control system with traffic security alarm is proposed in this paper. The proposed system is a combination of hardware and software devices. And this is the real time control system with fast dynamics situation. This is implemented by using assembly language programming.

Index Terms- Programmable Interface Controller (PIC), embedded system, security control system, detected circuit, PIC 16F877A single display, Power Electronic Devices,

I. INTRODUCTION

This system utilizes the traffic light security alarm to control the traffic light. There are one main road and one side street at a certain traffic junction. This system aims to develop a computer implemented PIC controller system that would automatically generate the durations of the green light to be lit for both ways as control output giving the main road higher priority. The traffic light is to have three lights (red, yellow, green), be able to shine red, yellow, and green for a certain number of seconds each, and be able to repeat this sequence indefinitely.

It is of a computer that controls the selection and timing of traffic movements in accordance to the varying demands of traffic signal as registered to the controller unit by sensor. The second part is that the visualization is signal face. Signal faces are part of a signal head provided for controlling traffic in a signal direction and consist of one or more signal sections.

These usually comprise of solid red, yellow and green lights. The third part is the detector or sensor. The sensor or detector is a device to indicate the presence of vehicles. The main aim of Intelligent Traffic Signal simulators is to reduce the waiting time of each lane of the cars and congestion [6].

II. RELATED WORKS

There are a lot of traffic light control systems. In developing the traffic light control system, some use the fuzzy

logic, MATLAB software, Lab VIEW software, PIC microcontroller is used in developing this traffic light control system. Owing to using the chip of PIC microcontroller with sensor, this system developed more than other.

The sensor will help to alarm in crossing the road at the wrong signal. In this system, microcontroller is applied of secure system. Nowadays, PIC microcontroller is used for a few kilobytes requirements of device control instead for a few kilobytes requirements of device control instead of personal computer. PIC microcontroller is very useful in the application areas of communication, transportation, product manufacturing and automatic control etc [2] [3]. Microcontrollers have traditionally been programmed using the assembly language of the target device. Although the assembly language is fast, it has several disadvantages. An assembly program consists of mnemonics and it is difficult to learn and maintain a program written using the assembly language.

High level language has the advantage that it is much easier to learn a high level language than the assembly. Also, very large and complex program can easily be developed by using a high level language.

III. MICROCONTROLLER

Circumstances that we find ourselves today in the field of microcontrollers had their beginnings in the development of technology of integrated circuits. This development had made it possible to store hundreds of thousands of transistors into one chip. That was a prerequisite for production of microcontrollers, and adding external peripherals such as memory, input- output lines, timers and other made the first computers. Further increasing of the volume of the package resulted in creation of integrated circuits.

These integrated circuits contained both processor and peripherals. That is how the first chip containing a microcomputer, or what would later be known as a microcontroller came out.

Microcontroller versus microprocessors

Microcontroller differs from a microprocessor in many ways. First and the most important is its functionality. In order for a microprocessor to be used, other components such as memory, or components for receiving and sending data must be added to it. In sort, it means that microprocessor is the very heart of the computer. On the other hand, microcontroller is designed to be all of that in one. No other external components are needed for its

application because all necessary peripherals are already built in to it. Thus, we save the time and space needed to construct devices [5] [7].

General features of PIC 16F877A

General features of PIC16F877A are RISC (Reduced instruction Set Computer). The PIC 16F877A microcontroller is the midrange microcontroller from the Microchip technology Inc [1]. It has the following features:

- 40 pins devices (33 input / output pins)
- 8192*14 flash program memory
- 368 bytes of RAM
- 256 bytes of EEPROM
- 8 multiplexed A/D converters with 10 bits resolution
- 3 timers, analogue capture and comparator circuit, USART and internal and external interrupt facilities
- 10000 erase/write cycles
- 1 K word of program
- timer and interrupt functions

IV. HARDWARE COMPONENTS

This system includes three major hardware components: the controller implemented to the system, the LDR sensors which detect the presence of vehicles, the light emitting diodes (LED) which act as the actuator and the countdown timers [6] ,12V and 5V power supply and the 555 timer used as a timer in alarm generating circuit is also discussed.

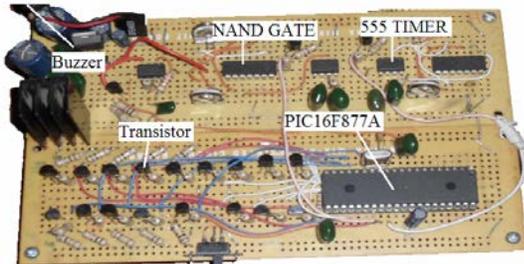
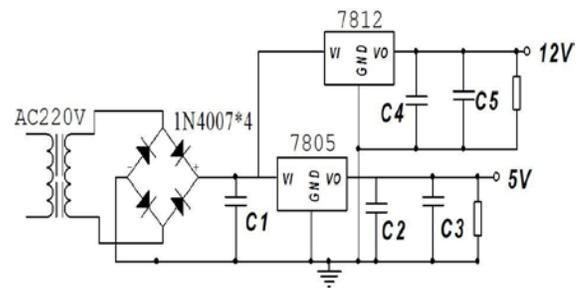


Figure 1. 16F877A Microcontroller
12V and 5V Power Supply

A power supply is an essential part of each electronic system from the simplest to the most complex. The DC power supply converts the standard 220v, 50Hz AC into a constant DC voltage. The DC voltage produced from a power supply is used to power all types of electronic circuits. In this system, full wave bridge rectifier uses four diodes. Diodes are used in circuits as rectifiers that convert AC voltage to DC voltage as shown in Figure 2.



C1...22µF 50V C2,C4...10 µF50V
R1...,R2....1KΩ C3,C5...0.1µF

Figure 2. 12V and 5V Power Supply Circuit

555 Timer-monostable and astable

The 8-pin 555 timer is one of the most useful chips ever made and it is used in many projects. With just a few external components it can be used to build many circuits, not all of them involve timing. So, it is a versatile and widely used device. It can be configured in two different modes as either a monostable multivibrator (one-shot) or as an astable multivibrator (oscillator), an astable multivibrator has no stable states and therefore changes back and forth (oscillates) between two unstable states without any external triggering. There are several reliable timers but the 555 timer is the most common whether you are putting together an alarm or a circuit to activate a computer a timer is the common component [4].

V. SYSTEM DESIGN AND IMPLEMENTATION

This system intends to develop sensor based on traffic light security alarm control system using PIC16F877A microcontroller. The (figure 5) is a diagram of the perfect circuit in traffic light alarm control system. This system applies both the monostable and astable of 555-timer, then controls PORT RA0,RA1 of PIC 16F877A. Sensor is used for alarm system, and buzzer device is controlled in PORT RB7 to broadcast alarm. Alarm device connected to PORT RB7 will broadcast if any passer-by or vehicle crosses the road at the red signal. To display countdown timer connected to transistor, both PORT RA0, RB0, RB1, RB3, RB4, RB5, RB6, RC0, RC1, RC2, RC3, RC4, and RD0, RD1, RD2, RD3, RD4, of PIC 16F877A control the 7-segment display.

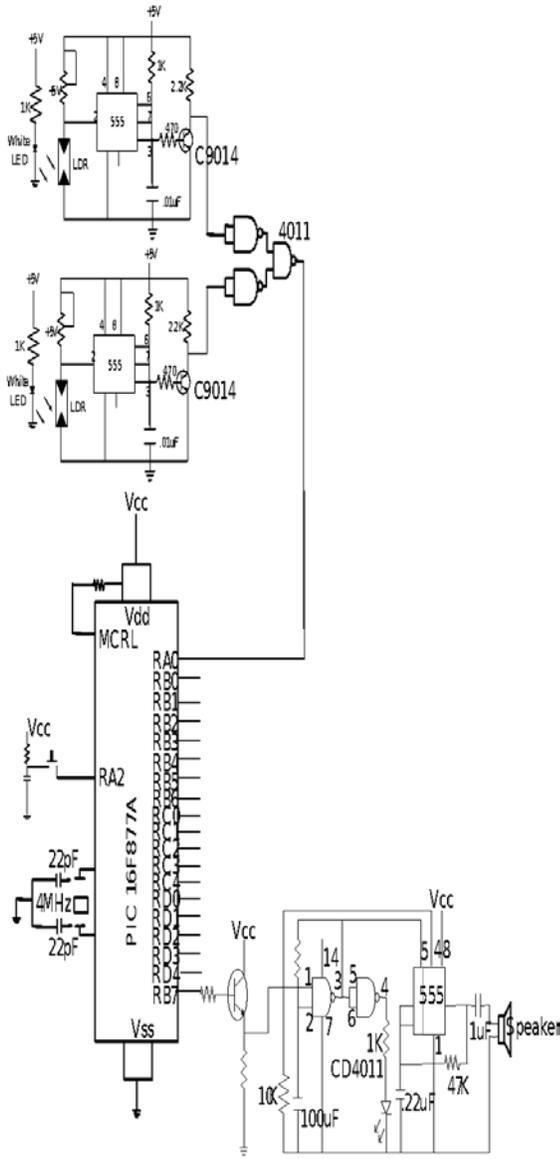


Figure 3. Circuit Diagram of Security Alarm System Using PIC16F877A Control

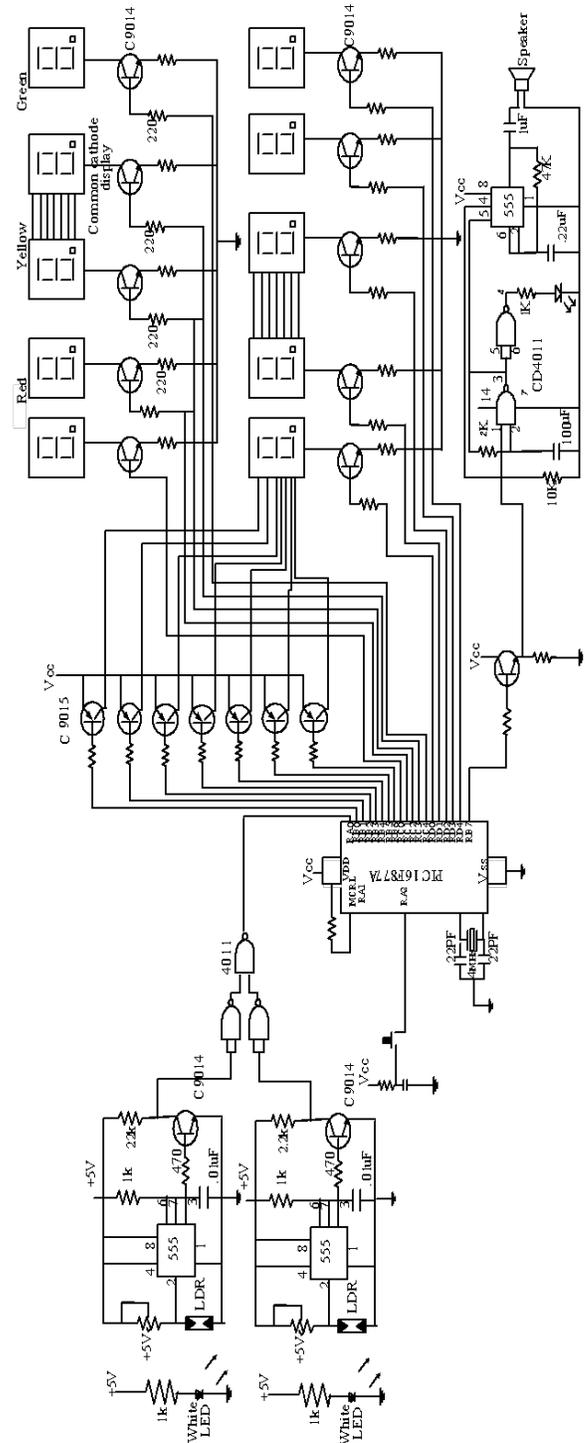


Figure 4. Complete Circuit Diagram

VI. EXPERIMENTAL RESULTS

In order to implement the traffic light control system, it needs to set up and assemble the hardware components and write a program to control the traffic light control [6]. The layout of the traffic light control is displayed in (figure 6).

The sensor based traffic light control system is made of microcontroller. There are three signals –such as yellow, red, green – in this system under the law of traffic light. The traffic

light signal operation will start with the traffic light illuminating in red for 25 seconds in all directions. It will start operating in the North lane [6], the East lane, South lane, the West lane and then goes back to the North lane. Firstly, simulator will check the north lane condition. It will check whether the sensors are triggered or not.

The total number of the sensors triggered will be used in the mathematical function to calculate the appropriate timing for the green signal to illuminate. After the green signal finishes the illumination of timing, the yellow signal will illuminate for 3 seconds, and finally the red signal will illuminate [6]. The yellow signal means that vehicles and passers-by are standby.

The red signal means to wait for the countdown and the green, to cross the road safely. Of course, if a vehicle or man on the road at the red signal crosses the road, and then sensor device will receive the object and alarm control will broadcast. This system will save the waiting time of vehicles to cross the road.

Since the waiting time of the vehicles for the true signal is optimal, the emission of carbon monoxide from the vehicles can be reduced. This will also save a positive effect to the green house effect towards the environment [6]. This system will save the motorists' time .It will help reducing the traffic congestion. Moreover, in crossing the road at the wrong signal, alarm control will help to broadcast. So, any vehicle and passer-by can cross the road safely and sound at the green signal.

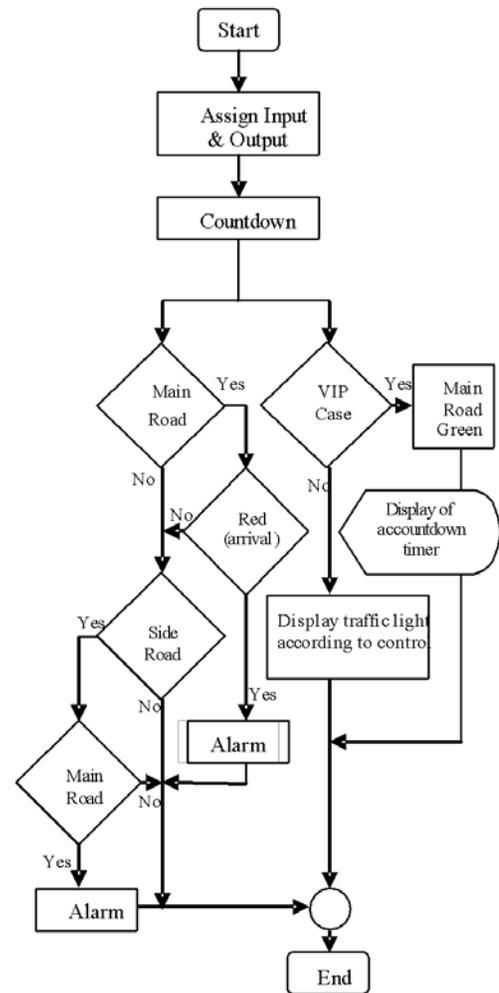


Figure 5. Flow Diagram of Proposed System

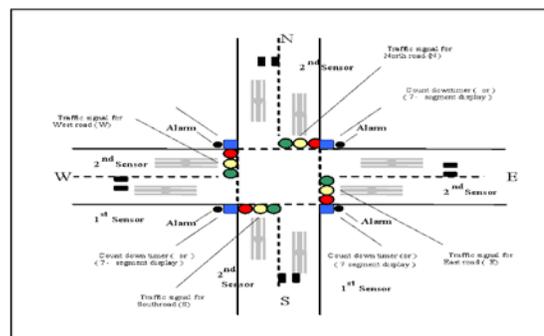


Figure 6. Traffic light security alarm simulator layout



Figure 7. Model of the traffic light security alarm control system

VII. CONCLUSION

This traffic light control system develops more than normal one. For, the system had successfully been designed under the control of the sensor. The sensors are interfaced with Lab VIEW integrate system [6]. This interface is synchronized with the whole process of the traffic system. It is this prototype (figure 7) in the real life situation.

The sensors will detect the presence or absence of vehicles or passers-by [6]. Crossing the road at the wrong signal which is that there is a vehicle or passer-by on the road at the red signal,

alarm control will help to broadcast. And, the system consists of the sensors to detect in all directions so that it has a wide range of detection capabilities, which can be enhanced and ventured into a perfect traffic system [6].

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Data Transfer for Secure Information by Using Symmetric Key Algorithm

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Abstract- Today, it is important that information is sent confidentially over the network without fear of hackers or unauthorized access to it. Cryptography was created as a technique for securing the secrecy of communication and many different methods have been developed to encrypt and decrypt data file in order to keep the message secret. Cryptanalysis on symmetric key cryptography is encouraging the use of larger key size and complex algorithm to achieve an unbreakable state. To implement this system AES (Advanced Encryption Standard) and CBC (Cipher Block Chaining) algorithms are used. Data transfer system can prevent from interruption, destruction, reparation of eavesdroppers, hacker, and blockers and so on, and can make the data secure. The implementation is written in C# using Microsoft Visual Studio 2008 and Microsoft .Net Framework v3.5.

Index Terms- AES (Advanced Encryption Standard) and CBC (Cipher Block Chaining) algorithms

I. INTRODUCTION

Cryptography is the science of information and communication security. It is also the science of secret codes, enabling the confidentiality of communication through an insecure channel. It protects against unauthorized parties by preventing unauthorized alteration of use. Generally, it uses a cryptographic system to transform a plaintext into a ciphertext, using most of the time a key. Cryptography provides the basic for the authentication of message as well as their secrecy and integrity.

Encryption/Decryption is the main process of cryptography. In this paper, we have studied AES and CBC, symmetric encryption, in order to transfer data securely. Since the security of symmetric encryption / decryption depends on a secret key. Since this system combines the AES with CBC mode, it provides more secure data transmission than simple conventional encryption.

II. BACKGROUND AND RELATED WORK

In cryptography, there are two types of encryption algorithms: symmetric and asymmetric. In this paper, we have studied AES-CBC, symmetric encryption. Symmetric key cryptosystems are an important type of modern cryptosystems where the same key is used for both encryption and decryption [1]. Five ingredients of symmetric encryption scheme are:

1.Plaintext: This is the original intelligible message or data that is fed into the algorithm as input.

2.Encryption algorithm: The encryption algorithm performs various substitutions and transformations on the plaintext.

3.Secret key: The secret key is also input to the encryption algorithm. The key is a value independent of the plaintext and of the algorithm. The algorithm will produce a different output depending on the specific key being used at the time. The exact substitutions and transformations performed by the algorithm depend on the key.

4.Ciphertext: This is the scrambled message produced as output. It depends on the plaintext and the secret key. For a given message, two different keys will produce two different ciphertexts. The ciphertext is an apparently random stream of data and, as it stands, is unintelligible.

5.Decryption algorithm: This is essentially the encryption algorithm run in reverse. It takes the ciphertext and the secret key and produces the original plaintext [2].

A block cipher is one in which a block of plaintext is treated as a whole and used to produce a cipher text block of equal length. Block ciphers in general process the plaintext in relatively large blocks at a time.

III. PROPOSED INFORMATION SYSTEM

The main objective of this paper is to introduce a secure data transfer communication system that employs cryptography to encrypt and decrypt the secret message to be transmitted over a secure channel. In this system, in order to be secure of Data Transferring. Data encryption and decryption with AES-CBC algorithm are used. Any file type such as text file, image file and audio can be transferred by using Server/ Client application. The (Figure 1) shows the main form of the Administrator or Server Site and User or client Site. User (client) Accounts are assigned in Administrator Site and User Home and Password are identified by Administrator in order that the assigned users can login to User (client) Site and remove unwanted users. Moreover, user lists of User Site can be looked at from the view of Administrator Site. Administrator can encrypt and send assigned users data or any file by clicking the Add File button and remove by clicking Remove File button.

User can login to User (client) Site, can view encrypted any file type from the administrator site and download. But, since there files are sent by encryption, user can get existing original file by

the use of decryption software. So, this decryption software has to be login to the User (client) Site and user downloads any file type in User Home Page encrypted. Key and IV Numbers from the User Site are needed to decrypt, sent together with encrypted file from Administrator Site, taken and utilized by the user for the decryption stage to get the existing file again.

Mainly security is used term surround the characteristics of integrity, authentication, privacy, and Availability. Now a days we depend on the send information over the network; risk of secure transmission over the networks has also increased. For the secure transmission that term are important for data transmission.

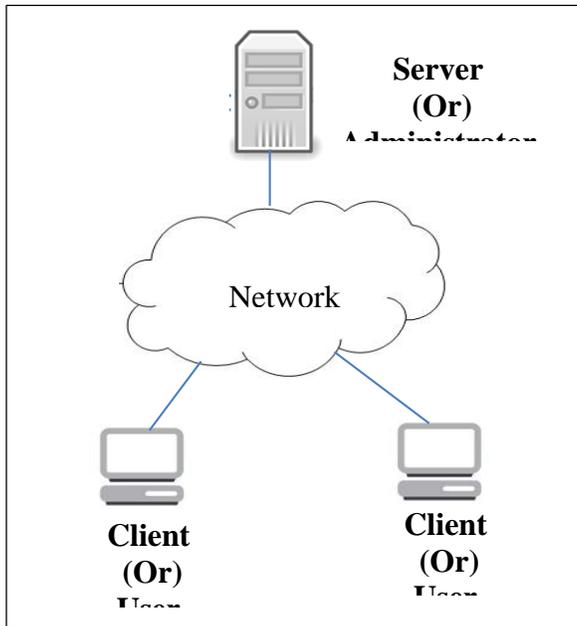


Figure 1. proposed system

IV. TECHNOLOGY USED

With the development of Science and technology, the information system is essential in our daily life. Cryptocurrencies emulate the concept of real world signatures by using cryptography techniques and the encryption keys. Cryptography methods use advanced mathematical codes to store and transmit data values in a secure format. Cryptography is a technique to send secure messages between two or more participants – the sender encrypts/hides a message using a type of key and algorithm, sends this encrypted form of message to the receiver, and the receiver decrypts it to generate the original message [3]. The System presented in this paper used the symmetric (AES) and CBC algorithms to implement the system for secure data transfer.

Advanced Encryption Standard (AES)

The development of data techniques the The development of data techniques the problem of data security becomes more and more important. In cryptography, AES is one of the most popular algorithms used in symmetric key encryption. AES is one of the most popular algorithms used in symmetric key cryptography . It is available by choice in many different encryption packages. AES has a fixed block size of 128 bits and a key size of 128, 192, or

256 bits can produce a corresponding output of the same size . AES is fast in both software and hardware, is relatively easy to implement, and requires little memory [1]. AES is used by the vast majority of network-based symmetric cryptographic application. AES is a substitution permutation process, which is a series of mathematical operations that use substitutions (also called S-Box) and permutations (P-Boxes) .

AES Encryption algorithm

- 1) Key Expansion
- 2) Initial round
 - a. AddRoundKey
- 3) Nr -1 Round
 - a. SubBytes
 - b. ShiftRows
 - c. MixColumns
 - d. AddRoundKey
- 4) Final Round
 - a. SubBytes
 - b. ShiftRows
 - c. AddRoundKey

AES uses variable number of rounds (Nr) which are fixed: 10 rounds for 128-bit keys, 12 rounds for 192-bit keys, and 14 rounds for 256-bit keys [5]. During each round, above operations are applied on the state.

- SubBytes: The substitute bytes operation is a nonlinear byte substitution that operates on each of the state bytes independently using S-box and changes the byte values.
- ShiftRow: every row in the 4x4 ray is shifted a certain amount to left depending on the row index.
- MixColumn: The mixcolumns transformation uses a mathematical function to transform the values of a given column within a state, acting on the four values at one time as if they represented a four-term polynomial.
- AddRoundKey: each byte of the state is combined with a round key, which is a different key for each round and derived from the AES (Rijndael) key [1].

(Means and variances of the variables) necessary for classification.

AES Decryption algorithm

- 1) Key Expansion
- 2) Initial round
 - a. AddRoundKey
- 3) Nr -1 Round
 - a. Inverse Shift Row
 - b. Inverse Sub Bytes
 - c. AddRoundKey
 - d. Inverse MixColumns
- 4) Final Round
 - a. Inverse Shift Row
 - b. Inverse Sub Bytes
 - c. AddRoundKey

AES decryption uses essentially the same algorithm, with the following changes: the inverse of the four main operations are used.

- Inverse Shift Row: The inverse shift row transformation, called InvShiftRows, performs the circular shifts in the opposite direction for each of the last three rows, with a 1-byte circular right shift for the second row, and so on [4].
- Inverse Sub Bytes: Inverse Sub Bytes is the inverse of the byte substitution transformation, in which the inverse S-box is applied to each byte of the State. This is obtained by applying the inverse of the affine transformation followed by taking the multiplicative inverse in GF (2⁸) [1].
- Inverse MixColumns: Inverse Mix Columns is the inverse of the Mix Columns transformation. Inverse Mix Columns operates on the State column-by-column, treating each column as a four-term polynomial as described [5].
- AddRoundKey: The round keys are used in the reverse order.

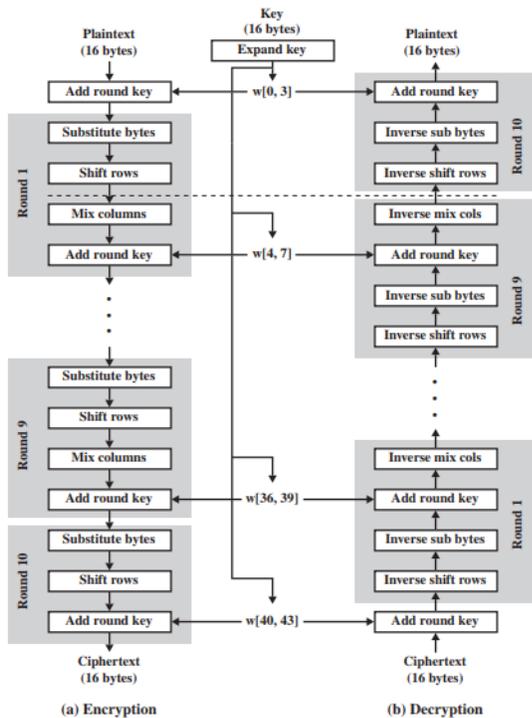


Figure 2. AES-128 is a 10 round block cipher encryption and decryption algorithm

Cipher block chaining (CBC)

In this scheme, the input to the encryption algorithm is the XOR of the current plaintext block and the preceding ciphertext block; the same key is used for each block. In effect, we have chained together the processing of the sequence of plaintext blocks. The input to the encryption function for each plaintext block bears no fixed relationship to the plaintext block. Therefore, repeating patterns of bits are not exposed. As with the ECB mode, the CBC mode requires that the last block be padded to a full bits if it is a partial block.

