

A Study of the Impact of Laboratory Approach on Achievement and Process Skills in Science among Is Standard Students

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Abstract- The purpose of this study was to compare the effects a laboratory based on the 7E learning cycle model with verification laboratory approach on university students' development of science process skills and conceptual achievement. In this study the sample consisted of 81 freshman university students who were taking the General Physics Laboratory-I- course at the university in DAVV Indore. In this study pretestposttest design with control group was used. B.Sc.class students (43) who took lower weighted standard points from university entrance exam (UEE) than BCA class students were selected as experimental group. BCA class students (38) were selected as control group. Thus, this study was quasi-experimental in design. In order to assess hypotheses of study was used "Science Process Skills Test-SPST" and "Force Concept Inventory -FCI" to compare skills and conceptual achievement of control and experimental groups students. Both tools were given to both groups as pretest and posttest.

Index Terms- A study of the impact, Laboratory approach on achievement.

I. INTRODUCTION

Science is one of the core components of the school curriculum. That is why, science as a separate subject has been incorporated in school curriculum. School curriculum includes following subjects:-

1. Language
2. Mathematics
3. Social Science
4. Natural Science

Introduction of science as a compulsory subject in school curriculum was done with the view to develop scientific attitude, scientific temperament, critical thinking active inquiry, independent work and understanding the physical world from different perspectives. 'Good science education is true to the child, true to life and true to science'. This simple observation leads to cognitive, content, process, historical, environmental and ethical validity of a science curriculum. So it is a powerful means of developing attitudes of critical inquiry, respect for truth, adaptability and systematic work which are a pre-requisite for

initiating the process of social change and of national development.

At the secondary school stage concepts that are beyond direct experience may come to occupy an important place in the science curriculum, since not all phenomena are directly observable. Science also relies on influence and interpretation, experimentation often involving quantitative measurement as a tool to discover theoretical principle should be an important part of science teaching.

1.1 Nature of science

Humans have, always, been curious about the world around them. The inquiring and imaginative human mind has responded to the wonder and awe of nature in different ways. One kind of response from the earliest time has been to observe the physical and biological environment carefully, look for any meaningful patterns and relations, make and use new tools to interact with nature and build conceptual models to understand the world.

1.2 This Human Endeavour is science.

Science is a dynamic, expanding body of knowledge covering ever new domains of experience. How is this knowledge generated ? What is the so called Scientific Method ? As with many complex things in life, the Scientific Method is perhaps more easily discerned than defined but broadly speaking, it involves several interconnected steps : observation, looking for regularities, making hypothesis, devising qualitative or mathematical models, deducing their consequences; verification or falsification of theories through observation and controlled experiments and thus arriving at the principles,

1.3 AIMS OF SCIENCE TEACHING IN SCHOOL

The general aims of science education follow directly from the six criteria of validity that are cognitive, content, process, historical, environmental and ethical. Science education should enable the learner to :-

- Know the facts and principles of science and its application, consistent with the stage of cognitive development.
- Acquire the skills and understand the methods and processes that lead to generation and validation of science knowledge.
- Relate to the environment (nature environment, artifacts and people) local as well as global, and appreciate the issues at the interface of science, technology and society.

- Acquire the requisite theoretical knowledge and practical technological skills to enter the world of work.
- Imbibe the values of honesty, integrity, cooperation, concern for life And preservation of environment.
- Cultivate 'scientific temer'- objectivity, critical thinking and freedom from fear and prejudice.

1.4 IMPORTANCE OF BIOLOGY LABORATORY

No course in biology can be considered as complete without including some practical work in it. Biology is a scientific topic, thus it should be learn through experimental method. The laboratory makes teaching of Biology more meaningful and interesting.

