

Difficulties Encountered in Solving Quadratic Equation of the Grade 9 Students: Basis For Constructing Instructional Materials

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Abstract- The study focused on the difficulties encountered in solving quadratic equation of the grade 9 students in Taligaman National High School. This study aimed to determine the difficulties encountered in solving quadratic equation of the grade 9 students. This study used descriptive research procedure which tested the hypothesis or answer question concerning the current status. In gathering the data needed, a survey questionnaire was used to 121 respondents randomly selected from grade 9 students in Taligaman National High School. The researcher used the random sampling design. On the analysis of data some statistical measures were used. The percentage were utilized to answer the respondent profile and the mean which was used to determine the level of student learning attitudes and teacher competency. In the level of determine difficulties encountered in solving quadratic equation the percentage statistical tool were used. This study concluded that the student profile, student learning attitude towards mathematics and teacher competency is not merely contribute to the difficulties encountered by the student in solving quadratic equation. Thus, the topic quadratic equation alone is difficult for some students or there is probability that the greater effect of the difficulties encountered by students are not included in the study. Based from this conclusion, the researchers suggested that the teacher may adopt the enhanced instructional materials provided by this study to decrease or enhance the skills of the students in the difficulties encountered in solving quadratic equation of the student.

Index Terms- Quadratic equation solving, least learned competency, Instructional Materials.

I. INTRODUCTION

Most of the people have persistent trouble with basic mathematics because people like different things. There is nothing that is universally liked by every human being. Math is no exception. Many people do not believe Mathematics is essential to living a modern life and resent being forced to study an abstract science. Some students feel like math is a foreign language in which they can't orient themselves since math is cumulative and they forgot something they learned a while ago and now becomes totally lost.

One of the most thing to do is teach children how important Mathematics in the modernization of the society. Explain to them that mathematics serves as a fundamental foundation that is used in real life situations. It is also a way to interpret and evaluate ideas, considered as a method of logical reasoning unique to man. Mathematics as a school subject, it must be learned expansively and with much depth but unfortunately most of the students find mathematics difficult to deal with. Usually, students lack the ability to easily connect the conceptual concepts of mathematics in reality.

Math requires deductive reasoning, and passive learners often struggle with this kind of active problem solving. Students with memory and attention problems also may struggle as both skills are necessary for mathematical aptitude (Cadiz 2016). Through the years, and probably through the centuries, teachers have struggled to make math meaningful by providing students with problems and examples demonstrating its applications in everyday life.

Sometimes, teacher has a great influence why students hate mathematics because math teachers often do not inspire their students with an appreciation for the beauty of mathematics, instead teaching by rote memorization. Educators are foremost believes in the old cliché: "Experience is the best teacher." A natural part of learning if this be true is the occurrence of personal knowledge or personal involvement. So teaching Mathematics is necessary to the teacher to have the capacity to deal with the learner, instruct, mold, and facilitate them in order to learn best.

There is another instruction we can use in teaching Mathematics, the Direct Instruction. Direct instruction is a teaching model which is aimed of helping student master basic skills and knowledge that can be taught in a step-by-step fashion. Often times it is described as "Straight forward and can be mastered in relatively short of time" on how to solve math problems using mathematical equations (Salandanam, 2000). The teacher should taught the students how to solve problems by following a step-by-step process. By that, they will have the idea on how to solve problems easily and perform well.

Mathematics instruction give the students opportunity to learn and to be able to perform Math problems easily. They can understand and can do Math by following instructions. Teachers and students must have cooperation, for them to understand each other well. Difficulties can be avoided if they will learn how to follow simple instructions that you gave them. Instructions shall

be follow, for them to have wide understandings and can help them lessen their difficulties in Mathematics.

II. CONCEPTUAL FRAMEWORK

This study was anchored on the theory of Bruner's that there are factors that influence the performance of the students in Mathematics. This study theorize further that students' profile, student learning attitudes, and the teachers competency as perceived by the students are contributory factors to the learning difficulties of the students. This was supported by various theories.

Constructivism has become a mainstream theory in educational policy and practice scene and as a result national standards documents influencing the curriculum, are affected. Realistic mathematics education builds upon the principles of the constructivist learning theory. Central within realistic mathematics education is the assumption that mathematics is a human activity which contrasts with mathematics as a well-organized deductive system. In other words, mathematics is viewed as a process in which the student is engaged.