For decryption, each cipher block is passed through the decryption algorithm. The result is XORed with the preceding

ciphertext block to produce the plaintext block [4]. The AES-CBC encrypted as shown in (Figure 3).

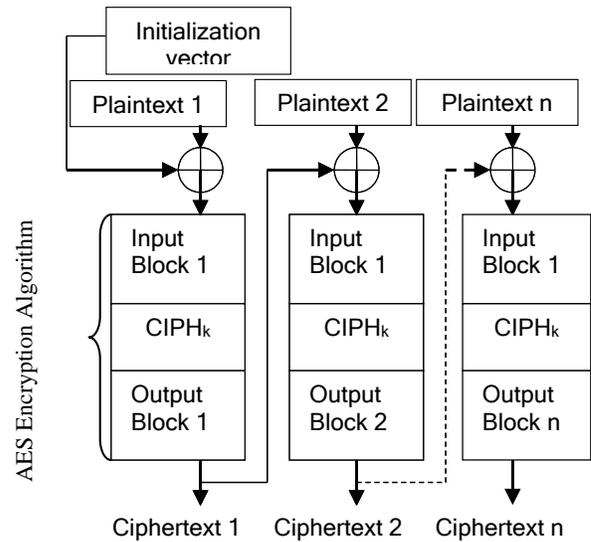


Figure 3. AES-CBC encryption

In AES-CBC encryption, the first input block is formed by XOR the first block of the plaintext with IV. The AES cipher function is applied to each input block to produce the ciphertext block (output block). With CBC mode, an XOR is performed on the input plaintext and the previously ciphertext block (output block). Since previously encrypted data is not available for the first operation an initialization vector (IV) must be provided. CBC works on complete 128-bits blocks of plaintext. In AES-CBC decryption, the AES inverse cipher function is applied to the first ciphertext block, and the resulting output block is XOR with the IV to recover the first plaintext block. In general, to recover any plaintext block (except the first), the AES inverse cipher function is applied to the corresponding ciphertext block, and the resulting block is XOR with the previous ciphertext block as shown in (Figure 4).

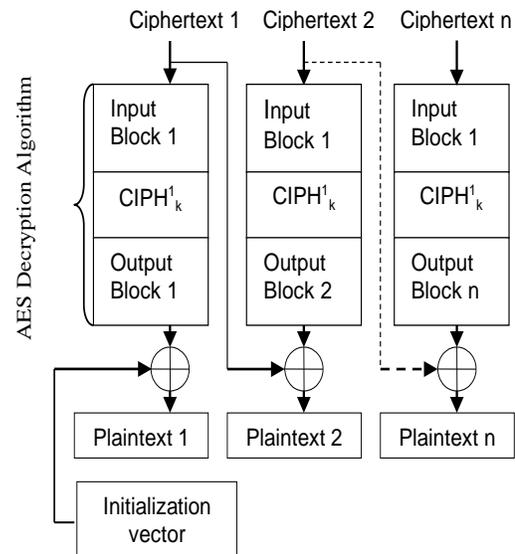


Figure 4. AES-CBC decryption

A common way to achieve the necessary increase is to append some extra bits, called padding, to the trailing end of the data string as the last step in the formatting of the plaintext. Other methods may be used; in general, the formatting of the plaintext is outside the scope of this recommendation. The padding bits can be removed unambiguously provided the receiver can determine that the message is indeed padded. One way to ensure that the receiver does not mistakenly remove bits from an unpadded message is to require the sender to pad every message, including messages in which the final block (segment) is already complete.

V. IMPLEMENTATION OF SECURE DATA TRANSFER SYSTEM

A. Login Page

In the Login page, the user needs to fill the security information (such as Administrator user Name and Password) to access the system. If the User Name and Password is correct, the user can enter to the Users Option.



Figure 5. Administrator form

B. Create Add User

From the Users Option Tab, the user can choose to go to Add User, Remove User and Check User Activity Page. In the Add User page, the user needs to fill new User name and password to create the system.

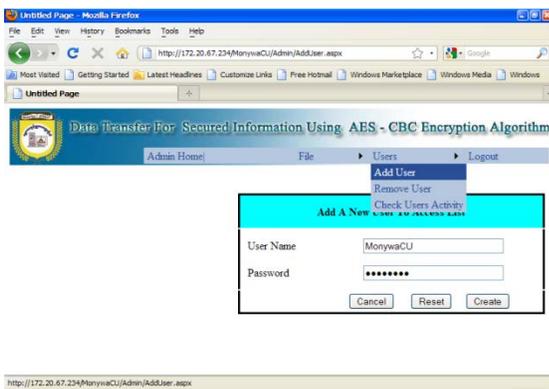


Figure 6. Add user

C. Encryption and Sending Any Files

In Figure 7, shows: the administrator can choose the files that files that is transmitted from the file menu. When File menu is click, Add File sub menu is appeared. It can be added files to deliver operation and can be selected user(s). Who can download the files when Add File sub menu is clicked.

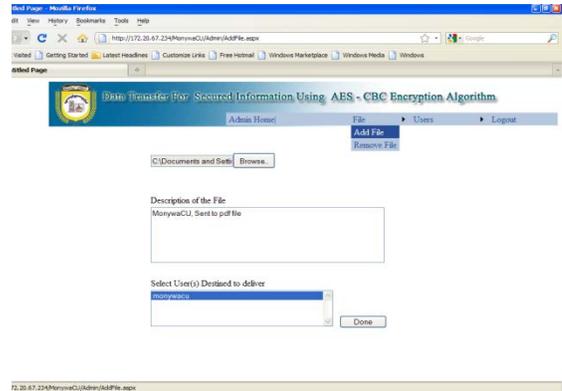


Figure 7. Encryption and sending any file

D. Encrypted file User receive encryption file

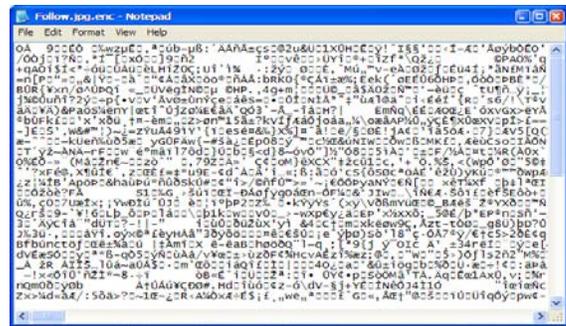


Figure 8. Encrypted file

E. User home page

The User Home page , It can be managed the process that Encrypted file and IV (Initialization Vector) and key are downloaded.

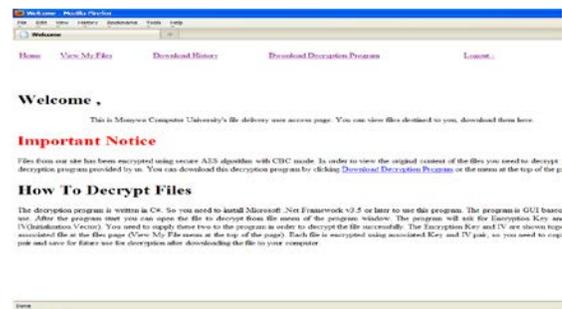


Figure 9. User home page

F. Download to decrypt program

The download files lists and its IV and Key can be seen from View My Files menu.

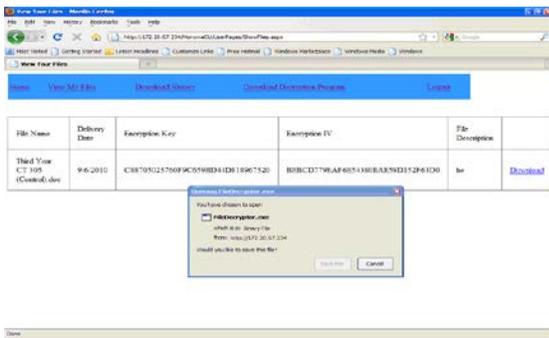


Figure 10. Download to decrypt program

G. Decrypted File

Show the condition is called decrypt the original file. When the encrypted file has been decrypted, asked for the please to save the decrypted file. It can be seen the original file when the saved file is opened.



Figure 11. Decrypted file

VI. CONCLUSION

This system implements secure data transfer system using AES algorithm and CBC mode their advantages can be taken to support an encryption/ decryption technique for the client /server system. While the performance of symmetric key cryptography that is implemented using only block cipher algorithms. Therefore, this system provides not only authentication but also confidentiality by using symmetric encryption.

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Migrant Society as A Source of Character Value in Social Studies Learning

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Abstract: The approach used in this study is a qualitative approach. This study researcher used a case study research approach. With another meaning a case study is a research where researchers explore a certain phenomenon (case) in a time and activity and collect information in detail and in depth using various procedures for collecting data during a certain period. The research technique in this study used observation, interviews and documentation. Data reduction is carried out continuously during the research process. At this stage after the data has been sorted and then simplified, and data that is not needed is sorted to make it easy for appearance, presentation and to draw conclusions temporarily. The data is then sorted according to the group and arranged in accordance with technical categories to be displayed in harmony with the problems in the study, including temporary conclusions obtained at the time of reducing data. The results of this study are through identifying character values in migrant communities in Wonokromo RW 5 Surabaya, through activities that are contained in the community, namely routine activities and incidental activities so that there are 9 character values, namely: religious, harmony, cooperation, maintaining wealth national culture, love for the motherland, honesty, protecting the environment, friendship, empathy and solidarity.

Keywords: *Migrant Society, Character Value, Social Studies Learning*

INTRODUCTION

The current social phenomena that illustrate the existence of moral degradation are very worrying. Truth, honesty, justice help and affection have become very rare things found in the social life of today's young generation and are covered by deception, oppression, not caring about others, free sex and many other deviation acts. (Hanang, 2016)

Education is a conscious effort carried out by society, nation and state in developing in a person which includes three aspects, namely life attitude, outlook on life, and life skills. These three aspects can be done in schools, families and the environment. In implementing outside the school or the surrounding environment, a clear plan and program are needed in accordance with the guidelines and flexible implementation according to the needs and environmental conditions. For the implementation of education in the family carried out informally without standard and written guidelines. In the implementation of these three aspects, it can provide cultural heritage and character possessed by the nation and society to form a better young generation in the future. (Muta'alim, 2017).

The inheritance of cultural values and characters in Indonesian education must be in accordance with the national education goals written in Chapter I Article 1 of Act Number 20 of 2003 concerning the National Education System, which confirms that: "Education is a conscious and planned effort to realize the learning process and atmosphere learning so that students can actively develop their potential to have spiritual, religious, personality, intelligence, self-control, noble character, and skills needed by themselves, society, nation and state ". (Ministry of National Education, 2003)

Social studies education as part of learning for education in general has an important role in improving the quality of education. Specifically, social studies education also plays a role in making quality students, namely humans who are able to think critically, logically, creatively, and take the initiative in responding to the symptoms and social problems that occur in society caused by technological developments that have increased in the global era. Therefore, social studies learning should be able to develop various kinds of knowledge, attitudes, and skills. Social studies learning function to develop knowledge, attitudes, and basic skills to understand social reality and can solve problems faced by students in their daily lives and are able to develop basic skills that are useful for themselves and society (Isjoni, 2007).

The problem faced in social studies learning in schools is the lack of motivation in learning both teachers and students, where it has been embedded that social studies are memorization lessons, meaningless and boring, without a thing that can be directly felt by students. From problems like this a teacher must give something meaningful to the students.

Teachers in using learning resources must pay attention to certain criteria or guidelines to choose appropriate learning resources. This is so that the learning resources that have been chosen are appropriate and in accordance with the learning objectives, and if applied in learning (Pratowo, 2012).

The study in this research is also an attempt to fulfill the objectives of Social Sciences. According to *The Multi Consortium of Performance Based Teacher Education* in the United States in 1973, the objectives of Social Sciences Education are as follows (Gunawan, 2011): 1) Understanding and being able to use several structures from a discipline or interdisciplinary to be used as new data analysis material, 2) Knowing and being able to apply important social science concepts, generalizations, and theories to new situations and data, 3) Having skills in problem solving, apply it as a research technique and evaluation of information, 4) Able to use a higher way of thinking in accordance with the goals and assignments he gets.

Based on the objectives of the Social Studies Education described above, the researcher must be able to understand the basic concepts of the social sciences, then integrate these concepts through a multidisciplinary approach to obtain a holistic understanding of a phenomenon or problem problems that exist in the community. In relation to the topic of this research, the researcher will make the activities contained in the community a source of value that can be integrated into learning.

The community is a study that can be used as a source of social studies learning in schools. Social studies subjects are designed to develop knowledge, understanding and ability to analyze conditions and social problems that occur in society in entering dynamic community life. Social studies subjects are arranged in a comprehensive, systematic and integrated manner in the learning process and what is expected is success in life in society. With the use of learning resources it is expected that students will gain understanding.

The community who came in RW 5 in Wonokromo village had different cultures and characteristics so that the plurality was seen in their daily lifestyle and language. However, the differences in the community can blend and influence each other in the local general cultural atmosphere. People who come in the area are Madurese, Javanese and Sundanese people.

Pluralism is spread in various Wonokromo regions, especially in RW 5. They have long lived side by side and interacted with each other by using local general culture so that the creation of togetherness and harmony in a multicultural society. This is in accordance with the opinion of Soekanto (1990) is the result of good social interaction and dynamic social relations between communities both between relationships between individuals, groups and between individuals and groups.

Therefore, the researcher will see and analyze how the pattern of interaction between one community and the other community and how the implementation of community activities in the area, so that the researcher will identify what character values appear in the activities in the kelurahan Wonokromo RW 5.

METHOD

The approach used in this study is a qualitative approach. Bogdan and Taylor (in Moleong, 2009) define qualitative methods as research procedures that produce descriptive data in the form of oral from people and written words and behavior that can be observed. In this research, researchers used a case study research approach. Case study research according to John W. Creswell in his book *Qualitative Inquiry and Research Design: Choosing among Five Traditions* that a case study is an exploration of a system that is bound or a case from time to time through in-depth data collection and involving various rich sources of information in a context.

In determining the research subject, the researcher used the Purposive sampling method, because not all samples or research subjects had criteria according to what the author had determined. In the method of determining this sample the researcher made the subject of the study, namely the person who was considered the most knowledgeable or the most powerful, could be a public figure or an official. So that people can make it easier to get information on the social situation to be studied.

Data collection techniques in this study are: 1) Observations in this study there are two, namely initial observations conducted by researchers in determining the initial stages in research and researchers can determine what steps should be taken when starting to enter the real research. The second observation is observation when the researcher starts collecting data, which is about location settings, research subjects and the situation of migrant people, how they interact with others and how they live their daily lives so that a character emerges in society. 2) Interviews are used as data collection relating to the formulation of the problem in the study, which is to gather information about the life and activities found in migrant communities in Wonokromo RW 5 Surabaya. In the interview process, researchers place themselves as friends so that they can convey information naturally without any pressure or coercion. The interview used in this study was unstructured interviews. 3) Review documents, namely reviewing: literature on research on migrant communities, official documents in relation to character values in migrant communities, junior high school social

studies curriculum and related manuals, to obtain information about types, forms and procedures for the use of learning resources in accordance with social studies at school.

RESULTS AND DISCUSSION

Identification of the Characteristics of Migrant Society in Wonokromo Village

In this study, researchers identified the character values of migrant society in Wonokromo RW 5, identifying character values through community activities both routine and incidental activities. And this character value can be found and can be used as a source of character values in social studies learning in schools, especially class VII. Some of the findings that will be discussed in this chapter include: (1) The position of this research in scientific repertoire, which provides an explanation regarding understanding or disagreement with research regarding the character values possessed by everyone, especially in a society; (2) Explanation of the failure of several desired research objectives in the preparation of sources in social studies learning in accordance with existing basic competence (KD); (3) The challenge of this research is related to the theory used when the results of this study are used in social studies learning.

This research is in accordance with previous research conducted by Tan and Mahadir (2017), which in his study that Malaysian society is a multi-ethnic society so that the existence of moral education in schools can provide a basis for people to behave in the lives of their communities. Important values that arise in multi-ethnic societies include values of respect, mutual help, hard workers and caring. Likewise, the research conducted by Novia (2015) states that the character values found in the Kampar society derive from one of the cultures, namely the *Badongong* rhyme culture, namely the values of religious character, honesty, discipline, hard work, independence and curiosity. And the research conducted by A. Bessinova and D. Shormanbayeva who examined the Kazakh society (2014), that the character value possessed by the community was a lack of responsibility due to the existence of regional authority by the soviets who dominated for more than seventy years.

The similarity of this study with previous research is that everyone must have a character and so does the group of people commonly referred to as the society. The character that is found in society is that it arises because of the habits carried out in the society so that it becomes a culture of the community itself. And in their habit patterns their interactions contain character values that can be used as guidelines for human life.

CONCLUSION

The results of research on society as a source of character values in social studies learning in schools, it can be summarized as follows: Identifying character values in migrant communities in Wonokromo RW 5 Surabaya is through activities that are contained in the community, namely routine activities and incidental activities so that there are 9 character values, namely: religious, harmony, cooperation, maintaining the richness of the nation's culture, love for the motherland, honesty, protecting the environment, friendship, empathy and solidarity.

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Proximate Composition, Mineral Content, Phytochemical Screening and Anti-Nutritional Constituents of Walnut (*Tetracarpidium conophorum* OR *Plukenetia conophora*) Seeds.

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Abstract: This study was designed to evaluate the phytochemical screening, proximate composition, mineral content and anti nutritional constituents of cooked and raw African walnut (*Tetracarpidium conophorum* or *Plukenetia conophora*) seeds. The phytochemical screening of the seed reveals the presence of alkaloids, glycosides, steroids and polyphenols. The result of the proximate analysis was shown to be moisture (17.5±0.03%), crude protein (4.506±0.01%), lipid (20.0±0.05%), crude fibre (20.0±0.02%), ash (15.5±0.05%), carbohydrate (22.49±0.01%), vitamin C (11.15±0.1mg/kg) for cooked seeds and moisture (18.0±0.02%), crude protein (13.13±0.01%), lipid (22.50±0.025%), crude fibre(18.0±0.01%), ash (14.25±0.08%), carbohydrate (14.12±0.01%) and vitamin C (11.0±0.1mg/kg) for the raw seeds. The result of the mineral content of the seed was shown to be Cu (0.079±0.003PPM), Zn (0.1507±0.01PPM), Mn (0.124±0.01PPM), and Fe (0.124±0.01PPM) for the cooked seeds and Cu (1.08±0.1PPM), Zn (2.26±0.1PPM), Mn (0.064±0.001PPM) and Fe (0.079±0.002PPM) for the raw seeds. The anti nutrients content of the cooked sample was shown to be oxalate (0.0207± 0.01mg/100ml), phytate (0.114±0.01mg/100ml), hydrocyanide (0.011±0.10mg/100ml) and that of the raw seeds was shown to be oxalate (0.204±0.10mg/100ml), phytate (0.123±0.02mg/100ml) and hydrocyanide (0.112±0.10mg/100ml). This analysis showed that African walnut seeds are a rich source of lipid, fibre, carbohydrate, vitamin C, alkaloids, Polyphenols, glycosides, Cu, Zn, Mn and Fe. The concentration of some of the analytes were lower in the cooked sample especially the anti-nutritional constituent, while carbohydrate, fibre and ash were higher in the cooked sample; this implies that processing of food results in the reduction of anti-nutritional factors. This seed could be eaten frequently by diabetic and hypertensive patients because of its constituents.

Keywords: Proximate composition, phytochemical screening, Anti nutrient, Mineral, Walnut.

1. INTRODUCTION

Walnuts are edible seeds that are widely cultivated for their delicacy. Prominent species include *Juglans regia* (L.), commonly known as the English walnut and belonging to the family *Juglandaceae*^[4]. The tropical African walnut, known as *Tetracarpidium conophorum* or *Plukenetia conophora*^[18], belongs to the family *Euphorbiaceae*^[7] is the seed of interest in this research. ^[1]stated that some walnut species are found in the family *Oleaceae*. The walnut is generally referred to as the conophor tree or conophor nut^[12]. The plant is popularly known as African walnut, black walnut and Nigerian walnut^{[8][16]}. However, lack of storage facilities has hampered the market value of the walnut and the nuts must be consumed within 1–2 days when cooked or else it will become foul smelling and unpleasant for sale and consumption^[13]. The seeds are consumed as snacks for refreshments. During its season, hawkers relate their walnuts quality to kola nut maturity. The buyers also shake each seed to ensure that the seed is intact in the

hard epicarp, and most times the quality of the seed can be seen from the nut colour and size. It is a perennial cash crop and an economic tree that is widely grown for its edible seeds^{[5][7][9]}; it is also used as wood in the timber industry.

This research work was designed to evaluate the proximate composition, mineral content, anti-nutrients and the phytochemistry of African walnut (*Tetracarpidium conophorum*) seeds to ascertain the nutritional value of the seeds.

2 MATERIALS AND METHODS

2.1 Sample collection and identification

Tetracarpidium conophorum or *Plukenetia conophora* (Walnut) seeds were obtained from watt market, Calabar North Local Government Area, Cross River State and were identified by a herbarium in Department of Biological Sciences, Cross River University of Technology, Nigeria.

2.2 PROXIMATE ANALYSIS

The proximate analysis was carried out using standard analytical methods as described by[3].

2.3 Determination of Moisture Content

2g of each of the samples were crushed and put into a dried weighed crucible. The samples were put in a moisture extraction oven at 105°C and heated for 3 hours. The dried samples were then put into desiccator and allowed to cool and reweighed. The difference in weight was calculated as a percentage of the original sample.

$$\% \text{ moisture} = \frac{\text{weight of original sample} - \text{weight of dry} \times 100}{\text{weight of original sample}}$$

2.4 Determination of Ash Content

2g of each of the samples were weighed into a crucible and were heated in a moisture extraction oven for 3 hours at 100°C before it was transferred into a muffle furnace at 550°C. This continued until the samples turned white and free of carbon. The samples were then removed from the furnace, allowed to cool in the desiccator at ambient temperature and were reweighed immediately. The weight of the residual ash was then calculated as ash content.

$$\% \text{ ash} = \frac{\text{weight of ash} \times 100}{\text{weight of original sample}}$$

2.5 Determination of Fat Content

25g of the samples were wrapped with a filter paper and put into a thimble which was fitted to a clean round bottom flask which has been cleaned, dried and weighed. 120ml of petroleum ether was used as extraction solvent. The samples were heated with a heating mantle and allowed to reflux for 5 hours. The reflux was recovered and evaporated. The weight of the fat was then determined.

$$\% \text{ oil content or } \% \text{ fat} = \frac{\text{weight of flask and oil extracted} - \text{weight of empty flask} \times 100}{\text{weight of original sample}}$$

2.6 Estimation of Crude Fibre Content

Crude fibre content was determined using the method reported by^[11] with the following processes; acid and base digestions.

$$\% \text{ crude fibre} = \frac{\text{weight of sample before incineration} - \text{weight of sample after incineration} \times 100}{\text{weight of original sample}}$$

2.7 Determination of crude protein content (Modified Kjeldahl Method)

Crude protein content was determined using Modified Kjeldahl Method.

$$\% \text{ Nitrogen} = \frac{\text{ml of HCl (sample)} - \text{ml of HCl (blank)} - \text{molarity of HCl}}{\text{weight of sample} \times \text{ml of digest} \times 1000}$$

$$\% \text{ Protein} = \% \text{ Nitrogen} \times \text{Protein factor.}$$

2.8 Determination of Carbohydrate Content

The carbohydrate content was calculated as the difference between the dry weight and the summation of other proximate parameters as Nitrogen free extract (NFE) percentage carbohydrate as shown below.

$$\text{NFE} = 82.5 - (\% \text{protein} + \% \text{fat} + \% \text{Ash} + \% \text{crude fibre}) \text{ for cooked sample.}$$

$$\text{NFE} = 82 - (\% \text{protein} + \% \text{fat} + \% \text{Ash} + \% \text{crude fibre}) \text{ for raw sample.}$$

2.9 Determination of Mineral content.

The mineral content was determined using Atomic Absorption Spectrophotometer (AAS) and the values for Cu, Zn, Mn and Fe were obtained.

2.10 Estimation of vitamin C Content

Vitamin C content was determined using titrimetric method described by^[19].

3. RESULTS AND DISCUSSION

The proximate composition of the walnut seeds is shown in table I. The moisture content of the raw sample was higher than that of the cooked sample (18±0.002 and 17.5±0.03% respectively). This is attributed to the hydrolysis of some of the minerals during the boiling process, this account for why the raw sample has a longer shelf life compared to the cooked sample. The ash content of the raw (14.25±0.08%) was lower than the cooked sample (15.5±0.05%). This increase in ash in the cooked sample is absurd. The crude fat content of the walnut seed was higher in the raw sample (22.50±0.025%) compared to the cooked sample (20.0±0.05%). This result agrees with 52.1% and 21.1% for both raw and cooked walnut seeds^[21]. This shows that the raw seeds contain higher fat than the cooked sample.