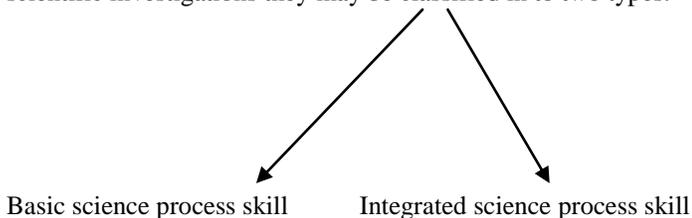
In the laboratories the learners learn about facts and laws of different branch of biology and check their truthfulness and learn to make practical use of them. In this method the learness become very active and learns himself. He himself notes down the figures of his observation and on the basis of calculation, draws conclusion so science laboratories are the places and means with the help which all these necessary activities can be performed smoothly and effectively. The practical work is to be carried out by individual in a science laboratory. Most of the achievement of modern science is due to the application of experimental method. At school stage, practical work is even more important because of the fact that we "learn by doing". Scientific principles and applications are thus rendered more meaningful. It is well known fact that an object handled impresses itself more firmly on the mind than an object merely seen from a distance or in illustrations. Centuries of purely deductive work did not produce the same utilitarian results as a dew decades of experimental work.

Practical classroom experiments help in broadening pupils experience and developing initiative resourcefulness and cooperation. Because of the reasons discussed above, practical work frames a prominent features in Biology. The active learning is that which uses the laboratory and traditional, which uses the teaching resources ordinarily available to the teacher. In laboratory students gain more content knowledge and knowledge of process skills compared to traditional instructions. The laboratory approach enhances knowledge and process learning for students.

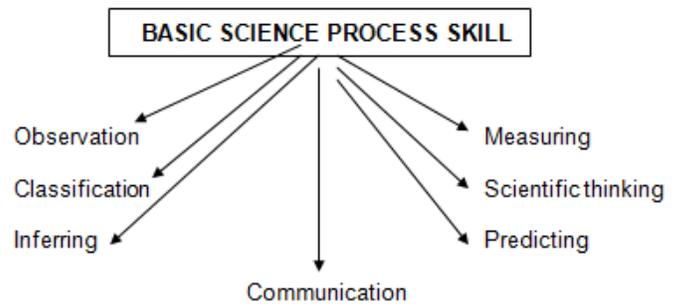
II. THE SCIENCE PROCESS SKILLS

Science process skills in science are very important to develop scientific ideas and to make learners independent thinkers.

SCREEN (1996) defined the process skills as the sequence of events that are engaged by researchers while taking part in scientific investigations they may be classified in to two types.



Brotherton And Preece (1995) Classified the basic science process Skills like :



They classified integrated science process skills as graphing hypothesizing, interpreting data, formulating models, experimenting and defining operationally.

Science series (2008) described that process skills in science are very important in the formal presentation of science to child. Process skill is a preparation to becoming a scientist. The work of science involves carrying out experiments, recording observations, making measurements and presenting data derived from the experiments. Process skills in science for children emphasizes the use of our five sense organs. The concept of doing science is very important for developing process skills among learners.

2.1 BRIEF DESCRIPTION OF THE SCIENCE PROCESS SKILLS

OBSERVATION :- The skill of observation is seen by miller and driver (1987) as an activity in which all the people young and old, engage in throughout their lives. It is said to be theory dependent in that what we see is dependent to some extent on the theories that we hold. They further aver that children's ability to observe involves the learning o a conceptual framework that identifies the elements of a complex situation that is scientifically worth observing.

Learners are curious by nature. They observe and compared the things. Observational skill developed among learners by designing such activities where learners are required to observe stages like:

- Use several senses while making observation.
- Use aids for observation such as microscope, thermometer.
- Make a number of observations.
- Identify similarities and differences.

2.2 HYPOTHESIZING:

The learners may provide some plausible explanation for observation. Each student may provide a different explanation, these plausible explanations become hypothesis. Thus hypothesis is a statement put forward or attempt to explain some happening or features.

- Hypothesis suggests an explanation which is consistent with evidences.
- Previous knowledge is used in attempting an explanation.
- Hypothesis is only provisional.