Experiential learning as advocated by David Kolb is learning that occurs by making sense of direct everyday experiences. Experiential learning theory defines learning as "the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience" (Kolb, 1984, p. 41). Students' experiences on learning mathematics in school and in their homes will really affect the students' knowledge acquisition of the subject. The mathematics curriculum allows for students to learn by asking relevant questions and discovering new ideas. Discovery and Inquiry-based learning (Bruner, 1961) support the idea that students learn when they make use of personal experiences to discover facts, relationships and concepts.

Jerome Bruner's theory rest on the theme that learning is an active process in which the learners create new ideas based on their prior knowledge. The learner selects and transform details, constructs hypothesis, and makes decisions to do so. According to Tall (2003) students have difficulties with mathematics. He classified these difficulties as genitive difficulties in learning analysis. Students experienced difficulties in learning math because of their computational weaknesses, their inability to create meaningful connections, and analyze word problems; how to translate it and effectively visualized math concepts.

A favorable attitudes of a student towards a particular subject influence a lot on his interest to learn. She/he learns faster in areas that she/he is interested most and takes for granted the subject that they like best. In addition the teacher academic trainings increases there is a possibility that she/he would prefer to be alone in her/his task, while teacher with lower educational level might prefer to close supervision and explicit instruction from the supervision to be able to perform well in their teaching task. The teacher has the basic responsibility in translating and implementing educational objectives into functional and valuable learning experiences for the student. The success of a student is usually measured in terms of achievements in classroom work particularly in his academic subject (Acero, 2004).

Learning outcomes of the students reflect the quality of teaching learning process. Their relationship with learners, the materials they used and procedure they follow can be observed and used to the advantages of uplifting the teaching learning process. The classroom, which is the formal learning area, must be managed effectively by the teacher in order to achieve the desirable attitudes and behavior of learners. Teaching methods as well as communication skills by the teacher greatly enhance the teaching learning process. Such could be cited as the variables that would indicate the teaching performance of the teacher. However, the nature of the learners must be also considered as there is fact that each individual is unique. (Exclamador 2006).

Schematic Diagram

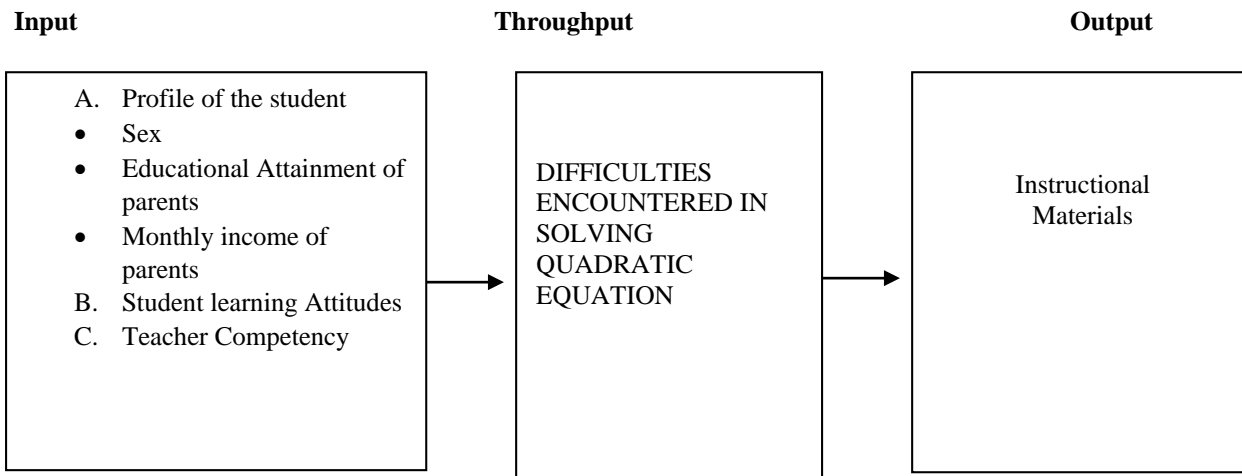


Figure 1. The schematic diagram showing the variables of the study

III. METHODOLOGY

The descriptive research was used in this study. It seeks to determine the learning difficulties of student in solving quadratic equation. It involves collecting data in order to answer the question concerning the current status of the subject of the study.

This study was conducted at Taligaman National High School as one of the popular public schools in Butuan City. The school is located at P-1 Taligaman, Butuan City near in National Highway of Butuan to Davao road. Taligaman National High School teaches students in junior and senior high school. It has a total of 33 rooms – 29 of which are for instructional purposes and the remaining 4 for non-instructional purposes. All in all, the

school has at least one canteen, clinic, computer lab, general academic classroom, home economics, industrial/workshop, laboratory, library, and office plus the senior high school building that is currently under construction. The all of the instructional rooms are standard rooms, meaning they meet the DepEd’s guidelines for safety and usability. As to school year 2016-2017 Taligaman National High School is awarded as Top 3.

