Chapter — VI

An Overview of the Study
# CHAPTER VI
## AN OVERVIEW OF THE STUDY

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CHAPTER – VI

AN OVERVIEW OF THE STUDY

INTRODUCTION

Education has come a long way from the oral tradition of the past to the current focus of education on ‘learning to know’, ‘learning to be’, ‘learning to do’, and ‘learning to live together’ as pointed out by the Delor’s commission on the education of 21st century. The change started at a slow and incremental pace and went on to progress by leaps and bounds supported by the materials and manpower. Since independence, our country has crossed enormous changes in the quantitative and qualitative expansion of educational institutions at various levels in school education. Many commissions and committees appointed by the free India have been taking serious efforts to keep a balance between quality and quantity of education offered to the various section of the community.

Basically primary and secondary levels of education are concerned with transfer of knowledge from the teacher to the taught. But high school education involves analysis, synthesis and information that run out to be knowledge. Teachers in high school education are to be involved not only in teaching but also in making good citizens of the country. Quality in high school education has become the talk of the day and there is abundance of literature on this issue.
THEORIES OF SKILL-DEVELOPMENT IN CHILDREN

Several educational psychologists have put forward theories of learning which specify the skills that could be developed in a child during his educational process. Among these psychologists, Frobel, John Dewey, Robert Gagne and Jerome S. Bruner have propagated some theoretical notions regarding scientific skill development, through experience and experimental method.

FROEBEL’S THEORY

Self-activity in Education

Among all the great western educators, Froebel was the first, who made self-activity of the child, the basis of learning. These activities are free and take place according to the laws of one’s own nature. Hence these are called self-activities. Such activity can guide all educational work. The child can see, handle, arrange, rearrange, make and remake things himself. The teacher is required only to guide and direct him to proceed in the right direction. It is a process of self realization through the union of nature and humanity.

Learning by Doing

The modern trend of education is towards practical training rather than academic attainment. Froeble’s observations have greatly changed the modern methods of teaching, which lays emphasis on learning by doing. His songs, movements and constructions stress the practical side of education.
JOHN DEWEY'S THEORY

Experience and Experimental Method

Dewey explains that where there is experience, there is a living being. Experience is regarded primarily as a knowledge-affair, but to eyes not looking through ancient spectacles. To learn from experience is to make a backward and forward connection between what we do to things and what we enjoy or suffer from things. The experimental methods have the following merits.

1. Experimental method is the foe of every belief that permits habits and wants to dominate invention and discovery, and ready-made system to override verifiable fact. Constant revision is the work of experimental inquiry.

2. Experimental method is fatal to dogmatism because it shows that all ideas, conceptions, theories, however extensive and self-consistent and aesthetically attractive they maybe, are to be entertained provisionally until they have been tested by acting upon them.

3. Experimental method is not just messing around nor doing a little of this and a little of that in the hope that things will improve. Just as in the physical sciences, it implies a coherent body of ideas, a theory, that gives direction to effort.

4. Mere activity is not experience. A stream of meaningful experiences should be provided. That kind of present experience
should be selected and emphasized which lives fruitfully and creatively in the course of future experiences.

Laboratory School

Dewey has established an ideal school- the University Laboratory School, founded in 1896. Dewey wanted that the training of scholars in the School should be such as to enable them for a complete living in the social world of today. Dewey posed the following problems and attempted to find their solution:

1. How to bring the school life into closer relation with the home and surrounding life?
2. How to introduce subject-matter in history, science and art to give a positive value and real significance in the child's life.
3. How to correlate instruction in different subjects with everyday experience and occupation?
4. How to cater to individual powers and needs?

GAGNE’S THEORY

According to Gagne, during the course of a child’s education, he should be trained in skills and competencies that will stay with him lifelong viz., number computation, spatial and manipulative classifying, measuring, inferring and model conceptualizing. Developing these skills enables a child to acquire knowledge of scientific principles.

BRUNER’S THEORY

Bruner favors learning through discovery which is a self rewarding experience that helps the child learn how to learn. According to him,
learning science is to introduce the child to the ideas and various techniques involved in problem solving and inquiry skills so that he grows into an educated man.

**SCIENTIFIC SKILLS**

*Narendra Vaidhya (1996)* asserts that development of the scientific skills as the desirable outcome of science education, which provides sufficient instructional experience as regard to the acquisition of skills. These skills will function at various levels of proficiency as the growing children pass through successive grades. Stress is not only on the memory of content but also on the improvement and refinement of tools that manipulate the content with required skills. Science teaching should be in such a way that it should develop certain scientific skills which also include some general as well as abstract skills.