- Hypothesis should be testable.

2.3 PREDICTING :

Prediction proceeds investigation. It is an intelligent guess to what would happen type of questions.

- Prediction helps in planning the experiments.
- Prediction suggests what type of investigation is required to test hypothesis.
- Prediction is different from guess in that it makes use of scientific knowledge.

2.4 CONTROLLING VARIABLES:

Brotherton & Preece (1995) classify controlling variables as a basic science process skill. Controlling variables is the ability to recognize dependent and independent variables. In practical investigations, practical group is usually exposed to some treatment (the independent variable) while the control group is not exposed to the treatment.

2.5. GRAPHING :

Mckenzie and padilla (1986) defined graphs are an efficient and effective tool for making sense of the pile of information. Graphs are modes of representing quantitative data and are important means of communicating scientific data Graph presents concepts in a concise manner this displaying a wealth of information in a small space.

2.6 EXPERIMENTING:

Miller and Driver (1987) describe experimenting as an integrated process skill that include other process skills like observation, interpretation, planning and reporting. Integrated process skills are involved when learners conduct experiments. They formulate hypothesis, design experiments and makes a generalizations after collecting data. A central feature of experimentation is said to be the idea of control in order that possible alternate, interpretations of a situation may be eliminated.

2.7 INFERRING:

Inferring is also a kind of guess based on subjective explanation for observations.

- Inferring is based on a number of observation
- It explains the observations.
- Uses scientific principles.

2.8 COMMUNICATING:

Reporting the results of investigation and sharing with peers and others is important communication in science involves graph, chart, table, symbols.

- Discussing ideas among students orally and in written form.
- Recording observations while conducting experiments.
- Using graph, charts diagram, table to make communication meaningful.

2.9 LEARNING OF SCIENCE PROCESS SKILL AT SCHOOL:

The learning of Basic science process skills.

Padilla and pyle (1996) identified three steps that may be followed during the learning of basic science process skills namely brainstorming observation about an object or phenomenon, creating inferences based on observations and testing the inferences through simple experiments padilla and pyle (1196) found that for learners to observe more systematically, select some activities that will held their interest and let them perform on their own.

2.10 Dixon Adams and Hypes (2001)

Identified the following steps that might be followed during the learning of the skill of controlling variables.

- Have the learners brainstorm to determine the factor that are involved in the investigation.
- Ask the learners how they might determine the set up of the investigation that would result in the maximum solution of the problem.
- Before beginning the data collection have learners work in groups to identify the factors that they will keep constant and those that they will vary during their investigation.

III. THE LEARNING OF INTEGRATED SCIENCE PROCESS SKILL

Integrated process skill are graphing, experimenting etc. The same consideration in the learning of basic science process skills are needed for the learning of the integrated science process skills

Roth and Roychoudhary (1993)

Described as an integrated process skill that involves transforming results in to standard form, graphing data, determining the accuracy of experimental data, defining and discussing limitation and assumption and explaining the relationship.

According to Kamii and clark (1997)

Integrated process skills may be developed and enhanced by using every day activities. They hold that learners should be encouraged to struggle with a problem and to debate it among themselves.

3.1 ASSESSMENT OF SCIENCE PROCESS SKILLS :

Swain (1989) defines a process skill as a series of connected actions, experience or changes; which go on internally with in a learner and can usually be demonstrated externally.

Tamir, Doran and chye (1992:265) Identified the assessment of the outcome of practical work as follows:

- Continuous assessment by the science teacher based on systematic observations and records.
- Evaluation of laboratory reports made by the learners on the bases of their laboratory experiences.
- Individual learner projects based on practical skills.
- Paper pencil test items pertaining to laboratory experience and related issues.
- Practical examination.