Table 1: Proximate Composition of Walnut seeds

| | COOKED % DRY WT | RAW % DRY WT |
|------------------|------------------------|---------------------|
| Moisture content | 17.5±0.03 | 18.0±0.02 |
| Ash | 15.5±0.05 | 14.25±0.08 |
| Lipid | 20.0±0.05 | 22.50±0.025 |
| Fibre | 20.0±0.02 | 18.0±0.01 |
| Protein | 4.506±0.01 | 13.13±0.01 |
| Carbohydrate | 22.49±0.01 | 14.12±0.01 |
| Vitamin C | 11.15±0.1(mg/kg) | 11.0±0.1(mg/kg) |

Values are mean ± standard deviations of triplicate determinations

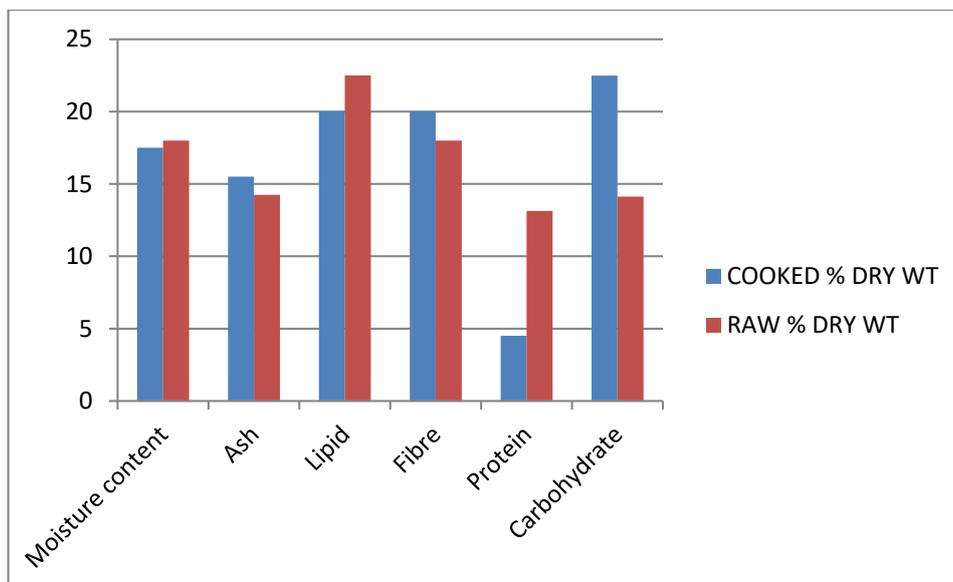


Fig. 1(a) Bar chart for proximate composition of cooked and raw samples of walnut seeds

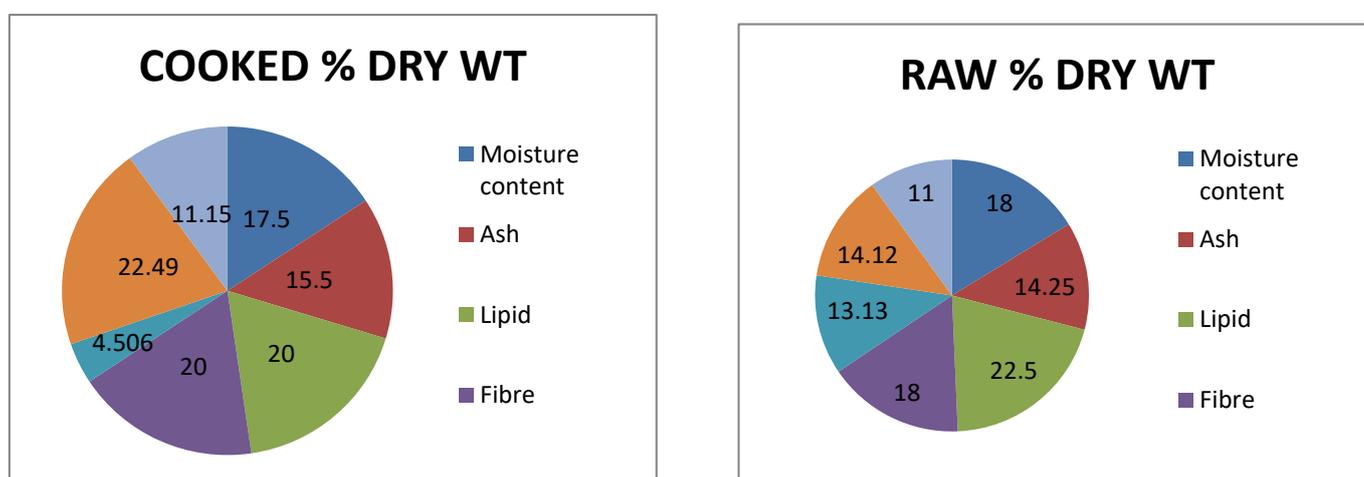


Fig. 1(b): Pie charts for proximate composition of cooked and raw samples of walnut seeds

The crude fibre content for the cooked seeds ($20.0 \pm 0.02\%$) was higher than the fibre content of the raw seed ($18.0 \pm 0.01\%$). These values are higher than that obtained from *Chrysophyllum albidum* seed ($16.00 \pm 0.13\%$)^[15]. Fibre in food plays an important role in providing roughage that aids digestion and reduces the accumulation of carcinogens in the body. The crude protein was found to be ($4.506 \pm 0.01\%$) for the cooked seed and ($13.13 \pm 0.01\%$) for the raw seed. This is lower than ($25.76 \pm 0.45\%$) for *Chrysophyllum albidum* seed^[15]. However, any plant food that provides more than 12% of its energy from protein is considered a good source of energy^[10]. Therefore, *Tetracarpidium conophora* is a good source of protein. The carbohydrate content for cooked walnut seed ($22.49 \pm 0.01\%$) was higher than that of the raw seed ($14.12 \pm 0.01\%$). The major function of carbohydrate is to provide the body with energy.

Table 2: Phytochemical screening of walnut seeds

| COMPONENTS | PRESENCE BOILED | PRESENCE UNBOILED |
|---------------|-----------------|-------------------|
| Alkaloids | + | ++ |
| Saponins | BDL | BDL |
| Flavonoids | BDL | BDL |
| Tannins | BDL | BDL |
| Glycosides | + | +++ |
| Anthraquinons | BDL | BDL |

| | | |
|-------------------|-----|-----|
| Steroids | + | + |
| Reducing compound | BDL | BDL |
| Polyphenols | +++ | +++ |
| Phlobatinins | BDL | BDL |

+ slightly present, ++ moderately present, +++ heavily present, BDL below detection limit.

The result of the phytochemical screening of walnut (*Tertracarpidium conophora*) seeds is shown in table 2. From the result obtained, alkaloids were slightly present in the cooked seeds and moderately present in raw seed. Alkaloids belong to a class of mainly basic nitrogenous compounds that have significant pharmacological and physiological importance and are not widely distributed in nature^[14]. Glycosides were slightly present and heavily present in both cooked and raw samples respectively. Glycoside have specific characteristics and powerful action exerted on cardiac muscles and therefore is used in congestive heart failure due to determination of work capacity per unit weight of mycroches tissues, medicinal interest on cardiac glycosides is because of their stimulant effect in the heart^[17]. Steroids were slightly present in both cooked and raw seeds. Polyphenol was heavily present in both cooked and raw samples. Phenols are structurally similar to alcohols but are much stronger acids^[20]. It helps in contracting the blood capillaries and so prevents certain hemorrhages. Saponins, flavonoids, tannins, anthraquinones, reducing compound and phlobatannins were below detection limit (BDL) in this study.

Table 3: Mineral content of Walnut seeds

| ELEMENTS | COOKED COMPOSITION (PPM) | RAW COMPOSITION (PPM) |
|----------------|--------------------------|-----------------------|
| copper (Cu) | 0.079±0.003 | 1.08±0.1 |
| Zinc (Zn) | 0.1507±0.01 | 2.26±0.1 |
| Manganese (Mn) | 0.124±0.01 | 0.064±0.001 |
| Iron (Fe) | 0.040±0.002 | 0.079±0.002 |

Values are mean ± standard deviations of triplicate determinations

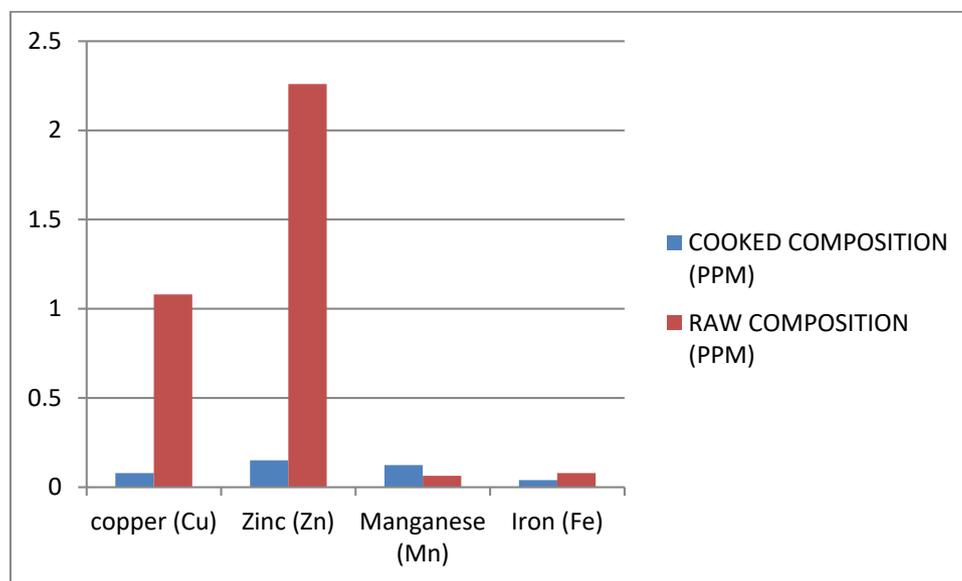
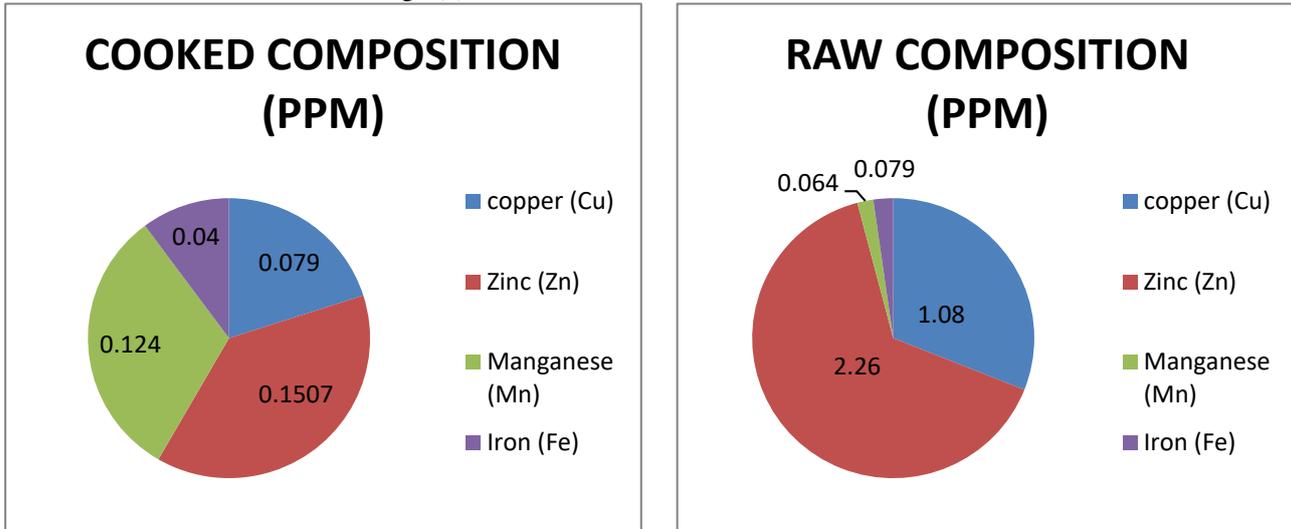


Fig. 2(a): Bar charts for mineral content of cooked and raw walnut seeds

Fig.2(b):Pie charts for mineral content of cooked and raw walnut seeds



The result of the mineral content of walnut seed shows that Cu, Zn and Fe were higher in the raw seeds compared to the cooked seeds with Mn slightly higher in the cooked seeds (Table 3 and pictorially in fig. 2(a) and 2(b) i.e. Bar and Pie charts). These minerals are essential for a healthy body especially Fe and Zn. Iron is needed for red blood cell formation. When iron is deficient in the body, it will manifest itself as iron-deficiency anemia^[15]. Zinc is require for the metabolic activity of about 300 of the body enzymes and is needed for meiosis and mitosis^{[6][15]}.

Table 4: Anti Nutritional composition of walnut seeds

| SAMPLE | Composition (mg/100ml) | |
|--------------|------------------------|------------|
| | Cooked | Raw |
| Oxalate | 0.0207± 0.01 | 0.204±0.10 |
| Phytate | 0.114 ± 0.01 | 0.123±0.02 |
| Hydrocyanide | 0.011±0.10 | 0.112±0.10 |

Values are mean ± standard deviations of triplicate determination.

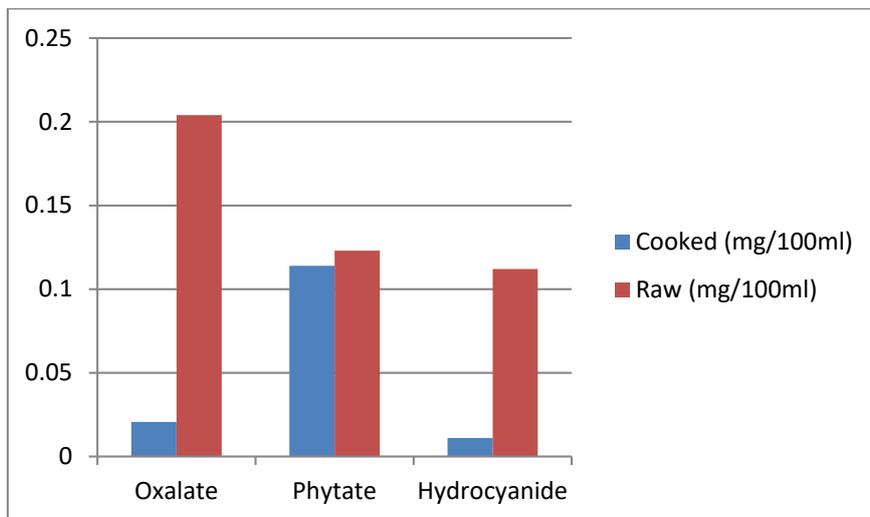


Fig. 3(a): Bar chart of anti-nutritional constituents of walnut seeds

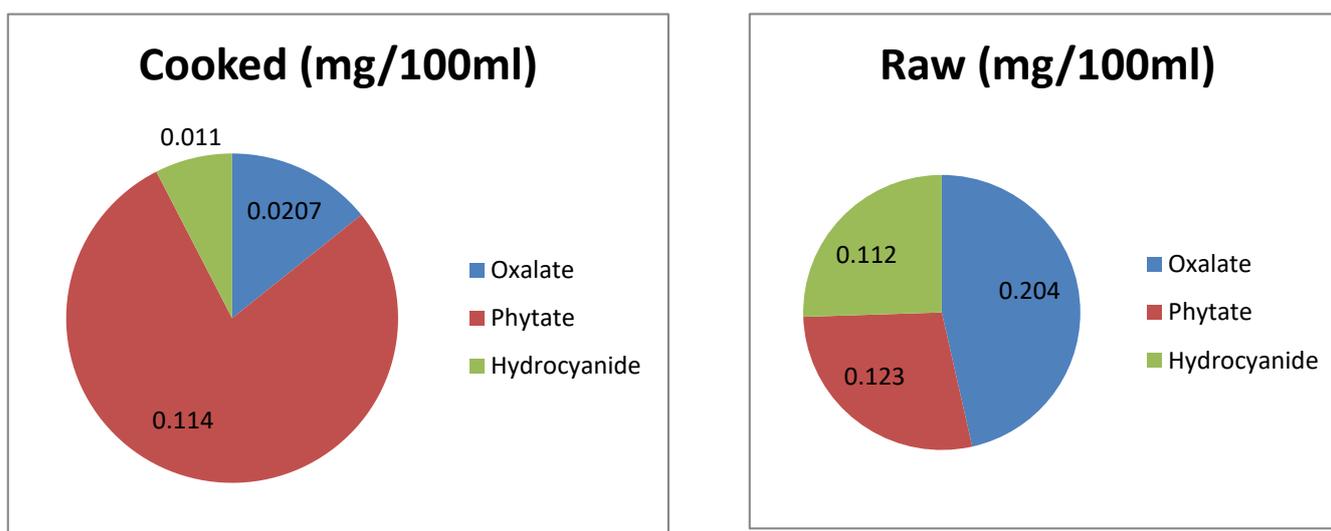


Fig.3(b):Pie charts of anti-nutritional constituents of walnut seeds

The anti-nutritional content of African walnut seed is shown in table 4 and pictorially in fig. 3(a) and 3(b) i.e. Bar and Pie charts. The values of oxalate, phytate and hydrocyanide in both the cooked and raw samples are lower than the values (oxalate; 1.43 ± 0.61 mg/l, phytate; 9.15 ± 2.31 mg/l, hydrocyanide, 0.15 ± 0.1 respectively) reported for some local edible vegetables^[2].

4. CONCLUSION

Phytochemical screening of African walnut (*Tetracarpidium conophora*) samples shows that it contains potent phytochemical substances such as alkaloids, glycosides, steroids and polyphenols which could be employed in the pharmaceutical industry for manufacture of drugs. The African walnut seed contains high level of carbohydrate, lipid and fibre but relatively low level of protein and vitamin C for the cooked seed. The seeds are rich in minerals such as Cu, Zn, Mn, and Fe. This seed could be eaten frequently by diabetic and hypertensive patients because of its constituents. Intensive research should be carried out on the samples and related members of the same family on the use of the seed for mineral, energy and medicinal supplements. The concentration of some of the analytes were lower in the cooked sample especially the anti-nutritional constituent, while carbohydrate, fibre and ash were higher in the cooked sample; this implies that processing of food results in the reduction of anti-nutritional factors. It is recommended that isolation, characterization and structural elucidation of the phytochemicals in the leaf and stem bark of the walnut plant should be assayed in view of pharmaceutical application.

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AUTHORS CONTRIBUTION

Sample collection, preparation and analysis were carried out by Mr. Agwupuye, John Akwagiobe of University of Calabar while the interpretation of results and writing of manuscript was done by Dr. Neji, Peter Amba of Cross River University of Technology, Nigeria.

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Improving Skills of Critical Thinking of Students Through Edmodo-Helped Problem Based Learning Model for Fifth Grade Students of Elementary School

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Abstract- This study aims to improve students' critical thinking skills in fifth grade students through *Edmodo's Assisted Problem Based Learning* model. The location of the study was at Lowokwaru Elementary School 2 Malang, with 34 subjects in the fifth grade-A. This study used Quasi Experiment with the design of *one group pretest posttest design*. This study was conducted in 2 meetings, by doing several stages, namely, developing a Learning Implementation Plan (RPP), Student Worksheet (LKS), and Critical Thinking Skills Test. Data collection techniques use the method of observation of teacher activities and student activities, tests, and student response questionnaires. The results showed an increase from the first meeting to the second meeting. For teacher activities at the first meeting the percentage was 81.40%, and at the second meeting the percentage increased to 92.10%. The activity of students in the first meeting had a percentage of 79.10% and at the second meeting the percentage increased to 94.10%. Improvement of students' critical thinking skills can be seen from the results of evaluations at the *pretest* and *posttest* which respectively have the results of the average *pretest* scores 55 and *posttest* values with an average of 92. While the aspects of student responses to learning activities using *edmodo* assisted *Problem Based Learning* models show percentage of 87%

Index Terms- Critical thinking skills, Problem Based Learning (PBL), Edmodo

I. INTRODUCTION

Towards the 21st century, the development of science and technology, especially in the field of information and communication, is growing rapidly. In addition, competition in life in the era has an influence on all aspects of life, including in the field of education. In facing the era of modernization, the education system in Indonesia is expected to be able to equip students with learning skills and life skills, one of which is critical thinking skills. Critical thinking skills are skills that must be possessed by students by referring to five indicators namely providing simple explanations, building basic skills, making inferences, giving further explanations, and managing strategies and tactics. Critical thinking skills are not skills that exist from birth, but skills that can be trained in the learning process (Ennis, 2011).

Critical thinking skills can be developed through learning approaches with learner-centered (Snyder & Wiles, 2015). These skills can be improved through *open-ended* questions during discussions and the provision of problem-based activities in each learning activity (Awang & Ramli, 2008). Many learning approaches are student-centered, one of which is the *Problem Based Learning* (PBL) model. According to the journal that has been investigated by Yuan, et al (2008) by adapting learning theory from Vygotsky found that PBL can improve students' critical thinking skills. The increase occurs because of the process of social interaction and cognition situated in the learning process. The success of the teaching and learning process in the classroom is also supported by learning tools used by a teacher, one of which is the use of learning media. Learning media has an important role to help the learning process. This is in accordance with the journal examined by Thaiposri & Wannapiroon (2015); Al-Rahmi & Zeki (2017) that students' critical thinking skills can be improved through the use of media (*online*) that have the result that information and communication technology has an important role for students to learn. Interesting social media (*online*) learning media are studied because, as Turkle (2010) says, by adapting Piaget's learning theory, it is found that the internet can form different social identities with *face to face* identities.

The forms of ICT utilization are very diverse, one of which is the use of *e-learning* (El-Seoud et al., 2014). According to the *Association for Educational Communications Technology* (AECT) in 2008, *e-learning* was a web-based feature oriented towards providing learning facilities to improve performance by creating, using, and managing technologies that fit processes and resources. The utilization of *e-learning* features includes reading, discussion, constructing knowledge, expressions (chat features) activities, and even searching for information (Ibrahim, 2015). *E-learning* is a learning activity using media sites (websites) that are accessed through the internet network. According to the type of website there is a variety of which one of them is a combination of social networking websites and *e-learning* which includes *Edmodo*.

Edmodo is a social media based learning platform aimed at teachers, students, and parents. *Edmodo* provides space to build virtual classes based on class distribution like in school. Teachers can easily send assignments, assessments, and quizzes through *Edmodo*. The process that must be passed to join a group in

Edmodo is to use or enter the code that is owned by the teacher. The application of *Edmodo*-based *e-learning* still requires teachers as *scaffolding* to set values in the learning process (Setyowati, 2017).

Quoted from the results of interviews conducted by researchers at one of the VA class teachers at Lowokwaru Elementary School 2 Malang on August 24, 2018, Farid Pribadi stated that Lowokwaru 2 Elementary School Malang was one of the schools in Malang City based on Adiwiyata, so that it had potential support, one of which is in the development of learning media. All classes are equipped with LCDs and projectors that can be used to support IT-based learning. In addition, teachers and students are also familiar with technology and there are also computer laboratories and intranet network facilities that can be used in learning. However, the use of computer labs is still not optimal, this is because these laboratories are often used for ICT learning and their use in daily thematic learning is very rare.

Things that can support other learning are gadgets owned by teachers that can actually be used as support in creative and innovative media design for learning, however, in reality the teachers have not been able to utilize some of the gadgets they have. Teachers often access through standard applications, for example Microsoft Word or Microsoft Power Point which are used to present material and practice questions to students in learning. This results in students still having difficulty in concretizing abstract concepts. Another problem that was found was that students in V-A class in answering questions from the teacher were still fixated in text or books, so when the teacher gave the *Out of the Box* questions the students still looked confused.

If observed, the statement of one of the teachers interviewed was that the facilities and infrastructure contained in the school were adequate, but in application and utilization still needed innovation or development. Therefore in this study we will try to develop *edmodo*-based *e-learning* in problem-based learning to improve critical thinking skills of fifth grade students.

II. METHOD

This study uses a type of quantitative research. The location of the research is in Lowokwaru Elementary School 2 Malang. The research subjects were V-A class teachers and V-A grade students at Lowokwaru 2 Elementary School Malang with a

total of 34 students. This research was carried out in a collaborative form between researchers and classroom teachers. The research design used was *one group pretest posttest design*. The design of this study will use one group which will be observed at the *pretest* (O1) stage which is then followed by giving certain treatments (X) and *posttest* (O2). The *one-group pretest-posttest design* can be written in the form:

O1 X O2

Information:

O1 = initial test (*pretest*) to find out students' critical thinking skills

O2 = final test (*posttest*) to find out students' critical thinking skills

X = treatment of learning by using *edmodo*-based *e-learning* in problem-based learning

Data collection techniques use the method of observation of teacher activities and student activities, tests, and student response questionnaires. Data collection techniques in the form of tests are prepared to analyze the improvement of students' critical thinking skills and are given at the beginning and end of learning. The data collection tool uses an evaluation sheet. The questions on the evaluation sheet are adjusted to the learning indicators provided by the teacher.

III. RESULT AND DISCUSSION

Result

The following will be explained about the results and discussion of quantitative research conducted by researchers with the title "Improving Students' Critical Thinking Skills Through *Edmodo*'s Assisted *Problem Based Learning* Model for Class V Elementary School Students". This study uses Quasi Experiment with the design of *one group pretest posttest design* to obtain data about teacher activities, student activities, increase tests of critical thinking skills, and student responses.