This study involved all 241 students from five sections. The student who were considered as participant of the study were randomly selected from different section having a sample size of 121. Sample size is the 50% of the population of the Grade 9 students in Taligaman National High School.

Table 1. The Total Number of Participants

Section	Population	Sample Size		Total
		Male	Female	
Dalton	48	16	8	22
Avogadro	48	7	17	24
Lavoisier	49	16	8	22
Chadwick	47	11	13	24
Rutherford	49	4	21	25
Total	241	54	67	121

The researchers aimed to have all the Grade 9 students of Taligaman National High School as the population of the sample. Therefore, the researchers get 50% of the population which 121 as the sample size. The participants were randomly selected in every five section.

The main instrument used to obtain the needed data and information in this study is survey questionnaire. The questionnaire consists of profile of the student, learning attitude of the students towards mathematics and the teacher competency as perceived by the students. The participants were required to answer all the questions involving quadratic equation. On the validity and reliability of instrument the questionnaire was

validated by our adviser. The pilot test was conducted at Basag National High School and Ampayon National High School and the data gathered was undergone series of statistical analysis and obtain .825 of reliability index.

Before the questionnaire was given to each of the participant, a letter made by the researchers noted by the adviser and the college dean was given to the principal of TNHS requesting permission for the researchers to gather the data needed for the study. The principal guided the researchers to the math teachers and to the five section of Grade 9.

The researchers then made a short presentation about the study, and then provided each student with survey questionnaire.

Participant filled out the questionnaire assuming that they have answered it truthfully with the guidance of the researchers.

Scoring and Quantification of Data

The data was gathered from the respondents were quantified for statistical treatment. The following quantification was utilized:

- A. Educational Attainment of Parents were group according to:

Level	Verbal Description
1	Elementary Level
2	High School Level
3	College Level

- B. Student learning attitudes and teacher competency

Level	Mean Interval	Verbal Description
1	1.00-1.50	Disagree
2	1.51-2.50	Moderately Disagree
3	2.51-3.50	Moderately Agree
4	3.51-4.50	Agree
5	4.51-5.00	Strongly Agree

- C. Difficulties encountered in solving quadratic equation of the students

Level Description	Verbal
1	Very Easy
2	Easy
3	Moderately Difficult
4	Difficult
5	Very Difficult

Statistical Tools

In analyzing the gather data, the following statistical tools were utilized in the study: The percentage is used to describe the profile of the respondents and the level of difficulties encounter in solving quadratic equating of the respondents. The Mean use to describe in perception of the Grade 9 students on their learning attitudes towards Mathematics and the teacher competency.

IV. PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

Problem 1. What is the profile of the student in Taligaman National High School in terms of Sex, Educational attainment of parents and Monthly Income of Parents?

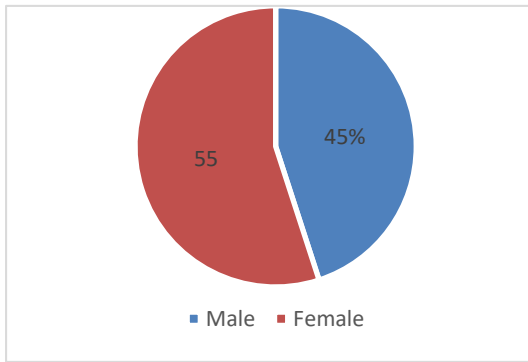


Figure 1 showed the percentage distribution of the sex profile of the respondent. Most of the respondents are female with the population of 55% and the rest is the male with population of 45%.

Figure 1: Distribution of respondents across sex

Figure 2 showed the frequency distribution of the family income of the respondents. Majority of our respondent family income were on below 10K and only few have a family income of 10-15K Above.