**EDUCATIONAL TECHNOLOGY**

Educational Technology principles are applicable to all topics and subjects and hence basic to all curriculum development. Educational Technology is made up of two words (1) Education and (2) Technology. Educational Technology a system of 5 M’s namely machines, materials, media, men and methods are interrelated and work together for the fulfillment of specific educational objectives. ‘Technology Explosion’ has yielded several new machines, materials and media which have great potential for use in the educational enterprise. A judicious use of these together with new functions and roles of educational personnel can bring about more efficient and effective teaching-learning.
Educational technology is often considered to be the intermix of two aspects-technology of education and technology in education. Technology in education is the application of technology to any process of the educational enterprise. It refers to the use of the technological advancement in terms of various equipment, materials and machines for educational purposes. It involves the increasingly complex range of audiovisual equipment, hardware and sophisticated electronic devices like projectors, films, radio, television, tape recorder, teaching machines, teletext, computer, projectors (OHP, LCD) for individualised and group learning. Technology of education symbolises a technological approach to education. It is the application of psychology of learning theories, principles of instruction, curriculum and learning to the process of education.

EDUCATIONAL TECHNOLOGY IN SCIENCE TEACHING

The advancement of science and technology which enhances the modernization of the society, has been found to play an important role in making teaching-learning process interesting and accessible to many people. Though the role of a teacher cannot be ruled out in a classroom situation, promoting new methods using educational technology to make education relevant and easy is important in today’s context. Educational technology not only helps to overcome the difficulties faced by the teacher in the class but also improves the quality of education.

APPROACHES TO TEACHING SCIENCE

A variety of approaches has been proposed to teach science in order to develop practical skills effectively. However, any approach
becomes successful only if the teacher is eclectic enough to combine all the methods judiciously so as to produce best results. Various methods should supplement and complement each other. In the modern educational context, the teaching-learning process has been moving from teacher-centered approach to learner-centered approach. While the laboratory-experimental method, problem solving method, project method, programmed learning, co-operative learning, computer Assisted Instruction (CAI) method, multi-media learning, Activity Based Learning (ABL) and Active Learning Method (ALM) follow child-centred approach. Chalk and talk method, demonstration method, historical method, biographical methods and the modern team teaching are considered to be teacher-centred in their approach.

However, a single method cannot be stated as the best to teach science. Each method is unique in nature and it is necessary to use a variety of techniques to avoid boredom in the classroom in learning science concepts. Some techniques and strategies however, seem to be more suitable to achieve particular objectives in a particular class at a particular time. Moreover, learning to think is the major process goal among many other goals of teaching science but it can be hardly satisfied by resorting to a single mode of the teaching learning process.

INSTRUCTIONAL STRATEGIES AVAILED IN THE STUDY

CONVENTIONAL METHOD

Even after the availability of technology in education, the conventional method or chalk and talk method still finds its place in Indian classrooms. Owing to the flexibility of this method, the instructors
adapt themselves to the subject matter, achievement level of learners, time limit, available apparatus and equipment in a very short notice. The interaction between the instructor and the learner is highly accelerated in this method. Ability to get the learners’ attention through voice-modulation, suitable non-verbal communications such as gestures, posture and movement are considered to be the advantages of this method. Moreover, the physical environment of the conventional method may give security to some learners as they are doing the right thing by being present along with their co-learners at the right place, at the right time and respond to the instructor in one way or other. However, modern educational experts are of the view that the conventional method enhances more teaching, rather than learning in a classroom.

ACTIVITY BASED LEARNING (ABL)

Activity Based Learning is one of the latest trend in science teaching. The basis of Activity Based Learning (ABL) method is skill development. It considers 663 skills to be developed at school level. The word activity suggests that something is active. Learning takes place all the time when our senses are activated. Sometimes only one or two senses may be used. The greater the number of senses, as a rule, the better is the quality of learning. John Dewey said, “we learn by doing and reflecting on what we do”.

ABL ensures that each and every child participates fully in each activity. The gap between the students and the teacher is lessened and hence the teacher gets an opportunity to act as a facilitator, rather than a
task master in the classroom. Teacher can spend more time with the slow learners.

Pupils learn at their own pace. Even if the pupil is absent on a particular day he can continue from the place where he was left after he comes back. Students are given full freedom to select the learning experience on their own. Self learning, group learning and peer group teaching are encouraged.