1. Implementation of RPP in Teacher Activities

The following is a table of implementation of lesson plans by the teacher:

Table 1. Teacher Activity Data

| Meeting | Teacher Activity Average Score | Percentage of Teacher Activity | Category |
|---------|--------------------------------|--------------------------------|-----------|
| 1 | 4.07 | 81.40 % | Good |
| 2 | 4.60 | 92.10 % | Very Good |
| Average | 4.33 | 86.75 % | Very Good |

Based on Table 1 it is shown that learning with *edmodo*-based *e-learning* in PBL models to improve students' critical thinking skills is carried out in a very good category. The data shows the percentage of learning feasibility in each meeting containing preliminary activities, core activities, and closing activities which were assessed by two observers. At the 1st

meeting, the final average score was 4.07 with the percentage of suitability of the two observers' assessment amounting to 81.4%. While at the 2nd meeting the final average score is 4.60 with the percentage of appraisal of the two observers equaling 92.1%.

2. Student Activity

Table 2. Student Activity

| Meeting | Average Student Activity Score | Percentage of Activity of Students | Category |
|----------------|--------------------------------|------------------------------------|-----------|
| 1 | 3.95 | 79.10 % | Good |
| 2 | 4.72 | 94.54 % | Very Good |
| Average | 4.33 | 85.45 % | Good |

Based on Table 2, it is shown that in general the activities of students observed in each meeting recorded by two observers during the learning process are considered Good. At the 1st meeting, the final average score of activity was 3.95 with a percentage of two observers matching 79.10%. While at the

second meeting the final average score was 4.72 with the percentage of appraisal of the two observers equaling 94.54%.

3. Test of Critical Thinking Skills

Table 3. Test of Critical Thinking Skills

| Student | Pretest | | Posttest | | Enhancement | |
|----------------|-----------|----------------------|-----------|------------------|-------------|-------------|
| | Score | Category | Score | Category | G | Category |
| 1. | 54 | Not completed | 93 | Completed | 0.85 | High |
| 2. | 60 | Not completed | 83 | Completed | 0.58 | Medium |
| 3. | 50 | Not completed | 100 | Completed | 1.00 | High |
| 4. | 60 | Not completed | 100 | Completed | 1.00 | High |
| 5. | 52 | Not completed | 93 | Completed | 0.86 | High |
| 6. | 40 | Not completed | 97 | Completed | 0.95 | High |
| 7. | 52 | Not completed | 87 | Completed | 0.73 | High |
| 8. | 55 | Not completed | 100 | Completed | 1.00 | High |
| 9. | 64 | Not completed | 97 | Completed | 0.92 | High |
| 10. | 60 | Not completed | 100 | Completed | 1.00 | High |
| 11. | 52 | Not completed | 100 | Completed | 1.00 | High |
| 12. | 46 | Not completed | 93 | Completed | 0.86 | High |
| 13. | 46 | Not completed | 100 | Completed | 1.00 | High |
| 14. | 60 | Not completed | 90 | Completed | 0.75 | High |
| 15. | 62 | Not completed | 83 | Completed | 0.56 | Medium |
| 16. | 60 | Not completed | 87 | Completed | 0.68 | Medium |
| 17. | 52 | Not completed | 80 | Completed | 0.62 | Medium |
| 18. | 54 | Not completed | 90 | Completed | 0.78 | High |
| 19. | 40 | Not completed | 87 | Completed | 0.78 | High |
| 20. | 52 | Not completed | 100 | Completed | 1.00 | High |
| 21. | 60 | Not completed | 86 | Completed | 0.65 | Medium |
| 22. | 50 | Not completed | 87 | Completed | 0.54 | Medium |
| 23. | 50 | Not completed | 93 | Completed | 0.86 | High |
| 24. | 55 | Not completed | 97 | Completed | 0.93 | High |
| 25. | 60 | Not completed | 83 | Completed | 0.58 | Medium |
| 26. | 46 | Not completed | 80 | Completed | 0.63 | Medium |
| 27. | 54 | Not completed | 93 | Completed | 0.85 | High |
| 28. | 52 | Not completed | 100 | Completed | 1.00 | High |
| 29. | 55 | Not completed | 93 | Completed | 0.84 | High |
| 30. | 68 | Not completed | 100 | Completed | 1.00 | High |
| 31. | 55 | Not completed | 87 | Completed | 0.71 | High |
| 32. | 46 | Not completed | 87 | Completed | 0.76 | High |
| 33. | 55 | Not completed | 97 | Completed | 0.93 | High |
| 34. | 58 | Not completed | 100 | Completed | 1.00 | High |
| Average | 55 | Not completed | 92 | Completed | 0.82 | High |

Based on Table 3, it was shown that the average value of the students' critical thinking skills at *pretest* was 55 with the Not Completed category, while at the *posttest* it was 92 with the Completed category. Based on these two data there is an increase in the average value of students' critical thinking skills before and after the implementation of *edmodo*-based *e-learning* in problem-based learning. Increased critical thinking skills of High category students with an average score of n-gain of 0.82.

4. Student Response

Table 4. Student Response

| Student | Questionnaire Indicator | | | | | | | | Σ TSEV | Σ s_max |
|---------|-------------------------|---|---|---|---|---|---|---|---------------|----------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| 1. | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 5 | 37 | 40 |
| 2. | 5 | 5 | 4 | 5 | 5 | 4 | 4 | 5 | 37 | 40 |
| 3. | 5 | 5 | 5 | 4 | 5 | 4 | 4 | 5 | 37 | 40 |
| 4. | 5 | 4 | 4 | 5 | 4 | 5 | 5 | 5 | 37 | 40 |
| 5. | 4 | 4 | 5 | 4 | 5 | 4 | 5 | 5 | 36 | 40 |
| 6. | 4 | 4 | 5 | 4 | 5 | 4 | 4 | 5 | 35 | 40 |
| 7. | 5 | 4 | 5 | 3 | 5 | 5 | 4 | 5 | 36 | 40 |
| 8. | 5 | 4 | 5 | 4 | 5 | 4 | 4 | 5 | 36 | 40 |
| 9. | 5 | 4 | 3 | 5 | 5 | 3 | 4 | 5 | 35 | 40 |
| 10. | 5 | 4 | 5 | 5 | 5 | 4 | 5 | 5 | 36 | 40 |
| 11. | 5 | 4 | 3 | 5 | 4 | 5 | 4 | 4 | 34 | 40 |
| 12. | 5 | 4 | 3 | 5 | 5 | 3 | 4 | 5 | 34 | 40 |
| 13. | 5 | 4 | 4 | 4 | 5 | 5 | 4 | 3 | 31 | 40 |
| 14. | 4 | 4 | 5 | 5 | 4 | 3 | 4 | 4 | 33 | 40 |
| 15. | 5 | 4 | 4 | 4 | 5 | 5 | 4 | 5 | 36 | 40 |
| 16. | 5 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 31 | 40 |
| 17. | 4 | 5 | 3 | 5 | 5 | 5 | 4 | 4 | 34 | 40 |
| 18. | 5 | 4 | 5 | 3 | 5 | 4 | 5 | 4 | 36 | 40 |
| 19. | 5 | 4 | 3 | 3 | 3 | 4 | 5 | 5 | 32 | 40 |
| 20. | 5 | 4 | 3 | 5 | 5 | 3 | 3 | 4 | 32 | 40 |
| 21. | 5 | 4 | 5 | 3 | 5 | 5 | 5 | 5 | 37 | 40 |
| 22. | 5 | 5 | 3 | 5 | 3 | 3 | 5 | 5 | 34 | 40 |
| 23. | 5 | 4 | 3 | 5 | 3 | 5 | 5 | 5 | 34 | 40 |
| 24. | 4 | 3 | 5 | 5 | 4 | 5 | 5 | 5 | 36 | 40 |
| 25. | 5 | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 35 | 40 |

| | | | | | | | | | | |
|--------------|---|---|---|---|---|---|---|---|------|------|
| 26. | 5 | 4 | 5 | 5 | 5 | 5 | 4 | 4 | 37 | 40 |
| 27. | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 4 | 36 | 40 |
| 28. | 4 | 3 | 3 | 4 | 4 | 5 | 5 | 5 | 33 | 40 |
| 29. | 5 | 5 | 3 | 4 | 4 | 4 | 5 | 5 | 35 | 40 |
| 30. | 4 | 4 | 4 | 4 | 5 | 5 | 4 | 4 | 34 | 40 |
| 31. | 4 | 4 | 5 | 5 | 4 | 3 | 4 | 4 | 33 | 40 |
| 32. | 5 | 5 | 5 | 4 | 3 | 4 | 3 | 4 | 34 | 40 |
| 33. | 3 | 5 | 4 | 4 | 4 | 5 | 5 | 5 | 35 | 40 |
| 34. | 3 | 5 | 3 | 5 | 5 | 5 | 5 | 4 | 35 | 40 |
| Total | | | | | | | | | 1185 | 1360 |

Table 4 shows the percentage of students' responses to learning activities by using *edmodo*-based *e-learning* in problem-based learning through 8 item statements. Of the 8 items of statements that have been given, obtained answers with very good categories. Based on the table it can be interpreted that the response of students to the learning that has been done is Very Good with a final percentage of 87%.

IV. DISCUSSION

1. Implementation of Learning

In the preliminary activity, there is one phase of the problem learning model, namely the orientation phase of the students towards the problem. The introduction of problems is the most important phase in the problem-based learning model, because new understanding will be formed if the experience of the students is involved in the problem situation created by the teacher (Savery, 2006). This activity begins with a joint prayer activity, which is then followed by the delivery of learning objectives to be achieved. Apperception activities will have an impact on the formation of students' initial schemes because the higher the level of attention of students in learning, the higher the ability of students to absorb information in the learning process (Lapono, 2008). The second activity is core activities. The core activities consist of 4 phases of problem-based learning models which include phase 2 orienting students to learn, phase 3 guiding students to carry out individual and group activities, phase 4 developing and presenting the work, and phase 5 analyzing and evaluating problem solving processes (Mustaji, 2018). The four phases in problem-based learning in this activity can help students optimally in improving critical thinking skills. To provide further explanation in critical thinking, students are required to be able to provide sources of evidence that support their explanation regarding the learning done. The core activity in learning begins with phase 2 of the problem learning model, which is to orient students to learn. In this phase it teaches students to learn how to design problem solving strategies, conduct investigations, and collect data (Hosnan, 2016; Wayne, et al., 2015). During this phase, each group will be given the opportunity to argue and

criticize the opinions of other groups so that each group will share and evaluate alternative conclusions that have been written. In other words, this discussion session was designed to give students the opportunity to learn to criticize the products produced (conclusions or explanations), the methods used, and the relevant sources chosen. That is because problem-based learning does not have a patent answer or a definite answer, so that each argument will be asked for evidence and strong reasons (Silver, 2004; Savery, 2006; Hosnan, 2016). The next activity after the students have had discussions between groups to improve and criticize the results of their work and other groups, students are assigned to compile a written report that contains all the results of the discussion and explanation during the learning activities. The results of the report will then be evaluated or reviewed by other groups in order to obtain final conclusions that have been agreed between groups (Wayne, et al., 2015; Hosnan, 2016).

2. Student Activity

There are 11 aspects observed as assessment material by two observers during the learning process that are expected to emerge during learning are discussion activities that can improve students' critical thinking skills. These aspects are listed in the student assessment sheet on points 3, 4, 6, 8, and 9. In the table, data is presented on the activities of the third student, namely the students look at the task of investigating information through the activities that have been presented in the Assignment feature and the link in *Edmodo* to recognize the topic of the problem, categorized very well with the average score of each meeting in a sequence of 3.5 and 4.5. By paying attention to the question item 3, it will help students in completing the fourth activity, namely designing a solution to the problems surrounding the material presented in the Assignment feature according to the steps in the LKPD. The score of the fourth item in the fourth row is 4 and 4.5 with good and very good categories. There was an increase in activity from the first meeting to the last meeting for two meetings, it showed that students began to focus on designing solutions to problems surrounding the material presented in the Assignment feature according to the steps in the LKPD. The fifth aspect is to fill the mind map of argumentation as a result of the data obtained in the material from the Assignment feature. Based on the results of the activities obtained, the average score for the two meetings

is 4 and 5 respectively in the good category at the first meeting, and very good at the second meeting. At this fifth meeting there was an increase in scores, it showed that students began actively in building basic statements, giving further explanations, and conclusions in making mind maps (Hosnan, 2016). The activity of the sixth student is that students conduct interactive discussions between groups so that they can exchange arguments, criticisms, and improve explanations in the discussion forum at *Edmodo*. This activity must be carried out through group and inter-group discussions to discuss arguments or explanations that have been expressed by other groups to determine agreed and acceptable statements (Hosnan, 2016). Based on Table 4.7 the sixth activity in the two meetings experienced an increase in scores in a row namely 3.5 and 5 with sufficient and very good categories. This increase shows that students begin to actively engage in discussion activities and argue in the classroom. The activities of the sixth, seventh, eighth, and ninth students are interrelated activities. The four activities of the students are the follow-up activities carried out by students in the discussion activities, namely making and reviewing the results of discussions conducted. This report provides opportunities for students to explain the purpose of the discussion in solving problems, the methods used, and the results of their overall explanation. Writing activities are integrated into problem-based learning models with the aim that individuals can understand how to make clear evidence to be presented to readers and how to make acceptable explanations (Wayne, et al., 2015; Hosnan, 2016; Rusman, 2010).

3. Test of Critical Thinking Skill

Critical thinking skills can be developed through learning approaches with learner-centered (Snyder & Wiles, 2015). These skills can be improved through *open-ended* questions during discussions and the provision of problem-based activities in each learning activity (Awang & Ramli, 2008). Many learning approaches are student-centered, one of which is the *Problem Based Learning* (PBL) model. According to Awan, et al. (2017) the PBL model is based on Vygotsky's learning theory by using the structure of the Progressivism Philosophy and Philosophy of Pragmatism which develops human-human learning processes. According to the journal that has been investigated by Yuan, et al (2008) by adapting learning theory from Vygotsky found that PBL can improve students' critical thinking skills. The increase occurs because of the process of social interaction, assimilation, accommodation, and cognition situated in the learning process. The most fundamental thing about this theory is that there is a relationship between the learning process and the experience of students, so that if new information is received by students in line with their experience, it can be easily assimilated. Through the activities in the LKPD that are in the *edmodo*, it will provide opportunities for students to build their own knowledge and share their ideas through discussion sessions when mingling in small groups during learning, during these activities students will evaluate the results of the discussion and improve their thinking skills both verbally and non verbally. Through discussion activities that students will be accustomed to giving a simple explanation, then build basic skills in determining relevant sources so that they can support the explanation, make conclusions about the sources to be used, provide further explanations to maintain or improve arguments and sources he chose, and set the strategies and tactics that will be used in solving the problem. Critical

thinking skills are not skills that exist from birth, but skills that can be trained in the learning process. The series of critical thinking skills is facilitated in problem-based learning activities which consist of several phases, namely: student orientation to the problem, orienting students to learning, guiding students to conduct individual and group investigations, developing and presenting work, analyzing and evaluating problem solving processes.

4. Student Response

Table 4 shows that the response is very well seen in item statement number 1 which shows clear material presentation to be understood. Item number 2 which explains that the material is very interesting to learn. Item number 6 learning with *e-learning* developed can increase students' knowledge and knowledge. While the response with a balanced percentage can be seen in item statement number 7, *e-learning* developed can support students' critical training.

V. CONCLUSION

Based on the results of data analysis, discussion of results, and research findings concluded that *edmodo*-based *e-learning* in problem-based learning has a practical category, and is effective so that it is feasible to be used to improve critical thinking skills of fifth grade students.

Providing initial understanding of critical thinking skills to students must be done or familiarized early. It aims to make it easy for students to condition themselves in new learning situations so that students can provide active participation in critical thinking activities. Teachers need to provide guidance to students related to critical thinking skills in providing further explanations and setting strategies in problem solving through the provision of questions in the form of stimuli that facilitate the resolution of problems.

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“Mutrakrichchhra (UTI): A Literature Review Based On Ayurveda and Modern Perspective”

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ABSTRACT

Mutrakrichchhra is one of the commonest health problems in community practice and it is a broad term which covers all most all the conditions of urinary tract infection (UTI), that is described in modern medical science. The *pratyatma lakshana* of *Mutrakrichchhra* is “*Dukhena mutra pravritti*” means discomfort during micturition. UTI may be defined as a condition in which bacteria enter, persist and multiply within the urinary tract. *Mutrakrichchhra* is also found as a *lakshana* in other diseases like *Ashmari*, *Mutraghata*, *Mutraja vriddhri*, *Arsha*, and *Gulma* etc. Description of this disease is given in almost all-important texts that deliberate its commonness in ancient period. *Acharya Sushruta* has been described *Mutraghata* and *Mutrakrichchhra* separately in *Uttar-tantra*. In *Mutrakrichchhra*, *prakupit pitta dosha* along with *vata* (mainly *Apana vayu*) goes into *Vasti* (Urinary bladder) and affect the *Mutravaha Srotas* due to which the patient feels difficulty in urination with the symptoms like *Daha*, *Ruja*, *Basti-gurutva*, *Shotha*, *Muhurmutrata*, *Peet mutrata*, *Sarakta mutrata*. The above mentioned symptomatology resemble more closely to symptoms of LUTI (i.e. Urethritis and Cystitis). The present study was done to assess the literature review of *mutrakrichchhra* according to various texts and to find out inter-relation between *mutrakrichchhra* and UTI. In this literature review of the *mutrakrichchhra* has been illustrated in accordance with *Ayurvedic* classics, and research papers collected from indexed journals accessed physically and through the internet.

Keywords: *Mutrakrichchhra*, Urinary tract infection (UTI), *Mutraghata*, *Ruja*, *Apan-vayu*.

INTRODUCTION

Good urination habits are important for a healthy life. Persons, that having healthy urinary tract is generally resistant to infections. Incidence of UTI is higher in women than men, 40% to 50% of whom suffer at least one clinical episode during their lifetime¹. UTI is a common distressing and occasionally life-threatening condition. It occurs more in female than male, at a ratio of 8:1.² Female sex, obstructive uropathy, severe vesico ureteric reflux, constipation and repeated catheterization, poor hygienic conditions and environment, poverty and illiteracy these are the predisposing factors, which causes recurrent urinary tract infection. They also contribute their roll in increasing the percentage of urinary tract infections.

Trimarmas (Vital parts) described by *Ayurveda* classics, *Basti* (Bladder) is one of them.³ *Basti* is seat of urine and faeces, known as the best *prana ayatana* (where life resides)⁴. *Hridaya* (Heart), *Shira* (Head), and *Basti* (Urinary bladder) are the live essence of person, so we should try to save them by treating the diseases and by following the rules of *swastha vritta* (Daily healthy routines)⁵. Many diseases like *Mutraghata*, *Prameha*, *Shukra doshas* and *Mutra doshas* occurred in *basti*⁶. *Mutrakrichchhra* is a disease of affecting *basti* and *mutra marga* (urinary passage). Diseases of *mutravaha srotas* (channels carrying the urine) included *Mutrakrichchhra*, *Mutraghata*, *Prameha* and *Ashmari*. When a *mutravaha srotas* is injured, the treatment is explained as a *Mutrakrichchhra chikitsa*⁷.

The term *Mutrakrichchhra* originates from two words -*Mutra* and *Krichchhra* and is self-explanatory. The word *mutra* is derived from ‘*prasrava*’ means to ooze⁸. The word ‘*krichchhra*’ is derived from ‘*kashte*’ means causing trouble or painful. Difficulty or painful micturition is called as *Mutrakrichchhra*.

All the classical texts have explained its silent feature is “*Dukhen mutra pravritti*”. Any type of ‘*Dukha*’ (Discomfort) during micturition is included under *Mutrakrichchhra*⁹. *Mutrakrichchhra* is a broad term which covers the conditions described in modern medical science as urinary tract infection. In Urinary tract infection (UTI), parts of the urinary tract are affected by the infection. When this infection affects the lower urinary tract then it is called as a simple cystitis (i.e. Urinary bladder infection)

and when it affects the upper urinary tract then it is called as pyelonephritis (i.e. kidney infection). There for, urinary tract infection is also called as acute cystitis or urinary bladder infection¹⁰.

Mutrakrichchhra can also be seen as an independent disease as well as *purvarupa* and *rupa* of the other diseases. *Mutrakrichchhra* may also occur as a result of *Mutrakshaya*. *Mutrakrichchhra* is found as a *lakshana* in following diseases i.e. *Pakvasayastha vata*¹¹, *Mutranirodhajanya udavarta*¹², *Sukrashmari*¹³, *sAshmari purvarupa*¹⁴, *Mutraja vridhi*¹⁵, *Vataja ashmari*¹⁶, *Mutra kshaya*¹⁷, *Ushnavata*¹⁸, *Mutrasada*¹⁹, *Kaphaja arsha*²⁰, *Gulma*²¹.

Ayurvedic Perspective

An outcome product of digestion of food and metabolism in the body which is passed through urethra is known as *Mutra*²². *Krichhrata* (i.e. dysuria) and *Mutra-vibandhta* are simultaneously present in both *Mutraghata* and *Mutrakrichchhra*, but *krichhrata* (dysuria) is predominance in *Mutrakrichchhra*.

Definition of *Mutra Krichha*:

Mutrakrichchhra is known as “The painful voiding of urine”. In this disease patient has urge to micturate, but he passes urine with pain.

Nidana (Etiology):

It can be concluded that *Vyayama*, *adhyashan*, *ruksha sevana*, *yana gamana* are causative factors for *vata prakopa*²³. *Tikshna aushadha*, *amla sevana* causes *pitta prakopa*²⁴, and *Anupa mamsa sevana*, *vyayama*, *adhyashan* causes *kapha prakopa*²⁵. So these *Nidanas* cause vitiation of *Doshas* along with *Stroto-dushti* of *Mutrvaha strotas*. *Stroto-dusti* will cause *kha-vaigunya* in *Mutrvaha strotas*. These factor leads to *Mutrakrichchhra*.

These etiological factors can be summarized as:

| <i>Aharaja Nidana</i> | <i>Viharaja Nidana</i> | <i>Partantra Nidana</i> |
|-----------------------------------|------------------------|--|
| 1. <i>Adhyashana</i> , | 1. <i>Yana gamana</i> | 1. <i>Kaphaja arsha</i> ²⁶ |
| 2. <i>Ajirna</i> | 2. <i>Ativyayama</i> | 2. <i>Ajirna</i> ²⁷ |
| 3. <i>Ruksha anna sevana</i> | 3. <i>Aghata</i> | 3. <i>Vasti vidradhi</i> ²⁸ |
| 4. <i>Tikshna aushadha sevana</i> | | 4. <i>Gulma</i> ²⁹ |
| 5. <i>Ruksha madya sevana</i> | | 5. <i>Udavarta</i> ³⁰ |

Types of *Mutrakrichchhra*:

All the *Acharyas* except *Acharya Vagbhatta* have described eight types of *Mutrakrichchhra*. *Acharya Vagbhatta* has mentioned only *Doshaja Mutrakrichchhra*.

Rupa (Symptomatology):

Pratyatma lakshana

मूत्रकृच्छ्रमिति मूत्रस्य कृच्छ्रेण महता दुःखेन प्रवृत्तिः |³¹
रोमहर्षो अंगहर्षश्चमूत्रकाले च वेदना |
मूत्रकृच्छ्रेदशत्योष्टौबस्तिस्पृशितपाणिना ||³²

Chikitsa (Management):

1. *Shamana chikitsa*: It includes *Mutra-vishodhaniya*, *mutra-virechaniya*, *mutra-viranjaniya* and *ashmarihara dravyas*.
2. *Shodhana chikitsa*: It includes diuretic drugs & *uttara vasti* which dilutes and flushes various infective agents along with urine.
3. *Bahirparimarjana chikitsa*: It includes medicines that can be used externally in the form of douches, fomentation, showers, poultices and ointment etc.

Specific Management

1. *Vataja Mutrakrichra chikitsa*

Bahirparimarjana chikitsa:

Abhyanga, *Svedana*, *upanaha*, *Vatashamaka dravyas* like *dashmool*, *Eranda*, *Nirgundi*, *Parisheka on Kati Pradesh* with *Vatashamak Taila* and *Kwatha*.³³

Antahparimarjana chikitsa

- ♦ *Shodhana- Niruha vasti*, *Uttara vasti* with *vata shamak kwath* like *dashmoola kwath*.
- ♦ *Shamana- Amritadi kwatha*, *Sthiradi aushadha*, *Shwadanshra taila*, *traivritta taila* (Su.), *Mishraka sneha*.

2. *Pittaja Mutrakrichra chikitsa*

Bahirparimarjana chikitsa– *Sheeta Parisheka*, *Avagahana* in cold water, *pralepana* with *chandan* and *karpur*.³⁴

Antahparimarjana chikitsa

- ♦ *Shodhana- Virechana* with *tikta evam Madhur kashaya*, *Uttara vasti*.

♦ **Shamana-** Shatavaryadi kwatha (Ch.), Haritakyadi kwatha, Trinapanchmula kwatha (Y.R.), Trinapanchamula churna (Su.),ervaru beeja,yashtimadhu,devdaru with tandul dhavan.

3.Kaphaja Mutrakrichha chikitsa

Bahirparimarjana chikitsa

Svedana, Abhyanga with taila containing tikta ushna dravya.

Antahparimarjana chikitsa

♦ **Shodhana-** Vamana, Niruha vasti with kshara,tikshna,and katu dravya.

♦ **Shamana-** Vyoshadi churna praval bhasma(Ch.),shwadanshtradi kwatha,trikankantakadi ghrita,yava bhaksh,takra.

4.Sannipattaja Mutrakrichha chikitsa

In Sannipataja Mutrakrichra the treatment should be done according to vata sthana.

Gudadugdha yoga, dhatriyadi yoga.

“The dosha which is more dominant is treated first”

Antahparimarjana chikitsa

★ **Shodhana-** If kapha is predominant then vamana, if pitta is predominant then virechana and if vata is predominant then vasti karma should be performed.