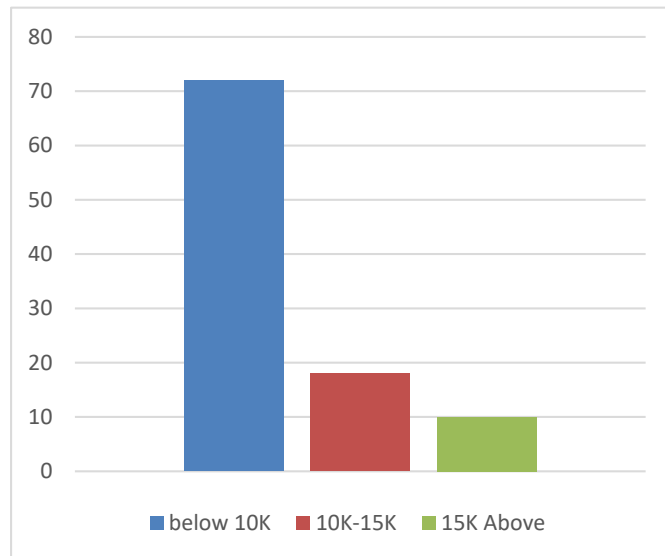


Figure 2: Distribution of respondents as to average monthly income.

Table 1: Percentage of distribution of respondents across Parents' educational attainment

Mother	Elementary Level	Father High School Level	College Level
Elementary Level	14.88	11.57	0.83
High School Level	13.22	33.06	5.79
College Level	0.83	7.44	12.40

Table 1 presented the percentage distribution of respondents' educational attainment. It showed that most of their parents are high school level which attained the highest percentage of 33.06. It followed both parents are elementary level which is 14.88% and a parents who are college level which gained 12.40% respectively.

Problem 2. What is the level of the student learning attitudes towards mathematics?

The below result data shows that the respondents have an average learning attitude towards mathematics that is moderately agree (3.32).

Table 2: Level of students' attitudes towards mathematics

Variable	Mean	Verbal Description
1. like working out a concrete everyday application of math.	3.29	Moderately Agree
2. I like working with friends and classmates on Math assignments.	3.80	Agree
3. I feel good in getting ready for Math test.	3.50	Moderately Agree
4. I like to know the Math result on which I expected to do well.	3.69	Agree
5. I always look forward to learn more about Mathematics.	3.50	Moderately Agree
6. I like solving on Mathematics assignment.	3.26	Moderately Agree
7. I take down notes during lectures/discussion.	3.92	Moderately Agree
8. I study at night before the Math examination.	2.98	Moderately Agree
9. I do review and study on a particular topic in Mathematics.	2.71	Moderately Agree
10. I spend much time to study my Math lesson every night.	2.58	Moderately Agree
Overall	3.32	Moderately Agree

As to willingness to learn mathematics the above data tells us that the students like working with friends on Math assignments (3.80), they also like to know the Math results on which they expected to do well (3.69). However, students hesitant in working out a concrete everyday application in Math (3.29) because most of them said that not all topics in Mathematics has a concrete application. The student feel good in getting ready on Math (3.50) because not all student prepared in taking Math examination and according to them "dili sila ganahan mag study mao ra gihapon lisod ang mga question naihatag sa ilang teacher", therefore, the questions are not appropriate to the different levels of the students' understanding. The student always look forward to learn more about Mathematics with mean of 3.50 which is moderately agree because student said that "nindot lang mag practice ug solve kung sayon ra ang topic pero kung lisod na gani na topic wala nay gana mag tuon."

As to manner of the student in studying the lesson in Mathematics they take down notes during the discussion/lectures (3.92). Students like solving on Mathematics assignment, they study at night before the Math examination, they do review and advance study on a particular topic in Mathematics and spend much time to study my Math lesson every night with the mean of (3.26), (2.98), (2.71), (2.58) respectively, which is moderately agree because some of the students were too lazy and they need self-motivation and time. "Dili ko mag hatag ug daku nga time sap ag tuon sa Math kay kapoy man gud naa pud uban dile jud ko kabalo mag answer, ganahan lang ko mag tuon ug mag practice kun kabalo ko ana nga topic", student said. Moreover, according to the students not all of them have their own learner's module where they can practice solving that's why Mathematics is

difficult for them. It implies that there are difficulties encountered by the students based on the interview with the students.

Problem 3. What is the level of teacher competency as perceived by the students?

Result shows the mean distribution of the teacher competency as perceived by the students. The overall average of teacher competency as perceived by the students is agree (4.45).