Practical test are administered individually or in groups, Individually administered tests involve a learner who performs the required tasks and an examiner who observes and assigns marks. Group practical tests involve learners. Written responses to questions which are based on observations, measurement inferences, Hypothesis, classification and reasoning by the learners during the performance.

IV. NEED AND IMPORTANCE OF THE STUDY

Science teaching does not mean passing on information only but is concerned with developing analytical, critical observation and problem solving abilities as well as the creativity of an individual. These abilities are less developed through traditional approach because in traditional approach practical and productive work does not find a prominent place.

Many research studies have been done concerning pupils achievement and performance. But very few researches have been made regarding process skill and achievement in the field of biology and this prompted the researcher to take up the present study of impact of laboratory approach on process skills and achievement.

V. STATEMENT OF THE PROBLEM

The present study is entitled as:- "A study of the impact of Laboratory Approach on Achievement and Process Skills in Science Among Standard Students."

VI. OPERATIONAL DEFINITION OF THE TERMS

Before proceeding further in any research the researcher should have a clear understanding of the problem. The problem selected for the study is impact of laboratory approach on process skills and achievement.

The terms such as achievement, process skill, laboratory approach, traditional approach needs special description, as these terms convey different meanings to different people. This may result in ambiguous understanding of the terms. Therefore, to overcome this problem, the researcher made an attempt to define the terms operationally so as to avoid confusion. In this study researcher has given the understanding of the terms.

VII. ACHIEVEMENT

Achievement is a general term for the successful attainment of some goal requiring –

1. A certain effect.
2. The degree of success attained in a test.
3. The result of a certain intellectual or physical activity defined according to individual and objective prerequisites.
4. Achievement is nothing but something accomplished successfully by means of exertion, skill, practice or perseverance.

7.1 PROCESS SKILLS:

Process skills are the sequence or events that are engaged by researcher while taking part in scientific investigations. Process skill as a series of connected actions, experiences or changes which go on internally with in a learner and can usually be demonstrated externally. Process skills are important to formal presentation of science.

7.2 LABORATORY APPROACH

By this approach students make systematic use of science processes, develop concepts via questioning and require exercise of discretion.

7.3 TRADITIONAL APPROACH

Traditional approach is built on the assumption that there is a particular body of information that should be covered and mastered by the students. This approach in education is teacher and text book directed and designed for generic students. Traditional approach contained different method like lecture, lecture cum demonstration etc.

VIII. OBJECTIVES OF THE STUDY

For the purpose of direction to the study the present researcher has formulated following objectives :

1. To study the effect of laboratory approach on developing process skills among IX std. students.
2. To study the effect of laboratory approach on the achievement of IX std. students.
3. To study the effect of traditional approach on developing process skills among IX std. students.
4. To study the effect of traditional approach on the achievement of IX std. students.
5. To study the differences in process skills achieved through traditional and laboratory approach.

IX. HYPOTHESIS OF THE STUDY

1. There will be variation in process skills among IX std. students studied through laboratory and traditional approach.
2. The development of process skills through laboratory approach will be better than the development of process skill through traditional approach.
3. There will be variations in achievement between IX std. students studied through laboratory and traditional approach.
4. The achievement of IX std. students studied through laboratory approach will be better than the achievement of students studied through traditional approach.

X. DELIMITATION OF THE STUDY

A. Spatiotemporal Limitation :

- The study has spatial limitation because it confined Khargone city only.
- The study has temporal limitation because it completed in a duration of 10 days.

B. Procedural Limitation :

- The study has a procedural limitation because the activities carried out through a selected laboratory and traditional approach.

C. Disciplinary Limitation :

- The study has disciplinary limitation because it conducted only in the field of Biological science.

D. Sampling Limitation:

- The study has a sampling limitation that it carried out only on 40 students of a single school.

XI. SAMPLE

Most of the educational phenomena consists of a large number of units. It would be impractical to observe each unit of the population under controlled conditions in order to arrive at principle having universal validity. Some populations are so large that their study would be expensive in term of time, money effect and man power. Sampling is a process by which a relatively small number of individual objects of events are selected in order to find out something about entire population from which it was selected.