★ **Shamana-** Pashanbhedadi yoga, Brihatyadi kwatha,

5.Raktaj Mutrakrichha chikitsa

It should be managed as sadyovrana.

6.Shakritajanya Mutrakrichha chikitsa

Vatahara kriya is done in shakritjanya Mutrakrichra.

Bahirparimarjana chikitsa

Abhyanga, Svedana, Avagahana.

Antahparimarjana chikitsa

★ **Shodhana:** vasti

★ **Shamana:** Churna kriya

Some other important formulations include

★ Varunadi kwatha

★ Varunshigruadi kwatha

★ Gokshuradi guggulu

★ Gokshuradi kwatha

★ Chandanasava

★ Chandraprabha vati

★ Trivikrama rasa

★ Chandrakala rasa

Pathya:

Ahara: Purana shali, yava, kshara,takra, dugdha,dadhi, jangal mamsa, mudga yusha, trapusha,nadeya jala, sharkara, kushmanda, patola patra,ardraka, gokshura, puga, narikela, laghu ela,karpura.

Vihara: Abhyanga,Swedana,Avagahana.

Apathya:

Ahara: Tambula, matsaya, lavana, pinyaka,hingu, tila, sarshapa, masha, karira, tikshna, vidahi,ruksha, amla dravya, virudhashana, vishamashana,

Vihara: Yana gamana, vega dharana, Ativyayama, Ativyavaya, Riding on elephant and horse.

Upadrava:

Only Acharya Kashyapa has mentioned the Upadravas of Mutrakrichchra.³⁵

Emaciation, uneasiness, anorexia, un-stability (of mind), thirst, pain, melancholy (nervousness), and discomfort are the complications of Mutrakrichchra.

Prognosis:

Disease affecting Marma are among Yapyo Rogas.³⁶

Modern Perspective

Urinary tract infections have plagued mankind long before bacteria were recognized as the causative agents of disease and before urology became an established medical specialty. The Ebers papyrus from ancient Egypt recommended herbal treatment to ameliorate urinary symptoms without providing insight into pathological mechanism. Hippocrates believed that disease was caused by disharmony of the four humors and accordingly diagnosed urinary disorders.³⁷ Urinary tract infection refers to both microbial colonization of the urine and tissue invasion of any structure of the urinary tract. Bacteria are most commonly

responsible, although yeast, fungi and viruses may produce urinary infection. Infants and young children with UTI may present with few specific symptoms. Older paediatric patients are more likely to have symptoms and findings attributable to an infection of urinary tract.³⁸ Differentiating cystitis from pyelonephritis in the paediatric patient is not always possible, although children who appear ill or who present with fever should be presumed to have pyelonephritis if they have evidence of UTI. *Escherichia coli* are the most common causative organism of this disease causes approximately 80% of acute infections in patients without catheters. Other gram-negative bacilli, especially *Proteus* and *Klebsiella* and occasionally *Enterobacter*, account for a smaller proportion of uncomplicated infections. Gram-positive cocci play a lesser role in urinary tract infections, nonetheless *Staphylococcus saprophyticus*, *Enterococci*, *Staphylococcus aureus* are associated with acute urinary tract infection in young females and in-patient with renal stone or previous instrumentation.³⁹

Definition

“Multiplication of organisms in the urinary tract is known as Urinary tract infection.”

Infection that affects the part of urinary tract is generally known as Urinary tract infection. Infections of the urinary tract can be subdivided into two general anatomic categories; lower tract infection (urethritis and cystitis) and upper tract infection (acute pyelonephritis, prostatitis and internal and perinephric abscesses)⁴⁰. Symptoms of a lower urinary tract infection include painful micturition, frequent urination, and feeling of incomplete voiding despite having an empty bladder. Superficial or mucosal infections include infection of urethra and urinary bladder, where as signify tissue invasion include pyelonephritis and renal suppuration⁴¹. Basically, there are 3 forms of UTI i.e. pyelonephritis, cystitis and asymptomatic bacteriuria⁴². Less common conditions are Focal pyelonephritis and renal abscess. From a microbiological perspective, when pathogenic microorganisms are present in the urine, urethra, bladder and kidney then the urinary tract infection exists. When the symptoms like dysuria, urgency and frequency unaccompanied by significant bacteriuria has been called as acute urethral syndrome. Although widely used, the term acute urethral syndrome lacks anatomic precision because most of the cases which is designated are actually urinary bladder infections. Moreover, in these patients, the causative agent can usually be identified, so that the term syndrome- implying unknown causation is inappropriate.

Aetiology

In our society, a common medical complaint is urinary tract infection (UTI). It is estimated that at some times in their lives up to 40% of women will have a UTI. Urinary tract infections are caused mainly by colonic bacteria. In females, 75-90% of all infections are caused by *Escherichia coli*, followed by *Klebsiella* and *Proteus*⁴³. *Enterococcus* species, *Staphylococcus*, *saprophyticus* especially in female adolescent and sexually active females and *Streptococcus* group B especially in neonates are included in other bacterial sources of UTI. Especially after instrumentation of urinary tract, Fungi (*Candida* species) may also cause UTIs. A rare cause of UTI is Adenovirus and it may cause haemorrhagic cystitis.

Treatment⁴⁴

Acute cystitis must be treated instantly to prevent possible progression to pyelonephritis. A specimen of bladder urine is taken for culture, but the symptoms are severe then immediately started the treatment without waiting the result of urine culture. But when the symptoms are mild or the diagnosis is not clear, then the treatment can be delayed until the results of culture are known. If the result is uncertain then the culture can be repeated. For example, if a gram-negative organisms grow between 10^4 and 10^5 colonies in a midstream culture, then a second culture may be taken by catheterization before the treatment is started. If treatment is started before the availability of results of a culture and sensitivities, then a 3 to 5 days course of therapy by trimethoprim-sulfamethoxazole is effective against most strains of *E. coli*. Nitrofurantoin (5–7 mg/kg/24 hr in 3 to 4 divided doses) is also effective and having the advantage of being active against *Klebsiella-Enterobacter* organisms. Amoxicillin (50 mg/kg/24 hr) is also effective as initial therapy but having no clear advantages over sulfonamides or nitrofurantoin.

In a case of acute febrile infections suggestive of pyelonephritis, a 10- to 14-day therapy of broad-spectrum antibiotics are able to reaching significant tissue levels is preferable. Children who are dehydrated, having vomiting, or are not able to drink fluids, are below or equal to the age of one month, or in whom urosepsis is a possibility must be admitted to the hospital for intravenous rehydration and intravenous antibiotic therapy. Ceftriaxone (50–75 mg/kg/24 hr, not more than 2 g) or ampicillin (100mg/kg/24 hr) along with an aminoglycoside like gentamicin (3–5 mg/kg/24 hr in 1 to 3 divided doses) is preferable as a parenteral treatment. The probable ototoxicity and nephrotoxicity of aminoglycosides would be considered, and serum creatinine and through gentamicin levels must be obtained before starting the treatment, as well as daily thereafter as long as therapy continues. Treatment by aminoglycosides is especially effective against *Pseudomonas* spp., and alkalinization of urine by sodium bicarbonate increases their effects in the urinary tract. Oral 3rd-generation cephalosporins such as cefixime are effective against a variety of gram-negative micro-organisms other than the

Pseudomonas as effective as parenteral ceftriaxone, and these medications are considered by some supermacy as the treatment of choice for oral therapy. In children with a febrile UTI Nitrofurantoin should not be used routinely because it does not gain significant renal tissue levels. For resistant micro-organisms, especially *Pseudomonas*, in patients more than 17 year, the oral fluoroquinolone ciprofloxacin is used as an alternative agent. It is also used in younger children with cystic fibrosis and pulmonary infection secondary to *Pseudomonas* and is occasionally used as short-course therapy in children having *Pseudomonas* UTI. However, in children the clinical use of fluoroquinolones should be restricted due to potential cartilage damage which has been seen in research with immature animals. In children the efficacy and safety of oral ciprofloxacin is under study. Intramuscular injection of a loading dose of ceftriaxone along with oral therapy with a 3rd generation cephalosporin is effective in those children that having febrile UTI. One week after the termination of treatment of a UTI a urine culture confirm that the urine is sterile; in most of the children, this is useless, because the cultures often are negative.

Children require surgical or percutaneous drainage along with antibiotic therapy and other supportive measures, that suffering from renal or perirenal abscess or obstructed urinary tracts with infection.

Identification of predisposing factors is beneficial in a child, having recurrent UTIs. Most of the school-going girls have voiding dysfunction; in this condition treatment often reduces the likelihood of recurrent UTI. Some children that having urinary tract infections void infrequently, and some also having severe constipation. Counseling of parents and patients to establish more normal patterns of urination and defecation may be helpful in controlling recurrences of UTIs. Use of sulfamethoxazole-trimethoprim, trimethoprim, or nitrofurantoin at $\frac{1}{3}$ of the normal therapeutic dose once a day is effective as prophylaxis against re-infection. Amoxicillin or cephalexin also may be effective as prophylaxis against re-infection, but the risk of breakthrough UTI may be higher because bacterial resistance may be induced. There is interest in probiotic therapy, that replaces normal vaginal flora, and cranberry juice, that prevents bacterial adhesion and biofilm formation, but these agents are not proved beneficial in preventing UTI. The main emphasis of chronic renal damage is due to pyelonephritis, arterial hypertension and renal insufficiency; when these are found, then they must be treated appropriately.

CONCLUSION

- ❖ In the present time, a global issue of concern due to associated long term compromise in the quality of life is “increasing prevalence of UTI.”
- ❖ *Mutrakrichchhra* having similarity with Urinary Tract Infections, which is mentioned in Modern Medicine.
- ❖ Increment in renal damage, school absentees and frequent visit of the paediatricians, clinics or hospital, *Mutrakrichchhra* is an important cause.
- ❖ *Mutrakrichchhra* is a *Vata Predominant, Tridoshaj* disease that involving the *Mutravaha Srotas* with the *dushti of Mutra* and *Ambu*.
- ❖ *Nidanprivarjanam* (i.e. primary prevention) strategy has been given priority, in both *Ayurveda* as well as in modern medicine.
- ❖ In the first 3 months of life an uncircumcised male infant seen to be at increased risk of UTI.
- ❖ A girl with voiding dysfunction, due to the reflux of urine which is laden with bacteria from the distal urethra in to the bladder, is at higher risk for recurrent of UTI.
- ❖ Boys with true phimosis without abnormal voiding, particularly in the form of pyelonephritis, was noted to be at high incidence of Urinary Tract Infection.
- ❖ Urinary Tract Infection causes by micro-organism, so patient should maintain their proper hygiene to decrease the risk of UTI. Parent, Caregivers can help in prevention of UTI in children by teaching them about good hygiene, maintaining healthy hydration and by being aware your child’s daily bathroom habits.

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Misinterpretation of Mental Retardation Disability by Caregivers in Jammu Region of India

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Abstract- There is abundant research on different areas of Mental Retardation worldwide. The present study intends to assess the misinterpretation among the care-givers of Mentally Retarded patients in Jammu region of Jammu & Kashmir. One hundred fifty-two (152) caregivers who were actively involved in the care of Mentally Retarded patients and reported in psychiatry hospital Jammu for percentage of disability certification for financial/monitory purpose constituted the sample. Caregivers were assessed by a qualitative inquiry by asking the purpose for disability certification and in order to get important information about the MR patient. The patients were assessed on developmental mile stone Screening test, Bhatia Battery performance test of intelligence, Seguin Form board test. Caregivers of patients with severe, profound and major psychiatric illness were excluded from the present study. The study showed that mental retardation disability and financial benefits to the intellectually disabled are considered as a sort of nail in the coffin for such patients and no further attempts are made to rehabilitate the disabled person. The patient is considered as a financial burden. The authors insist on better psychosocial rehabilitation services in addition to the financial benefits to the disabled persons.

Index Terms- Misinterpretation, Disability of Mental Retardation, disability pension, financial benefits

I. INTRODUCTION

Mental retardation (MR) or intellectual disability is defined as limitations in an individual's intellectual and adaptive functioning. The term was once used only to denote cognitive difficulties but the concept was rightly broadened to include an individual's functioning and interaction with the environment. The Mentally Retarded individual has lack of ability to generalize information from one situation to another and often finds it difficult to use his executive controls. Such individuals have significantly below average mental functioning with intelligence quotient or IQ of 70 or less as compared to the normal average of 100. Such limitations cause problems with everyday living. People who are mentally retarded may have problems with communication, taking care of themselves, daily living, social skills, community interaction, directing themselves, health & safety, school, ledger activities and work. This condition is more common in boys than girls. This is assumed to be due to mutations

on the X chromosome (Raymond FL, 2006). Mental retardation may begin at birth or in childhood.

There are four levels of mental retardations. Mild, Moderate, Severe, and profound. These levels are determined by performance on standardized IQ tests and by the potential to learn adaptive skills such as communication and social interaction. Children with IQ level between 55-69 are diagnosed as mild mental retardation. These often go undiagnosed until they are well into their school years. They are often slower to walk, talk and feed themselves than most other children. They can learn practical skills, including reading and math, upto about 4th to 6th grade level. Mildly retarded adults usually build social and job skills and can live on their own. Moderate mental retardation people have IQ ranging from 40-54. Children who are moderately retarded show noticeable delays in developing speech and motor skills. Although they are unlikely to acquire useful academic skills, they can learn basic communication, some health and safety habits, and other simple skills. They cannot live alone usually but they can do some simple tasks and travel alone in familiar places. People have IQ's ranging from 20-39 and are considered severely mentally retarded. Their condition is likely to be diagnosed at birth or soon after. By preschool age, they show delays in motor development and little or no ability to communicate. They usually learn to walk and gain basic understanding of speech as they get older and they need to be directed and live in a protected environment. Children with IQ of 0-24 are considered profoundly retarded. Their condition is usually diagnosed at birth, and they may have other medical problems and need nursing care with training, they may learn to use their legs hands and jaws. They cannot take care of themselves and need complete support in daily living.

Mental Retardation may be caused by many factors. However, etiologically this may be put under three broad categories: Primary, Secondary and Cultural familial. Primary Mental Retardation is a chronic state of sub-average intelligence, caused by congenital malformations and do not show much improvement in spite of intensive remedial training. Secondary Retardation is caused by localized brain damage or physiological disorders affecting intellectual processes involved in learning leading to significant deterioration of intelligence and adaptive behavior. An individual with secondary retardation may show variable pattern of skills. In some cases, there may be dramatic improvement in IQ after Training. The third type of retardation is caused by Psychosocial or Cultural deprivation. This group is most responsive to remedial education, rehabilitation and training.

If a person's performance or social functioning is inadequate or affected, it may lead to greater burden on the care-givers. In such situations, the occurrence of disorder in the family is perceived as a trauma. The field of disability has attracted substantial scientific attention and public concern in recent times, which is in sharp contrast to the situation that existed in last few decades. Major changes have occurred in the immediate socio-political environment and has influenced our contemporary understand of the nature of the disability. Most prominent among the events are enactment of the persons with disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act 1995 which has been replaced recently by Rights of Persons with Disability act 2016 (The rights of persons with disabilities act, 2016), establishment of the Rehabilitation Council of India and National Institutes devoted to the welfare of people with different disabilities. The persons with disability (PwD) act provide for welfare benefits for persons with various disabilities including mental disability. These benefits include disability pension, travel benefits, insurance schemes, reservation in employment & education, IT exemptions, loans, skill training & job placements, housing schemes, marriage allowance, pension transfer to PwD, exemptions from routine transfers and free legal aid services (Hamza A (Ed), 2014). Not taking anything away from these prodigious aids to a population really in need of such services, sometimes mistakenly these are considered as alms for a unimprovable illness by the caregivers. They begin to think that a disability pension means that person with the illness can't get better now and they stop seeking help for psychological and vocational betterment of the person.

If a person's performance or social functioning is insufficient, it may lead to more stress and distress to the family members. Provencher (1996) found that the negative consequences identified most frequently were tense relationships in the household, physical and emotional problems of the primary caregivers, disturbance of the lives of other adults in the household and disturbance in the primary caregiver's work performance. Most carers reported personal and social restrictions, but carers were significantly more likely than non carers to report financial, personal and physical burden (McGilloway et al, 1997). This chronic stress and social description and narratives of mental retardation produces a sense of rejection and dejection in caregivers. They sense to feel that now they are stuck with a disease where no treatment is possible and solely begin to focus on the financial aspects of the disability certification. This attitude leads to colonial mindsets where individuals with MR were generally isolated, rather than encouraged to lead fulfilling and healthy lives. Therefore, the present study was carried out with aim to bring substantial change in the perception of caregivers for disabled persons with regard to social skills training, self-management, rehabilitation and special education.

Objective:-

- To study the effects of education of care givers on treatment modalities
- To study the effect of socio-economic status on treatment modalities.
- To examine the influence of age on treatment modalities

II. MATERIALS AND METHODS

The present study sample comprised 93 males 59 female caregivers of Mentally Retarded patients reported to Psychiatric Disease hospital Jammu from September 2010 to 2014 September reported for certification of disability through the district disability boards. The district disability board in J&K is headed by the chief medical officer of the respective districts. In this study the term caregiver was used to refer to a person above 16 years of age, male or females, who is actively involved in the care of patients in same house for not less than 10 years. Caregivers with IQ less than 70 and those who did not consent were excluded from the present study. In addition, caregivers of patients with Severe, profound and major psychiatric illness were excluded from the present study.

Tools:-

1. Developmental mile stone Screening test-DST (Bharat Raj J, 1983) is a non-verbal test to measure the mental development of children from birth to 15 years.
2. Seguin Form Board Test is the most commonly used performance test used as a quick measure of general intelligence in children between 3 to 11 years and for Mentally Retarded adults.
3. Bhatia Battery performance test (Bhatia CM, 1955) consists of five sub-test for measuring the intelligence between the age group of 11yrs-16 yrs and for both illiterates and literates.

Procedure:- The assessment were carried out on the selected sample of 152 children where the tests were individually administered, with instructions about the tests in order to assess the degree of Mental Retardation. The test took 1 to 2 hours to administer on every patient. After testing each patient was scored for each scale following the respective standard procedure for scoring. A Qualitative inquiry was sought from caretakers by asking the purpose for applying of disability certificate asking one question "Aap ko ye disability certificate kyun chahiye", (Why do you need disability certificate?). The qualitative inquiry was to enable the care givers to "Articulate" their history about the child personal way. A semi structured interview for care givers was framed in order to get important information about child. Based on caregiver's demographic information, Age, education level, occupational status, socio-economic status, marital status, religiosity, area of residence (rural or urban) and siblings order. Data obtained on demographic were analyzed by Percentage method.

III. RESULTS

The present study revealed that the caregivers/parents who reported for disability certification were Middle to Old age. The age ranged from 40 years to 60 years. Among those majority of the caregivers were illiterate. Because of academic deficits, the cognitive mechanisms involved by caregivers for their patients were very poor in respect of any rehabilitation program to live with dignity. Majority of the caregivers were parents of the patients. Table 1 shows the socio-demographic profile of the caregivers.

Socio-demographic characteristics of the sample: - Caregivers=(N 152)

| S.no | Variables | N | Percentage (%) |
|------|--------------------------------------|-----|----------------|
| 1.) | <u>Age:</u> | 152 | |
| | 40 to 60 years | 144 | 94.74% |
| 2.) | <u>Sex</u> | 152 | |
| | Male | 93 | 61.18% |
| | Female | 59 | 38.81% |
| 3.) | <u>Education:</u> | 152 | |
| | Literate Up Graduate | 6 | 4 % |
| | Illiterate | 146 | 96 % |
| 4.) | <u>Socio-Economic status:</u> | 152 | |
| | Lower | 132 | 87% |
| | Middle | 18 | 13.15% |
| | Higher | 2 | 13.31% |
| 5.) | <u>Occupation:</u> | 152 | |
| | Farmers | 62 | 41% |
| | State employee | 14 | 9.21 % |
| | Workers | 76 | 50% |
| 6.) | <u>Habitat:</u> | 152 | |
| | Rural | 107 | 70.39% |
| | Urban | 45 | 29.60% |
| | | | |
| 7.) | <u>Marital Status:</u> | 152 | |
| | Parents | 112 | 74% |
| | Single close relation | 2 | 1.31 % |
| | Widows | 34 | 22.36% |
| | Divorced | 4 | 2.63% |
| 8.) | <u>Religion :</u> | | |

| | | | |
|------|------------------------------------|-----|--------|
| | Hindu | 110 | 72.36% |
| | Muslim | 13 | 8.55% |
| | Sikh | 28 | 18.42% |
| | Christian | 1 | 0.65% |
| 9.) | <u>Sibling order :</u> | | |
| | 1 st child | 53 | 34.86% |
| | 2 nd child | 35 | 23.02% |
| | 3 rd child | 30 | 19.73% |
| | 4 th child | 23 | 15.13% |
| | 5 th child | 5 | 3.28% |
| | 6 th child | 1 | 0.65% |
| | 7 th child | 3 | 1.97% |
| | 8 th child | 2 | 1.3% |
| | | | |
| 10.) | Level of Mental Retardation | 152 | |
| | Mild Mental Retardation | 64 | 42.1% |
| | Moderate mental retardation | 88 | 57.9% |
| | | | |

IV. DISCUSSION

The main objective of the present study was to bring substantial changes in the lives of disable persons through their caregivers. One of the major problems faced by the caregivers was negative and ill-informed attitude towards Mental Retardation that they are unable to do anything work. Very few were educated up to graduate, their main concern was financial burden as who would look after the patient when they are no more and their savings were drained because of regular expenses of the chronic disorder. Karp (2001) in his study found that financial stress / burden stems not only from actual expenses of care giving like medication but financial strain also occur from “*opportunity cost of care*” the things someone gives up to become a care giver for example quits job or declines job promotion or advancement opportunities. The present study revealed that majority of the reported in hospital were from Weaker / Poorer sections of the society in Rural areas; as also reported in National Sample Survey Organization that the incidence of disability was more in Weaker / Poorer sections of Rural areas. This is because in rural areas facilities for optimal training in social skills are not available. Services like village level workers equipped with skill in home training for Mentally Retarded persons are lacking in most rural areas.

On analysis tense relationship among the parents as care givers were reported. Widows & divorced caregivers also contributed to the sample. Two participants were from close relationship from maternal house and were living together from more than 10 years. Province (1996) found that the most negative consequences of care giving was tense relationships in the household and also disturbed work performance. Further, the caregivers reported that they found undefined and stressful nature of the care giving role as there are few guidelines available. This undefined role was also reported in a study conducted by Deimling and Bass (1986). It is noteworthy that the two care givers who were from close-relation could understand the nature of disability and change the mind set about disability and bring substantial changes through training as a caregiver. These major changes include special education and self-management for patient which could improve the family members daily living conditions as well as reduce care giving stress. Most of the caregivers were from Hindu families, followed by Sikh and Muslim, and one from Christian family. It was noticed that degree of burden with respect to finance was main concern for all caregivers, as to who will look after patient when they are no more. This was seen in all the religious communities. Most of the caregivers reported embarrassment, anger and helplessness in case their child behaved in a socially unacceptable way. This helplessness turned into

dejection and would force them think that no permanent and effective treatment is possibly for this issue. Academic deficits, low level of cognitive maturity, lack of professional health care, few social guidelines for caregivers and low socio-economic status made caregivers feel that patient is unable to perform any work. It is clear from the caregivers that they faced many problems while caring for a Mentally Retarded person. Their social and personal life was affected, while dealing with social unacceptable behavior of the patient. Moreover, the patient was dependent on the care givers who were older and their major concern was who would look after patient when they are no more which is basically dominated by the fact that they take responsibility for their Mentally Retarded child.

Of all the participants in the study only two turned up for follow up after being called for psychological treatment of their mentally retarded children. They were educated how things work for these children. Like how positive changes can be brought in patient through social skill training, special education and self-management. In order to justify above mentioned findings of the study it was found that all care givers of Mentally Retarded patients carry very similar psychological burden and are exposed to similar situational stressors which was supported by Sinha (2013) that all primary care givers share similar fate in their life, which is basically dominated by the fact that they take responsibility for their mentally ill family member. The feelings of isolation and stigma as well as restrictions in social activities where common experience of care givers. Similar findings have been reported in a number of studies (Grad & Sainsbug 1963, Mandelbrot & Folkard 1961, Waters & North 1965, Winefield & Harvey 1994). The degree of burden experienced is influenced by patient caregivers related factors and also varies by age & gender, and greater burden is associated in older care givers.