Table 3: Level of teachers' competencies as perceived by the students

Variable	Mean	Verbal Description
1. My Math teacher presents a particular topic from concept to example and vice versa.	4.52	Strongly Agree
2. My Math teacher presents the lesson logically.	4.52	Strongly Agree
3. My Math teacher explains the lesson very well.	3.74	Strongly Agree
4. My Math teacher cites examples in real life situation in presenting Math.	3.31	Agree
5. My Math teacher is willing to explain a problem in second time if student do not understands.	4.66	Strongly Agree
6. My Math teacher employs a different group activities/work such as problem solving and brainstorming.	4.43	Agree
7. My Math teacher asks question to an individual student.	4.31	Agree
8. My Math teacher is aware of our diverse needs.	4.26	Agree
9. My Math teacher is aware of the variety of IT/resources.	4.09	Agree
10. My Math teacher assesses our learnings at the end of the topic.	4.65	Strongly Agree
Overall	4.45	Agree

Student responded strongly agree that their Math teacher presents a particular topic from concept to example and vice versa (4.52), presents the lesson logically (4.52), explains the lesson very well (4.47), willing to explain a problem in second time if

student do not understands (4.66) and assesses their learnings at the end of the topic (4.65). It reveals that Math teacher competency as perceived by the student has the capability to present the particular topic definitely and clearly. From concept to example, logically and well explained. Passionate teacher reflected also in the table, in a way that the teacher willingly to explain a problem in second time if student do not understand and assesses the learning's of the student in every topic.

Somehow the students are also agree that when citing examples in real life situation in presenting Math (4.31), employing different group activities/work such as problem solving and brainstorming (4.43), asking question to an individual students (4.31), aware of student diverse needs (4.26) and aware of the

variety of IT/resources (4.09) as the respond of the student in each indicator. It implies that the level of teacher method of teaching was moderately effective as perceived by the student and the teachers' strategies had a big impact to the students learning towards Mathematics.

Problem 4. What is the level of difficulties encountered of the Grade 9 students in Taligaman National High School in solving quadratic equation?

Note that easy to very easy when compressed less than 50% of the student participants, hence the majority found the topic at least moderately difficult.

Table 4: Percentage Distribution on the level of difficulties in solving quadratic equations

Difficulties	Extent of difficulty				
	Very Easy	Easy	Moderately Difficult	Difficult	Very Difficult
1. Solving quadratic equation by (extracting square roots, factoring, completing the square, quadratic formula).	9.09	28.93	28.10	16.53	17.36
2. Solving the nature of the roots of a quadratic equation.	8.26	32.23	33.06	19.83	6.61
3. Solving the sum and the product of roots of quadratic equation.	6.61	35.54	30.58	15.70	11.57
4. Solving equation transformable to quadratic equation.	0.83	23.97	44.64	19.01	11.57
5. Solving word problems involving quadratic equation.	0.00	19.01	35.53	23.97	21.49

Results showed that in solving quadratic equation by (extracting square roots, factoring, completing the square, quadratic formula), most of the student found it moderately difficult. More precisely, the majority found the topic either very difficult (17.36), difficult (16.53) and moderately difficult (28.10). In solving the nature of the roots of a quadratic equation most of the student found it moderately difficult (33.06), difficult (19.83), very difficult (6.61). In solving the sum and the product of the roots of quadratic equation most of the students found it moderately difficult (30.58), difficult (15.70) and very difficult (17.57). In solving equation transformable the quadratic equation most of the students found the topic moderately difficult (44.63), difficult (19.01) and very difficult (11.57). In solving word problems involving quadratic equation the majority found the topic moderately difficult (35.54), difficult (23.97), and very difficult (21.49).

According to the students that the researchers interviewed to make easier for them in solving the above mentioned topic they said that "Ganahan mi mag solve ana nga mga topic kung naa me basihan nga example bisan isa lang para Makita namo ang process kay pag mag quiz man gud me kay ipa close ni maam ang amu ge pang copy", it implies that the students favored in solving equations if detailed example is provided. Moreover, individual worksheet is necessary for them than just post the problem in the board to avoid distractions especially when somebody is roaming around for any reason. They also like to write their output in the provided worksheet.

V. CONCLUSION

Based on the findings of the study, the following conclusions were drawn:

The respondents of this study were mostly female with 50%. For the educational attainment of parents mostly are in the high school level, the result found out that this indicator did not affect to the learning difficulties of the students in solving the quadratic equation. Furthermore, the parents' monthly income falls in below 10K. This implies that the students in Taligaman National High School belonged to the poor family.

On the level of learning attitudes towards Mathematics of the respondents, it has been found that the students have moderately agree to the statement in every indicator. Thus, it implies that the students have a moderately skillful towards the Mathematics subject. Since the level of teacher's competence as perceived by the students is very high, this means that teacher's effectiveness in teaching was good as perceived by the students.

For the level of difficulties encountered in solving quadratic equation, almost of the student find it difficult this implies that student needs more practice in solving problems involving quadratic equations.

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