An appropriately chosen sample size enhances the reliability and validity of research findings commonly used sampling techniques are random sampling, stratified random, quota and purposive sampling.

For conducting the present study keeping in view the limitation and resources available with the researcher, the method of simple random sampling has been used.

Guilford Stated that :- The best definition of simple random sampling is that it is selection of cases from the population in such a manner that every individual in the population has an equal chance of being chosen. The selection of any one individual is also in no way tied to the selection of any other.

Sample of the study is drawn from one school that is -

Shri Kanwartara Public School Mandleshwar.

- A preliminary sample of 40 students were obtained to which tools were administered.

Details of sample

Group	Students
Experimental	20
Control	20
Total	40

11.1 VARIABLES:

A variable is something that varies. It is property that takes in different Values. Variables are the conditions or characterizes that the experimenter manipulates, control or observes. There are following type of variables.

Independent Variables :

The independent variables are the conditions or characterization that the experimenter manipulates controls or

observes. The independent variables in the present study are laboratory approach and traditional approaches both are teaching approaches. The experimental group was taught by the laboratory approach and control group was taught by the traditional approach.

Dependent variables :

The dependent variables are the conditions or characteristics that appear or change as the experimenter removes or changes independent variables. The effect studied was in relation to the process skills and achievement in Biological science hence, dependent variables of the study are process skills and achievement.

11.2 DATA GATHERING DEVICES:

To select or construct appropriate tools for the study is an important aspect of any research study. Sometimes the researcher uses tools which have been constructed by others which are standardized. Sometimes the researcher has to construct tools to fulfill his/her purpose.

In this present study the researcher has constructed two tools and a observation schedule keeping in view the objectives of the study, they are-

1. Achievement test.
2. Practical test.
3. Process skill assessment schedule. (Observation schedule)

All the three above mentioned tools were based on a particular topic of Biological science.

- The achievement test consisted of 25 multiple choice questions, each carrying 1 mark. The time provided for this exercise was 35 minutes.

- The practical test which was based on activities comprised of the following points.

- Drawing the diagram.
- Preparation of slide
- Spotting
- Viva-voce

25 marks were allotted for this test the time allotted was 1 hour 30 minutes.

- The third test which was applied by the teacher was an observation schedule. This schedule was based on process skills which could be assessed through activities imbedded in schedule.

11.3 TABULATION OF DATA:

With the completion of field work the next task was to score the test sheets and tabulate the obtained data for statistical processing and analysis. Obtained marks in achievement and practical test were tabulated in the data sheet.

XII. STATISTICAL TECHNIQUES

The tabulated data was then processed for obtained mean, standard deviation and t. value of the test wise score to analyse the difference as aimed in the objectives of the study.

12.1 SUGGESTIONS FOR FURTHER RESEARCH STUDIES:

The present study being exploratory in nature bring in to limelight several issues. In which further research can be

undertaken. Following are the few suggestions for further research:

1. In the present study the researcher had taken only four process skills that are classifying, observing, hypothesizing and inferring. Beside this, other process skills are also there which can be studied further.

2. The process skills evaluation procedure which was applied by the researcher based on observation schedule and practical test. This evaluation can be done by some other ways.

3. In this present study only biological science content was taken to study the development of process skills but there are other branches of science like physical science and chemical science. So a comparative study can be done in these three branches of science.

4. The development of process skills according to the mental age and class level can be studied and compared.

XIII. CONCLUSION

The researcher in the present study come to the conclusion that :

- The achievement of student studied through laboratory approach was significantly higher than traditional approach.

The development of process skill were higher in the student who were taught by laboratory approach. Therefore the laboratory approach should be used in teaching and learning in Biological sciences. The students studied through laboratory approach were better in process skills, achievement and in practical test also. So laboratory approach is beneficial for the students.

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