V. CONCLUSION

Our study in no way tries even a little bit to belittle the disability pension given to the persons suffering from an illness as disabling as Mental Retardation. However, our endeavor is just to bring into light the mentality of society in general and caregivers in particular regarding the monetary benefits associated with disability pension. Based on the findings of present study, which is first of such kind of research in Jammu region, one of the major problems noticed by researcher was negative and ill-informed attitude due to lack of scientific knowledge and exposure in the field of mental retardation among the care givers. The patient illness was considered as burden in terms of finance by care givers and feels who will look after them when they are no more. And hence disability is applied to take care of the financial inadequacy of the person with mental retardation and very little effort is then made to rehabilitate the intellectually disabled. The researcher emphasizes on participation of caregivers for improving the life of disabled peoples not only through financial benefit but also to make them understand about the self-management, social skill training and special education for mild and moderate mentally retarded children. There is need of administration to understand and to give professional training and provide better developing facilities at both primary and tertiary level. An important finding was non-availability of professional help especially occupational and vocational training. Emphasis should be on workshop and

orientation programs for care givers. Therefore, there is a need for producing better rehabilitation procedures available for people with Mental Retardation, so that they will feel how things work in the real world. (Malhotra 2011)

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The *in vitro* evaluation of some South African plant extracts for minimum inhibition concentration and minimum bactericidal concentration against selected bacterial strains

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ABSTRACT

Bacterial infections are one of the world's most pressing public health problems. The major challenge in anti-bacterial treatment is the development of antibiotic resistant bacterial strains. This then reduces the number of drugs available for treating bacterial infections. In this study, antimicrobial activity of nine South African crude plant extracts were investigated for the first time against *Escherichia coli* (*E.coli*), *Pseudomonas aeruginosa* (*Ps aeruginosa*), *Staphylococcus aureus* (*S. aureus*) and *Enterococcus faecalis* (*E. faecalis*). The minimum inhibitory concentrations of the crude plant extracts were determined. Four plant extracts showed good inhibition effects against all four bacteria used which are *Lippia javanica* (0.25±0.00 to 1.13±0.29 mg/ml); *Ziziphus mucronata* leaf (0.44±0.00 to 1.00±0.00 mg/ml); *Erythrina lysistemon* (0.44±0.00 to 1.08±0.00 mg/ml) and *Schkuhria pinnata* (0.5±0.00 to 1.34±0.00 mg/ml). Similarly, gentamycin (positive control) had inhibitory effects ranged from 0.92±0.29 to 2.00±0.00 mg/ml against all four bacteria used. For the bactericidal effects, four plant extracts that showed bactericidal effects against three bacteria used (*E.coli*, *S. aureus* and *E. faecalis*). The plant extracts are *Lippia javanica* (0.25±0.00 to 1.00±0.00 mg/ml); *Ziziphus mucronata* leaf (0.25±0.00 to 2.00±0.00 mg/ml); *Erythrina lysistemon* (0.5±0.00 to 2.00±0.00 mg/ml) and *Schkuhria pinnata* (0.5±0.00 to 2.00±0.00 mg/ml). Furthermore, none of the plant extract showed bactericidal against *Ps. aeruginosa*. The results of this study suggests that four plants that demonstrated inhibition effect and bactericidal effects which supports their used in the traditional medicine treatment of various ailments.

Keywords: bacterial infections, antimicrobial activities, pathogens, inhibition, bactericidal.

1.0 INTRODUCTION

Bacterial infections are caused by pathogenic microorganisms that have the ability to cause diseases in humans (Alberts *et al.*, 2002; Ryan *et al.*, 2014). Not all bacteria are pathogenic, the ones that are pathogenic are responsible for causing diseases in humans. The most prominent pathogenic microorganism is *Mycobacterium tuberculosis* which is responsible for the highest tuberculosis burden in humans; and accounts for about 2 million deaths per year, mostly in sub-Saharan Africa (Chan *et al.*, 2013; Ryan *et al.*, 2014). Another globally important genera of pathogens are *Streptococcus* and *Pseudomonas* which are responsible for diseases such as pneumonia. Genera such as *Shigella*, *Campylobacter* and *Salmonella* are mainly responsible for foodborne illnesses. In addition to this, they can further cause infections such as tetanus, typhoid fever, diphtheria, syphilis and leprosy (Ben-Noun, 2009; Chan *et al.*, 2013).

The increase of antimicrobial resistance is a global concern. It is characterised by multidrug-resistance which is mainly caused by gram-negative bacteria (Exner *et al.*, 2017). This is due to genetic mutations and can also be triggered by misuse of antimicrobial drug prescriptions (Mwambete, 2009). Gram-negative strains that contribute towards multidrug-resistance have been reported and these include, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, *Enterobacter* spp and *Escherichia coli* (Exner *et al.*, 2017). Although more attention has been focused on multi-drug resistance (MDR) associated with gram-negative bacteria, and gram-positive antimicrobial resistance are also a serious concern (Doemberg *et al.*, 2017). For example, methicillin-resistant *Staphylococcus aureus* (MRSA) is a typical example that has raised increased global concern as a cause of community-acquired and healthcare-associated infection. Gram-positive organisms including bacteria of the genera *Staphylococcus*, *Streptococcus* and *Enterococcus*, are among the most common bacteria causes of clinical infection (Johnson *et al.*, 2005; Klevens *et al.*, 2007). The substantial increase in the drug resistance of antibiotics in recent years poses an ever-

increasing therapeutic challenges.

The organisms play a pivotal role in developing resistance to antibiotics. However, patients are also partly responsible for antibiotic resistance due to overuse, misuse, and/or lack of adherence to the prescription, failure to complete the course which has led to ever-increasing levels of resistance to antibiotic treatment (Franco *et al.*, 2009; Prestinaci *et al.*, 2016). Drug resistance has become particularly problematic in recent times because of the slow pace at which novel antibiotics are being discovered while antibiotic use continues to rise (Li and Webster, 2018). Due to the prevalence of microbial resistant strains, there is a need to focus on the plant species that show antimicrobial activities. The identification of plant species with antimicrobial properties is of great importance for therapeutic treatment of patients (Artizzu *et al.*, 1995; Izoq *et al.*, 1995; Eloff, 1998; Selvamohan *et al.*, 2012).

It is important to evaluate the ability of plant extracts to inhibit the growth of known pathogenic microorganisms. The general method used by most investigators is agar diffusion assay for the determination of microbial activities (Nascimento *et al.*, 2000; Al-Hussainin and Mahasneh, 2009). For the interest of this study, a sensitive and quick microplate method previously described by Eloff (1998) was used. This method is useful when investigating extracts with unknown components. Furthermore, this technique addresses shortfalls that have been observed on the agar diffusion; such as microbial effects may be inhibited by extrinsic factors or contamination (Marsh and Goode, 1994). Moreover, this method clearly distinguishes between bactericidal and bacteriostatic effects and it can determine minimum inhibitory concentration (Eloff, 1998). In addition, the minimum bactericidal concentration can be defined as the lowest concentration that can kill any visible bacterial growth (Sen and Batra, 2012).

2.0 METHODS AND MATERIALS

2.1 Plant collection and extraction

Plant species (n=9) were collected from Walter Sisulu National Botanical Gardens in South Africa, in February 2017 (see **Table 1 here below**). The voucher specimen are held at Walter Sisulu National Botanical Gardens herbarium. The plant material was air-dried in a well ventilated room. After drying, the plants were ground into fine powder and stored away from light at room temperature.

Table 1: Nine plant species with accession numbers and voucher specimen numbers use in this study.

| NUMBER | NAME | FAMILY | PART | ACCESSION NUMBER | VOUCHER OF SPECIMEN COLLECTED | |
|--------|--------------------------------|-------------|-------|------------------|-------------------------------|-----------------|
| | | | | | DATE | NUMBER |
| 1 | <i>Euclea crispa</i> | Ebenaceae | Leaf | 24/1982 | 11/10/1982 | 24, Behr, C.M |
| 2 | <i>Euclea natalensis</i> | Ebenaceae | Leaf | 178/1987 | 10/6/1987 | 479; Steel, B.S |
| 3 | <i>Schuhria pinnata</i> | Asteraceae | Weed | N/A | N/A | N/A |
| 4 | <i>Ziziphus mucronata</i> | Rhamnaceae | Leaf | 36/1982 | 15/10/1982 | 39; Behr, C.M |
| 5 | <i>Ziziphus mucronata</i> | Rhamnaceae | Fruit | 36/1982 | 15/10/1982 | 39; Behr, C.M |
| 6 | <i>Lippia javanica</i> | Verbenaceae | Leaf | 16/2014 | 22/1/2014 | 28; Kondlo, M |
| 7 | <i>Vernonia oligocephala</i> | Asteraceae | Leaf | 268/2013 | 12/05/2013 | 29; Hankey, A.J |
| 8 | <i>Clerodendrum myricoides</i> | Lamiaceae | Leaf | 11/1987 | 2/2/1987 | 367, Steel, B.S |
| 9 | <i>Erythrina lysistemon</i> | Fabaceae | Leaf | 21/1982 | 7/10/1982 | 22; Behr, C.M |

2.2 Preparation of crude extracts for biological assays

The ground plant extracts (leaves and fruit) were extracted with 90% methanol (1 g/10 ml) in clean honey jars and vigorously shaken for 3 hours. The crude extracts were filtered through Whatman No.1 filter paper and dried at room temperature under a stream of cold air. The crude extracts were reconstituted in methanol, dichloromethane and acetone at a concentration of 10 mg/ml for all assays

2.3 Bacterial strains

The antimicrobial activities of the plant extracts were tested against gram-negative bacteria [*Escherichia coli* (NCTC10538) and *Pseudomonas aeruginosa* (ATCC27853)] and gram-positive bacteria [*Staphylococcus aureus* (NCTC10538) and *Enterococcus faecalis* (ATCC29212)]. These bacterial strains were donated by the Pearson Institute of Higher Education, South Africa and the University of Pretoria Paraclinical Department. The bacterial strains were continuously maintained in nutrient agar and Mueller-Hinton agar sub-cultured weekly in order to ensure that fresh cultures were used each time for an inoculum preparation.

2.4 Determination of minimal inhibitory concentration (MIC)

Minimal inhibitory concentrations (MIC's) were determined using the microplate dilution method developed by Eloff (1998). Methanol (MeOH) crude plant extracts were re-dissolved in 50% distilled water and 50% solvent, namely MeOH, dichloromethane (DCM) and acetone (AC) to a concentration of 8 mg/ml. One hundred microliters (100 µl) of dissolved plant extract and a positive control, gentamicin (Sigma-Aldrich, Cat No, 1405-41-0) were serially diluted with distilled water in a 96 well plate. Bacterial suspension (100 µl), standardised to McFarland standard No. 0.5, was added to each well. The following concentrations of plant extracts were used in these experiments: 2, 1, 0.5, 0.25, 0.125, 0.062, 0.031 and 0.015 mg/ml respectively. Sealed plates were incubated at 37°C for 24 hours.

To indicate growth, 40 µl of *p*-iodonitrotetrazolium violet (INT) (Sigma-Aldrich, Cat NO. 18377), was dissolved in distilled water and added to the microplate wells were incubated at 37°C for 30-45 minutes. The presence of bacterial growth was observed as a pink/red colour, and clear wells indicated the inhibition of bacterial growth by the plant extract. The extract dissolving solvents (MeOH, DCM and AC) were used as negative controls and gentamicin served as a positive control (50 µg/ml). The assay was performed in quadruplicates and repeated three times.

2.5 Determination of minimal bactericidal concentration (MBC)

Minimal bactericidal concentration (MBC) was recorded as the lowest concentration of the crude plant extract that killed 100% of the test organisms. MBC was determined by adding 50 µl aliquots of the serial dilution which did not show any visible growth after incubation in the MIC assay, and 50 µl of INT, to 100 µl of Muller-Hinton broth. The plates were incubated at 37°C for 24 hours. The presence of bacterial growth was indicated by a pink/red colour, and clear wells indicated the inhibition of bacterial growth by the plant extract. The lowest concentration indicating inhibition of growth was recorded as the MBC.

2.6 Statistical analysis

The assay was performed in quadruplicate and repeated three times. All data was expressed as mean and standard deviation using MS Excel 2013 and ANOVA GraphPad Prism 5.

3.0 RESULTS

Antimicrobial effects of nine plant extracts were evaluated in terms of their ability to inhibit growth of the selected bacterial strains. Nine extracts were screened and found to be active against one or more of bacterial strains used (see Table 2). There was no significant difference observed between the solvents used in reconstitution of the extracts. For the results interpretation, an inhibition effect below 1 mg/ml was considered to be a good activity effect and anything above 1 was considered as moderate activity. Essentially above 2 mg/ml was not considered active effect in this study.

Table 2: Minimal inhibitory concentration of nine plant extracts expressed in mean and standard deviation.

| Plant Species | Plant part | Solvent | <i>E. coli</i> (mg/ml) | <i>Ps. aeruginosa</i> (mg/ml) | <i>S. aureus</i> (mg/ml) | <i>E. faecalis</i> (mg/ml) |
|---------------------------|------------|---------|------------------------|-------------------------------|--------------------------|----------------------------|
| | | | Mean± SDV | Mean± SDV | Mean± SDV | Mean± SDV |
| <i>Euclea crispa</i> | leaf | MeOH | 1.75±0.00 | 2.00±0.00 | 1.67±0.00 | 1.63±0.00 |
| | | DCM | 1.75±0.00 | 2.00±0.00 | 1.60±0.58 | 1.44±0.00 |
| | | EA | 1.28±0.00 | 1.50±0.71 | 1.34±0.00 | 1.38±0.00 |
| <i>Euclea natalensis</i> | leaf | MeOH | 1.25±0.00 | 1.00±0.00 | 1.33±0.00 | 1.12±0.00 |
| | | DCM | 1.75±0.00 | 2.00±0.00 | 1.60±0.58 | 1.55±0.58 |
| | | EA | 1.38±0.00 | 2.00±0.00 | 1.41±0.00 | 1.43±0.00 |
| <i>Schkuhria pinnata</i> | leaf | MeOH | 1.00±0.00 | 1.25±0.00 | 1.25±0.58 | 1.34±0.00 |
| | | DCM | 1.00±0.00 | 1.25±0.00 | 1.10±0.00 | 1.13±0.58 |
| | | EA | 0.50±0.00 | 0.63±0.00 | 0.74±0.58 | 0.94±0.00 |
| <i>Ziziphus mucronata</i> | leaf | MeOH | 0.50±0.00 | 0.63±0.00 | 0.82±0.58 | 0.83±0.00 |
| | | DCM | 1.00±0.00 | 0.88±0.00 | 0.84±0.00 | 0.82±0.00 |
| | | EA | 0.50±0.00 | 0.44±0.00 | 0.61±0.58 | 0.67±0.00 |
| <i>Ziziphus mucronata</i> | fruit | MeOH | 1.00±0.00 | 0.50±0.00 | 1.15±0.00 | 0.98±0.00 |
| | | DCM | 1.75±0.00 | 2.00±0.00 | 1.60±0.58 | 1.55±0.58 |

| | | | | | | |
|------------------------|------|------|-----------|-----------|-----------|-----------|
| <i>Lippia javanica</i> | leaf | EA | 1.50±0.58 | 2.00±0.00 | 1.31±0.00 | 1.06±0.00 |
| | | MeOH | 0.25±0.00 | 0.50±0.87 | 0.53±0.00 | 0.49±0.00 |
| | | DCM | 0.50±0.00 | 1.13±0.29 | 1.11±0.58 | 1.03±0.29 |
| | | EA | 0.50±0.00 | 0.50±0.29 | 0.43±0.00 | 0.50±0.87 |

| Plant Species | Plant part | Solvent | <i>E. coli</i> (mg/ml) | <i>Ps. aeruginosa</i> (mg/ml) | <i>S. aureus</i> (mg/ml) | <i>E. faecalis</i> (mg/ml) |
|--------------------------------|------------|---------|---------------------------|----------------------------------|-----------------------------|-------------------------------|
| <i>Vernonia oligocephala</i> | leaf | MeOH | 1.06±0.87 | 1.00±0.00 | 1.26±0.00 | 1.26±0.58 |
| | | DCM | 1.25±0.00 | 1.00±0.00 | 1.25±0.58 | 1.34±0.00 |
| | | EA | 1.75±0.00 | 2.00±0.00 | 1.67±0.00 | 1.63±0.00 |
| <i>Clerodendrum myricoides</i> | leaf | MeOH | 1.75±0.00 | 2.00±0.00 | 1.52±0.58 | 1.49±0.58 |
| | | DCM | 1.25±0.00 | 1.00±0.00 | 1.17±0.58 | 1.17±0.58 |
| | | EA | 1.75±0.00 | 2.00±0.00 | 1.67±0.00 | 1.63±0.00 |
| <i>Erythrina lysistemon</i> | leaf | MeOH | 1.00±0.00 | 0.88±0.00 | 0.91±0.58 | 1.08±0.00 |
| | | DCM | 0.50±0.00 | 1.00±0.00 | 1.00±0.58 | 1.09±0.58 |
| | | EA | 0.50±0.00 | 0.44±0.00 | 0.50±1.01 | 0.52±0.00 |
| Gentamycin | | MeOH | 1.75±0.00 | 2.00±0.00 | 1.31±0.14 | 1.19±0.00 |
| | | DCM | 1.19±0.00 | 2.00±0.00 | 1.01±0.29 | 0.92±0.29 |
| | | EA | 1.19±0.00 | 2.00±0.00 | 1.21±0.58 | 1.14±0.00 |

MeOH: methanol; DCM: dichloromethane; EA: ethanol; *E. coli*: *Escherichia coli*; *Ps. aeruginosa*: *Pseudomonas aeruginosa*; *S. aureus*: *Staphylococcus aureus*; and *E. faecalis*: *Enterococcus faecalis*.

Determination of minimal inhibitory concentration (MIC)

Table two lists the antimicrobial activity of all plant extracts. The following four plant extracts showed good antimicrobial activity against all four bacteria used which are *Lippia javanica* (0.25±0.00 to 1.13±0.29mg/ml); *Ziziphus mucronata* leaf (0.44±0.00 to 1.00±0.00 mg/ml); *Erythrina lysistemon* (0.44±0.00 to 1.08±0.00 mg/ml) and *Schkuhria pinnata* (0.5±0.00 to 1.34±0.00 mg/ml). Furthermore, it can be seen that the other five plant extracts showed good inhibition effects against three bacterial straight which were below 1.75±0.00 mg/ml, except for *Ps aeruginosa* (2.00±0.00 mg/ml). This suggests *Ps aeruginosa* is resistance against plant extracts used. Similarly, gentamycin (positive control) had inhibitory effects ranged from 0.92±0.29 to 2.00±0.00 mg/ml against all four bacteria used.

Determination of minimal bactericidal concentration (MBC)

Table 3 represents minimum bactericidal effects of nine plant extracts against all four bacteria used. Interestingly, the four plant extracts that showed inhibition effects (see Table 2) have demonstrated bactericidal effects against three bacteria used (*E.coli*, *S. aureus* and *E. faecalis*). The plant extracts are *Lippa javanica* (0.25±0.00 to 1.00±0.00 mg/ml); *Ziziphus mucronata* leaf (0.25±0.00 to 2.00±0.00 mg/ml); *Erythrina lysistemon* (0.5±0.00 to 2.00±0.00 mg/ml) and *Schkuhria pinnata* (0.5±0.00 to 2.00±0.00 mg/ml). Moreover, the bactericidal effects for other four plant extracts was observed to be 1.67±0.58 against *E.coli*, *S. aureus* and *E. faecalis*. Essentially, no bactericidal effect were observed for *Euclea crispa*. None of the plant extracts used showed bactericidal effects against *Ps aeruginosa*. This indicates that *Ps aeruginosa* is residence against plant extracts tested against.

Table 3: Minimal bactericidal concentration of nine plant extracts expressed in mean and standard deviation.

| Plant Species | Plant part | Solvent | <i>E. coli</i> (mg/ml) | <i>Ps. aeruginosa</i> (mg/ml) | <i>S. aureus</i> (mg/ml) | <i>E. faecalis</i> (mg/ml) |
|--------------------------|------------|---------|---------------------------|----------------------------------|-----------------------------|-------------------------------|
| | | | Mean± SDV | Mean± SDV | Mean± SDV | Mean± SDV |
| <i>Euclea crispa</i> | leaf | MeOH | 2.00±0.00 | 2.00±0.00 | 2.00±0.00 | 2.00±0.00 |
| | | DCM | 2.00±0.00 | 2.00±0.00 | 1.67±0.58 | 1.00±0.00 |
| | | EA | 1.00±0.00 | 2.00±0.00 | 2.00±0.00 | 2.00±0.00 |
| <i>Euclea natalensis</i> | leaf | MeOH | 1.00±0.00 | 2.00±0.00 | 2.00±0.00 | 0.50±0.00 |
| | | DCM | 2.00±0.00 | 2.00±0.00 | 1.67±0.58 | 1.00±0.00 |
| | | EA | 1.00±0.00 | 2.00±0.00 | 2.00±0.00 | 2.00±0.00 |
| <i>Schkuhria pinnata</i> | leaf | MeOH | 1.00±0.00 | 2.00±0.00 | 0.25±0.00 | 2.00±0.00 |
| | | DCM | 0.50±0.00 | 2.00±0.00 | 1.00±0.00 | 1.67±0.58 |

| | | | | | | |
|---------------------------|-------|------|-----------|-----------|-----------|-----------|
| | | EA | 2.00±0.00 | 1.00±0.00 | 1.00±0.00 | 2.00±0.00 |
| <i>Ziziphus mucronata</i> | leaf | MeOH | 0.50±0.00 | 1.00±0.00 | 0.25±0.00 | 1.00±0.00 |
| | | DCM | 2.00±0.00 | 2.00±0.00 | 1.00±0.00 | 1.00±0.00 |
| | | EA | 0.50±0.00 | 1.00±0.00 | 1.00±0.00 | 0.50±0.00 |
| <i>Ziziphus mucronata</i> | fruit | MeOH | 0.50±0.00 | 2.00±0.00 | 2.00±0.00 | 0.50±0.00 |
| | | DCM | 2.00±0.00 | 2.00±0.00 | 1.67±0.58 | 1.67±0.58 |
| | | EA | 0.50±0.00 | 1.00±0.00 | 2.00±0.00 | 2.00±0.00 |
| <i>Lippia javanica</i> | leaf | MeOH | 0.25±0.00 | 0.50±0.00 | 0.25±0.00 | 0.50±0.00 |
| | | DCM | 1.00±0.00 | 2.00±0.00 | 0.71±0.51 | 1.00±0.00 |
| | | EA | 1.00±0.00 | 0.25±0.00 | 0.75±1.08 | 0.50±0.00 |

| Plant Species | Plant part | Solvent | <i>E. coli</i> (mg/ml) | <i>Ps. aeruginosa</i> (mg/ml) | <i>S. aureus</i> (mg/ml) | <i>E. faecalis</i> (mg/ml) |
|--------------------------------|------------|---------|---------------------------|----------------------------------|-----------------------------|-------------------------------|
| <i>Vernonia oligocephala</i> | leaf | MeOH | 1.00±0.00 | 2.00±0.00 | 1.67±0.58 | 2.00±0.00 |
| | | DCM | 1.00±0.00 | 0.50±0.00 | 1.33±0.58 | 1.00±0.00 |
| | | EA | 2.00±0.00 | 2.00±0.00 | 1.67±0.58 | 2.00±0.00 |
| <i>Clerodendrum myricoides</i> | leaf | MeOH | 2.00±0.00 | 2.00±0.00 | 1.00±0.00 | 2.00±0.00 |
| | | DCM | 1.00±0.00 | 2.00±0.00 | 1.50±0.87 | 1.67±0.58 |
| | | EA | 2.00±0.00 | 0.50±0.00 | 0.42±0.14 | 2.00±0.00 |
| <i>Erythrina lysistemon</i> | leaf | MeOH | 1.00±0.00 | 1.00±0.00 | 0.50±0.43 | 2.00±0.00 |
| | | DCM | 2.00±0.00 | 2.00±0.00 | 1.42±1.01 | 0.67±0.29 |
| | | EA | 1.00±0.00 | 0.25±0.00 | 0.19±0.11 | 0.50±0.00 |
| Gentamacin | | MeOH | 2.00±0.00 | 2.00±0.00 | 0.25±0.33 | 1.00±0.00 |
| | | DCM | 0.06±0.00 | 2.00±0.00 | 0.83±1.01 | 0.50±0.43 |
| | | EA | 0.06±0.00 | 0.25±0.00 | 2.00±0.00 | 0.50±0.00 |

MeOH: methanol; DCM: dichloromethane; EA: ethanol; *E. coli*: *Escherichia coli*; *Ps. aeruginosa*: *Pseudomonas aeruginosa*; *S. aureus*: *Staphylococcus aureus*; and *E. faecalis*: *Enterococcus faecalis*.

4.0 DISCUSSION

The plant crude extracts were screened for their minimum inhibitory concentration and minimum bactericidal concentration using eight different concentrations; against four pathogenic organism. The findings of this research have shown that all plant extracts demonstrated inhibitory effects against pathogenic organisms tested against. However, only four plant extracts showed good inhibition effects against all three bacteria sued which are *Lippia javanica*, *Ziziphus mucronata leaf*, *Erythrina lysistemon* and *Schkuhria pinnata*. Similarly, positive control had inhibitory effects were comparable to those plant extracts gave good inhibition effects in all four pathogenic organisms used.

For the bactericidal effects, the four plant extracts that demonstrated good inhibition effects which are mentioned above also demonstrated good bactericidal effects only against three bacteria used. It was observed that *Ps. aeruginosa* did not demonstrate bactericidal effect against plant extract used.

The antimicrobial effects of plant extracts that showed inhibitory effects in our experiments are in agreement with their known medicinal use. For example, *Lippia javanica* has been reported to be used by Xhosa people to disinfect meat that has been contaminated by anthrax. In addition to that, it has been reported to be used for fever, cough, bronchitis and influenza (Van Wyk *et al.*, 2009; Van Wyk, 2011). *Ziziphus mucronata* has been reported to have various medicinal used per each region and the most common one is to treat boils, swollen glands, wounds and sores (Palmer and Pitman 1972). Interestingly, *Erythrina lysistemon* bark is used to treat sores, wounds, abscesses and arthritis. Furthermore, the leaves infusions are used as ear drops to relieve earache, and decoctions of the roots are applied to sprains (Van Wyk *et al.*, 1997).

Lastly, *Schuhria pinnate* have been used as a bactericide in open wounds, to treat acne, malaria and inflammation, and as a blood purifier and diuretic (Bussmann *et al.*, 2008).

In this study, four microorganisms were used as to assess the ability of plant extracts to inhibit their growth. These were gram-negative [*E. coli* and *Ps. aeruginosa*] and gram-positive [*S.aureus* and *E. faecalis*]. It was observed that plant extracts demonstrated a degree of inhibition towards both gram-negative and gram-positive bacteria. Generally, gram-negative bacteria

are resistance to most of antibiotics, mainly lipophilic and amphiphilic. This is mainly due to outer membrane in gram negative bacteria, which excludes certain drugs and antibiotics from penetrating the cell (Miller, 2016; Mia-Prochnow, 2016). In contrast to gram positive bacteria do not have outer membrane, so they are more susceptible to antibiotics (Verma, 2012; Mai-Prochnow, 2016).

In our findings *Ps. aeruginosa* was observed to be resistance towards most plant extracts tested. This has been previously reported in literature that *Ps. aeruginosa* has the ability to develop resistance to antibiotics rather rapidly over several generations. Essentially, resistance strains makes it difficult to treat once in a host, such as a human or other animal, is infected (Griffin *et al.*, 2004). The sensitive organisms (*E.coli*) demonstrated to be sensitive in our findings and this is due to the fact that *E. coli* is well characterised, widely available and sensitive to antibiotics (Livermore *et al.*, 2008).

5.0 CONCLUSION

To this effect, the findings suggest that there is a great need for further development of antimicrobial agents that may contribute to the improvement of future chemotherapeutic agents from medicinal plants. It was seen that *Lippia javanica*, *Ziziphus mucronata* leaf, *Erythrina lysistemon* and *Schkuhria pinnata* showed a good inhibitory and bactericidal effects against bacteria used. In four pathogenic organisms used, only *Ps. aeruginosa* demonstrated some degree on resistance is certain plant extracts used. Interestingly, *E.coli* was observed to be sensitive strain in almost all plant extracts tested followed by *S. aureus*. The plants contain diverse class of compounds which possess biologically active agents. The plant extracts have exhibited excellent antimicrobial activities, with minimum inhibitory concentrations comparable to those of standard drugs. The future work involves identification of the active compounds and characterization.

6.0 CONFLICT OF INTERESTS

The authors declare that they do not have any conflict with respect to the publication of this paper.

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Dermoscopic Features of Noncicatricial Alopecia

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Abstract- Noncicatricial alopecia (NCA) is hair loss without scar tissue formation. The mostly found NCA are androgenetic alopecia (AGA), alopecia areata (AA), and telogen effluvium (TE). These three NCA are difficult to distinguish clinically that additional examinations are needed to support the diagnosis. A descriptive cross-sectional study was conducted to determine dermoscopic features of NCA, which included 30 NCA patients, comprised of 15 AGA patients, 5 AA patients, and 10 TE patients. In this study, the mean age of NCA patients was 35,7 years (mean age: AGA: 46,93 years; AA: 16,4 years; TE: 25,3 years). AGA was found mostly in men (80%), whereas AA and TE were found mostly in women (60% and 90%, respectively). AGA was also found mostly with marital status (86,7%) and history of alopecia in father (66,7%). The mean duration of alopecia in NCA were varies (mean duration of disease: AGA: 16,4 years; AA: 5,4 months, TE: 10 months). The pattern of alopecia in AGA was found mostly as Hamilton-Norwood III (26,7%) in male pattern hair loss (MPHL) and Ludwig II (13,3%) in female pattern hair loss (FPHL), whereas the pattern of alopecia in AA was found mostly as multiple patches (60%). Dermoscopic features were found as diversity of hair diameter > 20% in all AGA patients (100%), yellow dot in all AA patients (100%), and empty follicle in all TE patients (100%). Other dermoscopic features were found with different frequency. Dermoscopy examination is beneficial in diagnosing NCA.

Index Terms- androgenetic alopecia, alopecia areata, dermoscopy, noncicatricial alopecia, telogen effluvium.

I. INTRODUCTION

Hair is a cylindrical keratin filament, with or without pigment, which grows from hair follicle in the epidermal layer of mammals. Hair growth is influenced by the rapid division of matrix cells on the base of hair follicle.^{1,2} Humans have 100.000-150.000 hair on the scalp.³ A number of 90% of the hair is in the anagen phase and 10% of the hair is in the telogen phase. After 2-3 months of telogen phase, hair falls off and is replaced with new hair in the same hair follicle.¹⁻⁵ Failure of hair regrowth causes baldness (alopecia).^{4,5}

Alopecia is classified into cicatricial alopecia (CA) and noncicatricial alopecia (NCA). CA is associated with permanent destruction of hair follicle unit, whereas NCA is not associated with scar tissue formation.^{2,4,5} The mostly found NCA are androgenetic alopecia (AGA), alopecia areata (AA), and telogen effluvium (TE).^{5,6}

AGA is a genetically inherited and androgen-dependent hair disorder.^{7,8} In men, AGA is known as male pattern hair loss (MPHL). Whereas, for women, AGA is known as female pattern hair loss (FPHL).^{6,9} AGA can be found from prepubertal period until the eighth decade of life.⁷ AA is a genetic, noncicatricial disorder in the anagen hair follicles mediated by the immune system.^{4,10} AA is found 0,2% worldwide with an estimated risk of AA in life of 1.7%.^{11,12} AA has been found in age of 3 months¹³ up to the seventh decade of life.¹⁴ The highest prevalence is at the age of 30-59 years.¹⁴ TE is a diffuse terminal hair loss throughout the scalp.⁵ Generally, chronic TE is found in women aged 30-60 years.⁴ These three NCA are difficult to distinguish clinically that additional examinations are needed to

support the diagnosis, such as trichogram, dermoscopy, and biopsy.⁶⁻⁸

Dermoscopy is a noninvasive diagnostic tool that can visualize the epidermal layer and its underlying structure. Dermoscopic examination of hair and scalp abnormalities is also called trichoscopy.^{6,15} Chiramel et al. describe the role of dermoscopy in the differential diagnosis of various alopecia with almost 90,5% of cases are difficult to diagnose clinically.¹⁶ The study by Elzbieta et al. obtained the sensitivity and specificity of dermoscopy as a diagnostic method in FPHL of 96% and 98% compared to clinical diagnosis. In TE, the sensitivity and specificity of the dermoscopy examination were 85% and 98%.¹⁷ The dermoscopic features in the form of black dot, hair vellus, differences in hair diameter, yellow dot, exclamation hair, and thin hair were statistically significant in diagnostic procedures and treatment evaluation for alopecia, both NCA and CA, but differences in dermoscopic findings are still found in several studies.^{17,18}

II. MATERIAL AND METHODS

Study sample

This descriptive cross sectional study was conducted in Cosmetic Division, Department of Dermatology and Venereology, Medical Faculty, Universitas Sumatera Utara, Universitas Sumatera Utara Hospital, Medan, Indonesia, from December 2017 until December 2018. The study was approved by the Health Research Ethical Committee, Medical Faculty, Universitas Sumatera Utara, Medan, Indonesia.

This study included 30 NCA patients aged ≥ 5 years, comprised of 15 AGA patients, 5 AA patients, and 10 TE patients. Demographic data and medical history were taken, including age, gender, marital status, course and duration of alopecia, previous disease and treatment history, also family history of alopecia. Clinical examination on hair and scalp was performed to determine the pattern of alopecia. In AGA, pattern of alopecia was classified based on Hamilton-Norwood classification for MPHL and Ludwig classification for FPHL. In AA, pattern of alopecia was classified into single patch, multiple patch, reticular pattern, ophiasis pattern, sisaipho pattern, alopecia totalis (AT), and alopecia universalis (AU). Diagnosis was made based on medical history and clinical examination.

Patient who agreed to participate and signed informed consent was included in this study. Patients with hair and scalp treatment (systemic and topical corticosteroid, minoxidil, biologic agent) in the past 6 months, congenital hair and scalp disorder (trichorrhexis nodosa, trichorrhexis nodosa, trichorrhexis invaginata and Netherton syndrome, pili torti and Menkes syndrome, monilethrix, Marie-Unna hypotrichosis, pili annulati), or infection of hair and scalp (folliculitis, tinea capitis, secondary syphilis, pediculosis capitis, scabies) are excluded.

Methods

Dermoscopy examination was performed with a video dermoscope (Firefly® DE300 Digital Video Dermoscope; Firefly Global, Belmont, USA) that was connected to a desktop computer (Hewlett-Packard All-in-One 20-c429d; HP Inc., Palo Alto, USA) with installed FireflyPro Software. Alcohol as immersion liquid was used before examining each patient to clarify the observation. Only hair loss regions were observed. At least 3-5 images were taken with video dermoscope at a 10 to 30-fold magnification. Each dermoscopic image were reviewed to determine dermatologic features, such as diversity of hair diameter > 20%, perifollicular brown depression, short vellus hair, yellow dot, black dot, broken hair, and empty follicle.

Statistical description

Data on demographic characteristic, clinical characteristic, and dermoscopy features of NCA patients were computed into a master data form in Microsoft Excel 2010. Statistical description was performed by using SPSS 17.0.

Table I. Demographic characteristic of NCA patients

| Variable | AGA | AA | TE | |
|----------------------------|--------|------------|------------|---------|
| Age (years) | 5-15 | 0 (0%) | 1 (20%) | 0 (0%) |
| | 16-25 | 0 (0%) | 2 (40%) | 4 (40%) |
| | 26-35 | 4 (26,7%) | 2 (40%) | 6 (60%) |
| | 36-45 | 3 (20%) | 0 (0%) | 0 (0%) |
| | 46-55 | 3 (20%) | 0 (0%) | 0 (0%) |
| | 56-65 | 5 (33,3%) | 0 (0%) | 0 (0%) |
| Gender | Male | 12 (80%) | 2 (40%) | 1 (10%) |
| | Female | 3 (20%) | 3 (60%) | 9 (90%) |
| Marital status | No | 2 (13,3%) | 2 (13,3%) | 5 (50%) |
| | Yes | 13 (86,7%) | 13 (86,7%) | 5 (50%) |
| Family history of alopecia | No | 5 (33,3%) | 4 (80%) | 8 (80%) |
| | Father | 10 (66,7%) | 1 (20%) | 1 (10%) |
| | Mother | 0 (0%) | 0 (0%) | 1 (10%) |

III. RESULTS

Demographic and clinical characteristic of NCA patients

In this study, the mean age of NCA patients was 35,7 years (age range: 8-65 years). Male and female patients were found in the same amount (50%).

AGA patients (n = 15)

The mean age of AGA patients was $46,9 \pm 12,6$ years (age range: 30-65 years). There were more males, with a male to female ratio of 4:1. Most AGA patients were found with marital status (86,7%) and history of alopecia in father (66,7%) (Table I). The mean duration of alopecia in AGA patients was $16,4 \pm 11,4$ years. Hamilton-Norwood III (26,7%) was mostly found in MPHL, whereas Ludwig II (13,3%) was mostly found in FPHL (Table II).

Table II. Clinical characteristic of AGA patients

| Variable | n | % | |
|---------------------|----------------------|---|------|
| Duration (years) | < 10 | 5 | 33,3 |
| | 10-20 | 4 | 26,7 |
| | > 20 | 6 | 40 |
| Pattern of alopecia | Hamilton-Norwood I | 0 | 0 |
| | Hamilton-Norwood II | 3 | 20 |
| | Hamilton-Norwood III | 4 | 26,7 |
| | Hamilton-Norwood IV | 1 | 6,7 |
| | Hamilton-Norwood V | 2 | 13,3 |
| | Hamilton-Norwood VI | 2 | 13,3 |
| | Ludwig I | 1 | 6,7 |
| | Ludwig II | 2 | 13,3 |
| | Ludwig III | 0 | 0 |

AA patients (n = 5)

The mean age of AA patients was $22,8 \pm 11,0$ years (age range: 8-35 years). There were slightly more females (60%) than males (40%). Most AA patients were found without marital status (80%) and history of alopecia (80%) (Table I). The mean duration of alopecia in AA patients was $5,4 \pm 4,2$ months. The pattern of alopecia in AA was found mostly as multiple patches (60%) (Table III).

Table III. Clinical characteristic of AA patients

| Variable | n | % | |
|---------------------|----------------------|---|----|
| Duration (months) | ≤ 6 | 4 | 80 |
| | > 6 | 1 | 20 |
| Pattern of alopecia | Single patch | 1 | 20 |
| | Multiple patch | 3 | 60 |
| | Reticular pattern | 0 | 0 |
| | Ophiasis pattern | 0 | 0 |
| | Sisaipho pattern | 0 | 0 |
| | Alopecia totalis | 0 | 0 |
| | Alopecia universalis | 1 | 20 |

TE patients (n = 10)

The mean age of TE patients was $25,3 \pm 4,3$ years (age range: 17-31 years). There were more females, with a male to female ratio of 1:9. Most TE patients were found without history of alopecia (80%) (Table I). The mean duration of alopecia in TE patients was $10,0 \pm 5,9$ months.

Dermoscopy features of NCA patients

AGA patients (n = 15)

Diversity of hair diameter > 20% was found in all AGA patients (100%). Other dermoscopic features that were found, from high to low frequency, including perifollicular brown depression (46,7%), short vellus hair (33,3%), and yellow dot (20 %) (Table IV).

Table IV. Dermoscopic features of AGA patients

| Dermoscopic features | n | % |
|----------------------------------|----|------|
| Diversity of hair diameter > 20% | 7 | 46,7 |
| Perifollicular brown depression | 15 | 100 |
| Short vellus hair | 5 | 33,3 |
| Yellow dot | 3 | 20 |

AA patients (n = 5)

Yellow dot were found in all AA patients (100%). Black dot and broken hair were found in the same frequency (40%) (Table V).

Table V. Dermoscopic features of AA patients

| Dermoscopic features | n | % |
|----------------------|---|-----|
| Yellow dot | 5 | 100 |
| Black dot | 2 | 40 |
| Broken hair | 2 | 40 |

TE patients (n = 10)

Empty follicle were found in all TE patients (100%) (Table VI).

Table VI. Dermoscopic features of TE patients

| Dermoscopic features | n | % |
|----------------------|----|-----|
| Empty follicle | 10 | 100 |

IV. DISCUSSION

Dermoscopy is a noninvasive diagnostic tool that can visualize the epidermal layer and its underlying structure.^{6,15} The dermoscopic features were statistically significant in diagnostic procedures and treatment evaluation for alopecia, both NCA and CA.^{17,18} The mostly found NCA are AGA, AA, and TE.^{5,6} These three NCA are difficult to distinguish clinically that additional examinations are needed to support the diagnosis.⁶⁻⁸

There are several dermoscopic features that can be found in AGA, including diversity of hair diameter > 20%, perifollicular brown depression, short vellus hair, and yellow dot.¹⁸ Similar to previous study by Mani et al, diversity of hair diameter > 20% is the most typical dermoscopic feature in AGA.¹⁹ This dermoscopic feature is usually found in early AGA,²⁰ which describes progressive miniaturization in hair follicle.^{21,22} Other dermoscopic feature in early AGA is perifollicular brown depression. In this study, this dermoscopic feature was found in 46,7% AGA patients, as reported by Ruiming et al in MPH (44%) dan FPHL (44,5%) patients.²³ Perifollicular brown depression is lymphocyte infiltration in the superficial perifollicle.^{21,22} Histopathologically, it shows perifollicular inflammation in Caucasians or post inflammation perifollicular pigmentation in Asians.²⁰

In Surabaya, Indonesia, Paramita et al also reported short vellus hair in all AGA patients.²⁴ This dermoscopic feature describes severe hair miniaturization in late AGA.²¹ Other dermoscopic feature in late AGA is yellow dot. In this study,

yellow dot was only found in 20% AGA patients. Yellow dot is caused by increased sebum production in follicle without terminal hair.¹⁹ Ruiming et al. reported positive correlation between yellow dot and AGA severity.²³

Dermoscopic features that can be found in AA are yellow dot, black dot, and broken hair. As reported in this study, Inui et al. in Osaka, Japan, also found yellow dot as the most found dermoscopic feature in AA (63,7%).²⁵ Yellow dots are hyperkeratotic plugs that fill the follicular infundibula.²⁶ Mahmoudi et al reported positive correlation between yellow dot and AA severity.²⁷

However, Mani et al in India reported black dot as the most found dermoscopic feature in AA (76%).¹⁹ Black dot (“cadaverous hair”) are pigmented residues of hairs destroyed and broken at scalp level. This dermoscopic feature is a marker of active disease.²⁶ These different results may be related with different skin type of patients in each study. In dark skin type patient, there are more pigments on the skin caused by darker rete rigide and narrow epidermis underlying the dermal papilla.²⁸

In TE, there is no specific dermoscopic feature. Dermoscopic features that can be found are hair density reduction and empty hair follicle.^{19,20}

V. CONCLUSION

Dermoscopic features of NCA are typical that promote application of dermoscopy as one of examination procedure in hair and scalp disorders.

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Prospects and Challenges of Cooperative Learning Approach in Mathematics Education

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Abstract- This research based paper has discussed the significance of cooperative learning approach guided by constructivist theory of learning mathematics. It has provided a model of implementing cooperative learning approach in classroom practices with required tools. As it used a quasi-experimental research design, it has compared the achievements of control and experimental groups of the students by statistical analysis of quantitative data. There was a higher achievement of the treatment-group compared to the control group demonstrating a significant effect of the cooperative learning approach on students' performance. The results of delayed post-test demonstrated that the treatment applied to experimental group was found to have a longer period of retention memory than the control group. The qualitative analysis of interview data highlighted some problems faced by teachers to implement cooperative learning in the classroom. Some pedagogical and theoretical implications of findings have been discussed at the end.

Index Terms- Cooperative learning, constructivism, quasi-experimental design, friendship group in learning

I. INTRODUCTION

It is a common experience of mathematics teachers that when students get an interactive situation, it provides them an opportunity to deconstruct misconceptions and construct, reconstruct and modify their mathematical understanding (Yackel, Cobb & Wood, 1991, as cited in Kshetree, 2011). Students get the opportunity to communicate and share ideas about mathematics when they solve problems in peer groups (Artzt & Armour, 1992). Cooperative learning process may enable students to engage actively in group interaction and discussion among the peers. The cooperative learning may increase the level of task-based discussion and negotiation of meanings for effective learning. However, the effective learning through cooperative approach is not an involuntary method. Therefore, it may require a task with a common objective, a mechanism of face-to-face interaction, cooperative environment, individual responsibility and team accountability (Johnson & Johnson, 2000).

The teachers can have choices of conducting classroom teaching/learning (T/L) practices either competitively or individualistically or cooperatively. These decisions may directly affect the quality of students' learning. In a competitive T/L situation, the students may struggle in a win-lose state to prove them as the best ones (ibid). In an individual attempt, students may work on mathematics problems by themselves to accomplish their

own objectives which many not be related to those of other students. Whereas, in a cooperative learning classroom, students may learn together to achieve both individual and group's learning objectives. In this classroom structure, students discuss the subject matters, help each other and learn from each other, and provide encouragement to the members of the group, which are some of the basic ingredients for making mathematics learning meaningful.

It has been observed, in one hand, that a lecture method or direct instruction is adopted in a large classroom with a limited time and resources and a fixed deadline to complete the course. Then, there may be no effort to value students' prior knowledge though students might relate it to the content of direct instruction. In the other hand, a discussion method is applied when the class size is small with adequate resources and enough time to cover the course materials. The teachers may have opportunity to value the pre-existing knowledge and skills of the students through motivational interactions, group works, and think-pair-share. To make the student learning more effective, inductive and problem-solving methods are used in which the students get more opportunities to use their potential to develop their creativity and critical thinking (Johnson & Johnson, 2006). At the same time, the cultural capital of the students should also get proper place to make the T/L meaningful. The cooperative method is one that gives significant role to cultural capital of the students to make their learning comfortable, joyful, meaningful and creative (Bourdieu, 1998, as cited in Kshetree, 2009).

The cooperative learning is generally understood as learning that takes place in a small group where students share ideas and work cooperatively to complete a given task. There are several models of cooperative learning approach that may vary considerably from each other (Slavin, 1995). In this method, the students work within their groups to make sure that all of them mastered the content. The cooperative learning approach also transforms teacher-centric approach to student-centric approach in their peer-groups in which they create group synergy to solve the given problems. Duffy and Cunningham (1996, cited in Kshetree, 2011) added that in the new education landscape, there are many pathways to arrive at the many peaks on the mountain range of talents over the past decade. The recent development in the field of educational technology has endorsed cooperative learning as a suitable referent for the development and meaningful use of appropriate software in education. Therefore, in this study, learning was viewed from the cooperative learning perspective.

A combination of theory, research and practice has made cooperative learning a powerful learning procedure. Therefore, the

cooperative learning process was designed and implemented to get all group members to participate in meaningful learning of mathematics. The purpose of this study was to design, implement, and assess the effectiveness of cooperative learning of mathematics through the real classroom practices. Thus, the materials and methods for this approach were framed to implement and examine in the natural setting of classrooms for both the qualitative and quantitative assessment of the phenomenon. In this study, the major research questions intended to be answered in Nepalese context were as: How does cooperative T/L approach get hold of better achievement than conventional T/L system? What are the problems being faced by teachers while adopting the cooperative learning approach in T/L mathematics?

II. THEORETICAL FRAMEWORK OF COOPERATIVE LEARNING

In the decade of 1980, the constructivist theory was widely accepted. There was a great contribution of Jean Piaget who established constructivism as a leading theory of learning mathematics which emerged an alternative conceptions movement in science education (Duit, 1995 cited in Ernest, 2010). Many scholars have attempted to develop a form of social or radical constructivism based on a Piagetian or neo-Piagetian constructivist theory of mind.

There are four philosophies of constructivist learning - trivial constructivism, enactivism, radical constructivism, and social constructivism (Ernest, 2010). The trivial constructivism argued that knowledge is built up actively by cognizing subject instead of passively receiving it. It accepts that true representation of the empirical and experiential worlds is achievable. The principle of enactivism claims that the individual continually changes schematic structure which determines its own actions and its orbit. It is about spontaneous self-organization based on the interaction of an individual and the situation (Reid et al. 2000, cited in Ernest, 2010). Actually, it is a process of construction of lived world through own active action and reaction revealed in learner's own circumstances.

In radical constructivism, learners build up their knowledge based on their pre-existing knowledge and personal interpretation of their experiences. It includes the individual construction of various affective responses along with their attitudes, feelings, beliefs and values. There is a great role of schemas as well. Nonetheless, in social constructivism, the construction of knowledge takes place in the social phenomena. According to Ernest (1995), there are two types of social constructivism. They are - Piagetian theory of mind which is attached on some social and developmental aspects (Piaget, 1976, cited in *ibid*) and Vygotskian theory of mind in which social contexts are more shared in the forms-of-life through conversation and learners' zone of proximal development (ZDP) (Vygotsky, 1978).

The different versions of constructivism imply that the knowledge is constructed based on learner's pre-existed knowledge, social interactions, dialogues, revised conversations, self-reflection, and contextual and situated environment. The basic principle of constructivist theories is that all knowledge is constructed by the individual through active construction of meanings of experiences. It is formed in the mind which cannot simply be transmitted from teacher to students. Thus, mathematics

teachers and educators must understand the learning phenomenon of students on the basis of which they can prepare and use different methods that may work well (Kshetree, 2009). In this regard, mathematics teachers need to think about a method guided by constructivism to provide maximum support to students for their effective learning. The cooperative learning method, inherited in the theory of constructivism, is a body of techniques for facilitating students to optimize the learning benefits.

The main theoretical base of cooperative learning is constructivism. In this regard, constructivism has properly outlined the creative role of students, teachers and organization along with the creation of cooperative learning environment in the classrooms. The cooperative learning is based on four major perspectives - motivational, social cohesion, cognitive and developmental. Motivational perspective focuses primarily on the reward or goal structures under which students work successfully (Slavin, 1995). According to Johnson and Johnson (2006), the reward is based on group performance which is the sum of individual performances. It may create an interpersonal reward structure in which the peers withhold encouragement in response to peers' task-related efforts. However, in social cohesion perspective, the students help their peers learn and remove the misconceptions because they care about the group (Slavin, 1995). The main characteristic of social cohesion is to conduct team building activities so that the group learning becomes effective. The cognitive perspective grasps cooperative norms and feeling among students which may increase students' learning achievement (Johnson & Johnson, 2006). It is done with cognitive processing of information which helps in meaningful learning. Similarly, the developmental perspective emphasizes the interaction among students around appropriate tasks to increase their mastery of concepts. In this regard, Vygotsky (1978) introduced the idea of Zone of Proximal Development (ZPD). In his view, collaborative activities promote students' progress by challenging and shifting one another's ZPD.

For such a cooperative group work, they need to be internally motivated, socially cohesive, cognitively interactive and developmentally shifting their cognitive and affective level with an encouragement to enjoy in their trustworthy peer-groups even to attempt and solve the mathematical problems. Further, the cooperative learning is based on students' group work with certain principles such as positive interdependence, equal participation, face-to-face interaction, structured investigation, individual accountability, team accountability, and forming and processing small groups (Stahl, 1994 cited in Kshetree, 2012).

III. METHODOLOGY

Research Design

As per the nature of the study, the research design was a mixed method with qualitative and quantitative both. The purpose of this study was to determine the effects of the cooperative learning approach by implementing it among the small groups of students. Its' effect was measured through the achievements of the students through three different tests (pretest, posttest and retention test). It also collected the opinions and attitudes of students and teachers toward this T/L approach. In order to measure the effect of cooperative learning method, it was

compared with non-cooperative (conventional) T/L method in the classroom environment by using a quasi-experimental design.

Sampling

The study was conducted in two public schools of Kathmandu Valley. The sample schools were chosen among the ten schools by administering the pre-tests on the basis of the similar achievements made by the students in pretest. Similarly, qualification and teaching experiences of teachers along with schools' physical facilities, school environment, school management system, and SLC (School Leaving Certificate) results were also taken in to consideration while selecting the schools. Both of these public schools had 34(control group) and 40 (experimental group) numbers of sample students studying in third grade. To specify an experimental school, it was selected simple random method by a lottery system. The school of the control group has been given the name "X" whereas "Y" for the school of the experimental group. The teachers were selected based on their teaching periods in the selected grades of those schools.

Development of Research Tools

The researcher prepared the following research tools and then consulted with senior researchers, subject experts, trainers and teachers for feedback, suggestions and necessary modifications. Some of the tools were adapted from other researches with some modifications as per the need of the research.

Observation checklist for classroom T/L practices. In order to maintain the norms and values of CL (Cooperative Learning) approach, it was most important to observe the attitudes, behaviors and practices of both teachers and students. Further, it was equally important to observe students' 5Es (Engage, Explore, Explain, Elaborate, and Evaluate) in their small peer groups. Thus, an observation checklist was prepared and used it by the researcher while observing classroom practices under CL approach.

Preparation of cooperative lesson plans. The researcher developed cooperative-lesson plans as per the learning philosophy of cooperative T/L approach based on the models given by Ask ERIC (1994 & 1998, cited in Kshetree, 2009). For its preparation, the researcher used the textbooks of different authors of the same grade written in both Nepali and English languages. The researcher also used the curriculum, teachers' guide, subject elaboration and exercise booklet. It also followed the principles and standards of school mathematics (NCTM, 2000).

Construction of T/L aids. The researcher emphasized on, as far as possible, construction of the T/L materials with no cost, low cost and from the locally available materials including creative use of already developed materials found in and around the schools. On the basis of cooperative-lesson plans, the main T/L materials developed were-- different geometrical shapes, blocks of papers, worksheets, weight boxes, vessels of liquid measurement, and different tools of length measurement such as tape, strings, graph papers etc.

Development of test items. Focusing the cognitive domain of learning, the researcher developed and standardized the

examining tools. For this, he prepared the test items by using textbook, specification grid-chart, curriculum and teacher's guidebook developed and prescribed by the Curriculum Development Center (CDC). Moreover, the test items were consulted with subject experts, senior teachers and trainers. The test items included three categories of questions (knowledge for concept, comprehension for process and application for behavioral skills) as per the Bloom's Taxonomy. The test items prepared, in this way, were piloted in one of the public schools in Kathmandu district.

Before finalizing the test items, the difficulty level of each item was analyzed and readjustment was made for very easy and very difficult items. To identify whether the students of control and experimental groups of the selected schools would be justified to implement the cooperative learning approach or not, a pretest was administered. Similarly, to see the immediate learning achievement and retention effect under the cooperative learning approach, the post-test and retention test were administered. The retention test was conducted after a month of the post-tests. The test items were parallel but different for pretest, post-test and retention test.

Interview guideline. In order to collect the qualitative data regarding teaching experiences of mathematics teachers in conventional methods and classroom setting along with new T/L approach of cooperative learning, an interview guideline was prepared and administered among the mathematics teachers of the sampled schools.

Training for the teachers. The teachers were provided a week-long training to understand and implement the basic principles of cooperative learning approach, develop and implement the lesson plans of CLA, use of T/L aids, and facilitate the group works. A second session of the second last day in the training was managed for a model school-visit program in one of the reputed private schools of Kathmandu valley where the child-centered learning methods were adapted with various activities conducted among the small groups of children. In the last day of the training, the trainees presented their project works of the previous days, and then they were subjected to discuss and provide feedbacks on their field observation reports.

IV. IMPLEMENTATION OF CL APPROACH IN SCHOOLS

Administration of pretest. A short and simple guideline was provided to them regarding the way of appearing and responding to the pretest. The time duration for the test was of 45 minutes. The main objectives of pretest were to compare the level of achievements of the students of two groups (control and experimental) and benchmark their level of learning after implementing new learning approach in the experimental group.

Orientation for students. In the sample schools, the researcher oriented students regarding the implementation of the new pedagogy of learning i.e. cooperative learning (CL) approach and its conduction in different modality. He interacted with them regarding the classroom setting, rules to follow along the learning steps and introducing them to a new way of learning. They were found to be happy when they knew the role of the teachers would be changed from talking and describing to listening and guiding them in small peer groups.

Cooperative lesson plans. The CL treatment was given to the students of experimental group by using the cooperative lesson plans in their classrooms. The students of control groups were left to remain under as usual conventional process of teaching with similar T/L aids. In this way, two different T/L processes were going on which were evaluated by assessing their learning outcomes with the same test items. These scores were subjected to statistical analysis. The cooperative learning approach was adopted in three stages:

The first stage. The teacher introduced the preliminary concept of teaching topic or any task of mathematics through either relevant open-ended question, storytelling, relating with real life situation, or any news items, etc. whilst s/he might code a few challenges faced by students with clues. The estimated time, for this session, used to be of five to ten minutes.

Second stage. The second stage was actual T/L and peer/group work stage. It went through setting/arrangement, distribution of T/L aids, working on tasks, sharing and feedbacking sessions.

Classroom setting: It consisted of students' group division, sitting arrangement and distribution of T/L aids among them. After dividing the students in groups, they used to undergo for group works. The groups formed were of moderate size consisting of around four students.

The distribution of T/L aids: The T/L materials, though optional, used to be distributed among the groups. It became more effective when the teacher instructed in plenary about different problems, put the T/L materials in desks/tables and allowed the students to join the desks according to their interest.

Five working steps: The students went under five successive working steps (5E-Engaging, Exploring, Explaining, Elaborating and Evaluating) in peer groups with the help of four successive skills (4F- Forming, Functioning, Formulating and Fermenting) to follow up the phenomena of cooperative learning approach as suggested by Johnson & Johnson (2000).

Plenary session: After spending the allocated time under the proper guidance of teacher, the groups reached the conclusion and aftermath they presented their way of doing, used strategies and formulae, findings and conclusions in plenary session. However, it was not needed after every item/activity of group work.

Third stage. The students presented their group works, turn by turn, in the plenary. The peers and teacher provided the

essential feedbacks if any. Moreover, the teacher reviewed the works, carried out formative evaluation, and went for briefing and debriefing, then wrapped up the class with conclusion.

Field works and test administration. The opinions were collected while visiting and working in the sample schools. The collected opinions were of cooperative-teacher, math-teachers, head teacher and other subject teachers.

Administration of post-test and retention test. After the completion of the specified time of experiment, a posttest was administered by using those questions which were prepared by considering cognitive domain (knowledge, comprehension and application) and grade wise outputs specified by the CDC, Nepal. To see the retention impact of cooperative T/L approach, there was a provision of taking delayed post-test, which was conducted after a month of the completion of the experiment in both the sample schools.

V. ANALYSIS AND INTERPRETATION OF THE DATA

The researcher analyzed and interpreted the quantitative data of students' performance in pretest, posttest and retention test by using a SPSS (version 20) which dealt with mean, standard deviation, coefficient of variation, dependent and independent t-tests. Similarly, the quantitative findings were presented in tables, diagrams, graphs and charts. The qualitative data collected with the help of checklists of observation of classroom activities and guidelines of interactions and interviews were analyzed by thematic analysis that generated major themes related to problems and challenges of implementing cooperative learning in mathematics classroom.

Analysis of the Data

The quantitative and qualitative data of the study have been analyzed and presented separately.

Quantitative Findings

The analysis and interpretation of the quantitative data was based on the marks obtained in pretest, posttest and retention test by the students. These marks were also further analyzed according to the different cognitive domains (knowledge, comprehension and application levels). The table wise data and their interpretations have been given below.

Table 1. Achievements of students in both groups in three different tests

| Tests (FM. 100) | X - School (Control Group) | | | | Y - School (Experimental Group) | | | |
|-----------------|----------------------------|-------|-------|----------------|---------------------------------|-------|-------|----------------|
| | No. | Mean | S. D. | Coeff. of Var. | No. | Mean | S. D. | Coeff. of Var. |
| Pretest | 34 | 27.91 | 12.03 | 0.43 | 40 | 26.55 | 10.52 | 0.39 |
| Posttest | 34 | 44.56 | 14.52 | 0.33 | 40 | 61.93 | 19.28 | 0.31 |
| Retention | 34 | 35.03 | 12.66 | 0.36 | 40 | 46.97 | 14.23 | 0.30 |

It was found that the mean scores and coefficient of variations of pretests of both the groups (control and experimental) were almost similar. The mean score of control group was 27.91 with standard deviation 12.03 and coefficient of variation 0.43. Similarly, the mean score obtained by experimental group was 26.55 with standard deviation 10.52 and coefficient of variation

0.39. It showed that both the groups were found to be similar to implement the treatment.

To measure their immediate learning outcome, there was a provision of post-test after completing the lesson activities. The researcher got the increment of mean marks from pretest 27.91 to posttest 44.56 in control group whereas in experimental group it increased to 61.93 from 26.55. The achievement made by the

students of experimental group was greater by 17.37 marks (Table 1). It showed that the learning achievement in the conventional type of teaching method was quite low compared to the cooperative learning. In addition, the coefficient of variation showed that the experimental group had more consistency in achievements than that of the control group. Though the progress in immediate learning had taken place in both the methods, a more substantiated learning achievement was found in the cooperative learning approach than in the conventional one.

In the same way, the retention tests were also administered (after a month of the post-tests) in order to measure their effectiveness for long-term memory. Regarding their retention power, it showed a decrease in marks in both the groups. The marks of the control and experimental groups were found to be 35.03 and 46.97, respectively in the retention test (Table 1). It was

revealed that the learning achievement was found to last longer in the students of experimental group than in the control group. On the basis of coefficient of variation, the experimental group showed more consistency in the achievements as well.

Further statistical test were administered, turn by turn, to examine the significant differences among the variables between the control and experimental groups. To see the homogeneity of two groups that was how the initial differences of mean scores existed between them, Levene's test was administered. According to Levene's test of equality of variance, the researcher found F-value 0.967 and the significance value 0.329. The significance value 0.329 is greater than the level of significance i.e. α -value 0.05, indicating that the groups were homogeneous (Table 2).

Table 2. Levene's test for equality of means for scores of pretests

| Pretests | Levene's Test for Equality of Variance | | T-test for Equality of Means | | |
|-------------------------|--|------------|------------------------------|-------|-----------------|
| | F | Sig. value | t | D. f. | Sig. (2-tailed) |
| Equal variances assumed | 0.967 | 0.329 | 0.519 | 72 | 0.605 |
| Equal var. not assumed | | | 0.514 | 66.16 | 0.609 |

As the variances of two groups were homogeneous (equal), it was found t-value as 0.519 with significance value 0.605. The significance value was greater than the level of significance value i.e. $\alpha = 0.05$, so, the null hypothesis was accepted (Table 2). It meant there was no significant difference between the achievements of the students in both the groups in pretests. They can be treated as similar groups though their difference of mean marks was 1.35 (27.91 – 26.55) (Table 1). This difference was not large enough to challenge the null hypothesis and so, it was not significant. So, both the groups were found to be homogenous in which the investigator could apply the treatment for either of the groups.

The study had evaluated and compared students' achievements by administering post test and retention test. Further, the net gain in learning mathematics was also obtained. The data were statistically processed and interpreted as provided below.

(i) Comparative Study of Posttest-scores of Both the Groups

The comparative study of posttests of both the groups has been depicted below in table 3.

Table 3. Levene's test for equality of means for scores of post-tests

| Posttests | Levene's test for Equality of Variance | | T-test for Equality of Means | | |
|----------------------|--|------------|------------------------------|--------|-----------------|
| | F | Sig. value | t | D. f. | Sig. (2-tailed) |
| Equal var. assumed | 4.58 | 0.036 | -4.31 | 72 | 0.000 |
| Eq. var. not assumed | | | -4.41 | 71.038 | 0.000 |

According to Levene's test of equality of variance, the researcher found F-value as 4.58 and the significance value 0.036, the latter one was smaller than the level of significance i.e. α -value 0.05, which implied that the variances of two groups were not assumed equal. So, it was taken t-value as -4.41 with significance value 0.000. The significance value was smaller than the level of significance value i.e. $\alpha = 0.05$, so, the null hypothesis was rejected (Table 3). It meant there was a significant difference between the achievements of the students in both the groups. The mean mark of the experimental group was 61.93, which was

greater by 17.37 than that of the control group's mean marks 44.56 (Table 1). It showed that the treatment given to experimental group was found to be significant to produce immediate learning enhanced learning outcomes.

(ii) Comparative Study of Retention Test-scores of Both the Groups

The comparative study of retention tests of both the groups has been given below in table 4.

Table 4. *Levene’s test for equality of means for the scores of retention tests*

| Posttests | Levene’s test for Equality of Variance | | T-test for Equality of Means | | |
|----------------------|--|------------|------------------------------|-------|-----------------|
| | F | Sig. value | t | D. f. | Sig. (2-tailed) |
| Equal var. assumed | 0.24 | 0.63 | -3.78 | 72 | 0.000 |
| Eq. var. not assumed | | | 3.82 | 71.84 | 0.000 |

According to Levene’s test of equality of variance, the researcher found F-value as 0.24. The significance value 0.63 which was greater than the level of significance i.e. α -value 0.05, so, the equal variances assumed. It was found t-value as -3.78 with significance value 0.000. The significance value was smaller than $\alpha = 0.05$. So, it rejected the null hypothesis. It meant there was a significant difference between the achievements of the students in both the groups in the retention tests. The mean mark of the experimental group was 46.97, which was greater by 11.94 than that of the control group’s mean marks 35.03 (Table 1). This implied that the treatment applied to experimental group was found to be useful for a longer memory as well. This finding

corroborates Johnson and Johnson (2006) in which they found cooperative learning activities supported students to increase their extensive thinking and explanation skills through sharing the ideas which facilitated more understanding, increased the level of reasoning and accuracy of last longer memory.

(iii) Comparison of Net-gain in Learning of Two Groups

The table 5 (a) shows that the mean score of the difference of pretest and retention test of X- School (Control group) and Y-School (Experimental group) were 7.0 and 20.4 respectively.

Table 5(a). *Scores differences of pretest and retention tests of both the groups*

| Difference of pretest & retention test scores | N | Mean | Std. Deviation |
|---|----|------|----------------|
| X - School (Control group) | 34 | 7.0 | 5.7 |
| Y-School (Experimental group) | 40 | 20.4 | 8.8 |

Its significance was tested as follows.

Table 5 (b). *Independent Samples Test*

| Diff. of pretest and retention test scores | Levene’s test for Equality of Variance | | T-test for Equality of Means | | |
|--|--|------------------|------------------------------|-------|-----------------|
| | F | Significance (p) | t | D. f. | Sig. (2-tailed) |
| Eq.var. assumed | 3.63 | 0.061 | 7.641 | 72 | 0.000 |
| Eq. var. not ass. | | | 7.909 | 67.19 | 0.000 |

According to Levene’s test of equality of variance, the researcher found F-value as 3.63 with significance value 0.061 (Table 5b). The significance value is greater than α -value 0.05 so, the researcher went for the p-value 0.000 of the row of equal variances assumed. Again, the p-value 0.000 was found to be smaller than α -value 0.05, which meant the rejection of null hypothesis. Hence, there was a significance difference in the net gain in experimental and control groups. The mean score of experimental group (20.4) was found to be significantly higher than that of control group (7.0). Thus, the researcher concluded that the effect of treatment was significantly in the favor of experimental group for net gain in learning of mathematics by using cooperative learning approach.

VI. FINDINGS OF THE STUDY

The quantitative and qualitative findings of the study have been presented separately.

Quantitative Findings

The statistical tools applied in this study for the analysis of the quantitative data of this study have drawn the following conclusions.

1. On the basis of pretest scores, the students of both the groups were found to be of same standard. After the use of cooperative learning approach, the students of experimental group were found to be significantly better in regard to their immediate learning achievements.
2. The statistical tool applied for retention tests implied that the treatment effect produced a longer memory in the students of experimental group than those of control group.
3. The students of experimental group stood significantly better than the students of control group regarding the net gain in learning.

Qualitative Findings

In the form of qualitative data, the study incorporated the experiences, opinions and observations of students, teachers, and subject experts. These conclusions have further been analyzed and made consistent with the conclusions of review of literatures, pre-existed theories and researcher's own reflections. All of these informative data and records were triangulated and verified to make the findings more consolidated.

In order to dig out the different types of problems being faced by the cooperative teachers, according to the principle of cooperative learning approach, they were interviewed. Moreover, the interview was also administered to head teachers and other mathematics teachers. They reported that, there were big problems of classroom setting having limited space and fixed furniture, which created obstructions to have group activities. The classrooms were small without enough light, the dilapidated walls and ceilings. There was no conducive environment, no proper management of T/L materials, and no raw materials (even card boards and sheet papers, colors, scissors etc) for preparation of T/L materials. Though, the students were managed in groups by making them to sit face-to-face manner pairs of benches and desks and they were provided the materials for the period of carrying out research by the researcher.

Similarly, there was lack of training to the teachers (if they had any trainings that were always of stereotype), low remuneration and motivation, no cooperation of school administration, no support of other colleague-teachers, teacher centric teaching where front benchers only seemed learning, other students were left isolated and inactive, examination system based on paper and pencil tests, and there was overload to teachers.

In addition, they reported that in traditional method, the teachers could not be the good and trustworthy friend to the students, there was a communication and generation gap as well between the students and mathematics teachers. There was no availability of curricula, reference books, teachers' guides, exercise books and elaborations of the subject. The commonly adopted T/L method was lecture method without group works and project works. The teachers could not give feedbacks and comments to the students' homework. The academic culture was degrading and blaming tradition was common among the students. There were no proper mechanisms to deal with the diversity of students' background and individual difference of the students. There was a communication gap among the teachers and also with the parents. In such situation, any effective teaching learning methods along with the cooperative learning one could not work much.

VII. REFLECTION AND DISCUSSION OVER THE RESULTS

At the beginning of the research, I had many obstacles and challenges viz getting similar status of schools, training to the teachers, teachers used to think that the course may not be completed on time, class may not be under the control of the teacher, good students may not follow the rules, implementation of different evaluation system, right way of conducting ,different tests etc. However, all of these problems came under the shadow by virtue of CL approach and zeal of the good research. Actually, the teachers not only successfully completed the research phase, but continued using the cooperative learning approach in their

schools even after the experiment was over. At the time of taking the retention test after a month, students were found to be satisfied and they provided me the credit upon it. In this way, though, I could not generate the new theories, but all of the findings were found to be consistent with the relevant theories and literature.

An effective learning may take place in friendship groups where the members can share their knowledge and skill without any hesitation in a cooperative group. Mathematics learning can be viewed as a social process, in which each individual learns mathematics through social interaction, meaning negotiation, and shared understanding (Vygotsky, 1978). According to Perry and Greenberg (2006, as cited in Kshetree, 2012), there are four benefits of cooperative learning approach - social, psychological, academic and assessment (evaluation of group and individual both and providing instant feedback). The cooperative learning environment is a virtue of team responsibility in learning in spite of individualistic and competitive as claimed by Johnson and Johnson (2000), and democratic behaviors as argued by Saxena (2001) who stated as in pairs; the empathetic cooperation, freedom of expression and publicity, resourcefulness and self-administration, individual and the collective development. So, it was intuitional effort to appraise democratic norms and values in cooperative learning-approach because it was a space for connecting teachers with students, self-expression, debating and dialoguing, searching archived knowledge and learning in a structured manner. Along with these best practices, the cooperative learning system was also found to be aware of students' cultural capital as Bourdieu (1998, cited in Haralambos & Hearld, 2006) claimed, those children whose home culture is similar to the school T/L system, they can cope easily with the system and learn effectively.

In this regard, Maria (2016) claimed that the teachers' works and culture in the post modernism reviewed that for enhancing the classroom environment for universal access to learning, strengthening cooperation, partnership, relationship between students and among colleagues the pedagogical practices of the teachers have profound effects. It makes the classroom life safer, more productive and more fulfilling for the children's lives. Usually, students are working in groups of two or more, mutually searching for understanding, solutions, meanings, and co-creating a product.

On the basis of pretest scores, the students of both the groups were found to be of same standard. The role of cooperative learning approach was found significant in immediate learning achievement of experimental group of the students. The consistent peer interaction could have a powerful influence on academic motivation and achievement (Light & Littleton, 1999 cited in Kshetree, 2011). In the cooperative learning, it has applied rational choice theory for peer activities as stated by Adam Smith and early functional theory for their self-esteem in peer groups which positively influenced to have immediate learning. In this regard, Doise (1990) argued that the main thesis of this approach is that "...it is above all through interacting with others, coordinating his/her approaches to reality with those of others, that an individual masters new approaches" (p. 46). It showed that the high achievement of the students was as expected and consistent due to the mastery of the individuals in it while working in groups. In this case, the study also found that the treatment applied to the experimental group under the cooperative learning approach

worked well to raise the scores of the students significantly than the students of control group.

The findings from the retention tests implied that the treatment effect produced a longer memory in the experimental group than in the control group. This finding is supported by Palincsar and Brown (1984) with basic reasons as talking turn by turn, listening more, reason, respect and being responsible, use of T/L materials, discussions to relate the problems to empirical methods, use of creativity, find the mathematics patterns and learning from concrete to abstract concepts of mathematics. Similarly, calling in action and do reflection, shifting from talking and describing to listening and addressing students' problems showed the tangible results of cooperative learning approach.

Moreover, in peers, students feel comfortable to exchange their every idea, each one is clear for his/her role of action. The students in groups take their own responsibility and be activated for their identity. They learn the mathematical concepts on their own pace and methodology, they verbalize their ideas to the group that help them to develop more clear concepts. Thus, the thought process becomes fully embedded in the students' memory for a longer time. Vygotsky supports this concept by claiming that verbalization plays significant role for long term memory (Vygotsky, 1978). As an effect of treatment, the net gain in learning was found to be significant in the students of experimental group in comparison to the control group. According to Vygotsky (1978), it happens due to availability of opportunities like - more interacting, arguing, conceptualizing the problem, rich problem solving, discussing for alternative solutions so that the students extend their zone of proximal development (ZDP).

Regarding the T/L challenges, the findings of qualitative study asserted that there was the stigma of dull students, no idea for peer education, teacher's unwillingness to take up additional responsibilities, noisy classes, ignorance, teacher dominance, and conventional assessment system. There was no support of other teachers and school staffs. It was difficult to identify socio-learning culture in the schools and classrooms. The teachers were not able to set the ground rules for peer groups, assessment of existing knowledge and attitude of the students, preparation and use of T/L aids with lesson plans. There was lack of supervision and its tools, indicators to monitor the progress, tools to interpret the experiences and narratives/anecdotal records. There was lack of leadership practice for making turn by turn group leaders, identifying inter and intra group relations/working modalities, etc. It means, the teachers and schools need to address these kinds of problems to see the full-fledged positive impacts of cooperative learning approach. However, as a result of the collective efforts, these activities were found supportive to face the challenging tasks or questions and helped moving towards applications which organized pertinent facts and ideas. Instead of being distant observers of questions and answers or problems and solutions, the students became immediate practitioners. It encouraged students to practice and develop higher order reasoning and problem-solving skills.

VIII. CONCLUSION

The students of control group were found to be in search of working rules and formulae to solve the problems rather than developing mathematical concepts. Teachers were supposed to be

all in all, so the students could not expose their ideas and hence they could not go beyond the instructions of the teachers as a result they compelled to follow the fixed rules. But the students of experimental group were going beyond the fixed rules. So, they were making themselves involved in learning mathematics with more enthusiasm.

Though the students of conventional method had their own pace and strategies for learning the new concepts, but it was more revealed in the students of cooperative learning group. The learning pace, action and strategies were based upon the contemporary situation as the system of values, beliefs, norms, artifacts and symbols that had been developed by the circumstances created around it. In fact, every activity of a person was based on cause and circumstances. Therefore, the performance of experimental group could be better depending upon the environment that was created. The learning could meaningfully be taken place through their direct involvement in the cooperation of colleagues rather than the teachers' instructions. Students felt comfortable to be corrected in the group rather than in plenary with the supervision of teachers. The T/L system required a liberating experience in which the student explored, created, used his/her initiatives and judgment and freely developed his/her talents to the full potential. Further, it promoted the self-participation, cooperation, coexistence and harmonization among the peer groups.

The study showed that the students of cooperative learning were found to be more forward, sharing, valuing to colleagues, interactive, trying for hard problems, discussing, and happy to contribute in the group. Moreover, they seemed to come out of any kinds of shyness, nervousness and mathematics phobia. The students of cooperative group were found to be in search of some kinds of drawing or tools to handle their mathematical problems. The passive students started to be actively involved in learning process with own interest when they were learning with demonstrations with scissors, papers, cubes, blocks, open ended questions, etc.

It was found that mathematical understanding was supported by classroom friendly behavior, communication, connections and decision-making in team. The simple trial and error method as Thorndike's learning theory was also found to be popular in the working groups. Also, teachers and students worked together and created conducive environment in their cooperative classroom. The discussion part of this study showed that the students of experimental group were significantly handling the situation and demonstrating the problem-solving skills.

The teacher was found to be more aware towards students' abilities when they worked in small groups. In the similar manner NCTM (2000) declared that while closely working with the students, it gives the teacher insight into problem-solving abilities. The teacher solicits students' ideas about how the problems might be solved and then gives the students time to solve the problems. As the teacher reflects on the strengths and ideas offered by the students, his/her expectations generally change. The classroom where thoughts were accepted, ideas were investigated, and meaningful problems were solved. The teacher used to think that students lack the necessary skills to work in-group activities, but the cooperative learning approach disproved it. As Ong and Yeam (2000, as cited in Kshetree, 2012) argued teacher taught the

missing skills and reinforced the skills that students needed in cooperative learning approach.

In sum, if the problems created by age-old T/L methods, conventional mind set of teachers, physical infrastructures, training of teachers, classroom settings and lack of T/L materials are taken seriously and solved them, the CLA can bring a paradigm shift in T/L mathematics so that teachers and students can work together to bring the most positive changes in T/L mathematics with better achievements of the students.

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