**NEED FOR THE STUDY**

Up to now, teaching of science has been content-based with little importance given to skill development in high school level. The present science curriculum is found to contain many defects regarding practical aspects. The National Policy on Education (1986) and Secondary Education Report (1952-53) have confirmed the defective nature of the present curriculum. Being narrowly conceived. It is bookish and theoretical; it is overcrowded without providing rich and significant contents. It also does not cater to the various needs and capacities of adolescents, and is dominated too much by examination. These reports emphasize the need for giving more importance to practical skills in science at high school level.

Activity Based Learning is one of the latest trend in science teaching. The basis of Activity Based Learning (ABL) method is skill development. It considers 663 skills to be developed at school level. Prof. John Deway said “We learn by doing and reflecting on what we do. Activity method is not just messing around nor doing a little of this and a little of that in the hope that things will improve. Just as in the physical
sciences, it implies a coherent body of ideas, a theory that gives direction to effort. Mere activity is not experience. A stream of meaningful experiences be provided. That kind of present experience should be selected and emphasized which lives fruitfully and creatively in the course of future experiences”. The above discussion establishes the need for the present study.

STATEMENT OF THE PROBLEM

Since time immemorial, the instructional activities in the classroom are based on the transfer of knowledge from the teacher to the learner. The advent of educational technology has dramatically changed the teaching-learning process. By reviewing various theories, the investigator is motivated to evolve a suitable strategy to develop appropriate practical skills needed for the students in the high school level. The present study is “EFFECTIVENESS OF ACTIVITY BASED LEARNING (ABL) AS COMPARED TO CONVENTIONAL METHOD OF TEACHING IN THE CONTEXT OF DEVELOPING PRACTICAL SKILLS IN SCIENCE”.

SCOPE OF THE STUDY

The investigator, using the accumulated experience as a bachelor teacher in science handling classes from IX and X over a decade and working as lecturer in physical science in B. Ed College, has been able to observe the absence of practical skills in science in the students at high school level. The traditional method of science teaching at high school level has not produced the requisite skills among the students. Hence, the investigator has selected experimental research in finding out the
effectiveness of ABL method compared to the conventional method at high school level.

NCERT Guidelines on science teaching (1990), National Policy of Education (1986) and Report of Education Commission (1964-66) have also insisted on development of skills in children. It is a well established fact that ABL helps to achieve the educational goals. The present study tries to establish the effectiveness of ABL compared to conventional method in developing practical skills in science at high school level. The ABL package prepared for the present study has been tried out to test its authenticity and validity. The above discussion establishes the scope of the present study.

**TITLE OF THE STUDY**

The title of the study is precisely stated below:

"EFFECTIVENESS OF ACTIVITY BASED LEARNING (ABL) AS COMPARED TO CONVENTIONAL METHOD OF TEACHING IN THE CONTEXT OF DEVELOPING PRACTICAL SKILLS IN SCIENCE".

**OBJECTIVES OF THE STUDY**

In any research in education, there is a need to operationalise the objectives in behavioral terms. They should be achievable and measurable as well, with these things in view, the objectives of the study are stated as follows:

1. To elaborate and examine the different instructional processes using conventional method and activity based learning (ABL)
method as alternative strategies in teaching science for the development of primary process skills, integrated process skill
and scientific communication skills among the IX Std students.

2. To study and develop the Activity Based Learning (ABL) package in science for the IX Std students for the development of primary process skills, integrated process skills and scientific communication skills.

3. To develop a CRT for assessing the achievement of primary process skills, integrated process skill and scientific communication skills among IX Std students at demonstration and extension stages.

4. To find out the relative effectiveness among conventional and ABL method of teaching in terms of development of primary process skills, integrated process skills and scientific communication skills in IX Std science at demonstration and extension stages.

5. To study whether the different instructional strategies viz conventional and ABL method, are effective in realizing the instructional objectives in science of IX Std students as measured by pre and post-tests at demonstration and extension stages.

6. To study whether there is any significant difference among different instructional strategies viz conventional and ABL methods in terms of their effectiveness in science at IX Std
level as measured by the post-tests at demonstration and extension stages

7. To study the relative effectiveness among conventional and ABL methods in terms of development of primary process skills, integrated process skills and scientific communication skills among the IX Std students as measured by the post-tests.

8. To study the student’s reaction towards the Activity Based Learning (ABL) package.

9. To study the teachers’ attitude towards the Activity Based Learning (ABL) package.

HYPOTHESES OF THE STUDY

The hypotheses of the study are stated as follows:-

1. There is significant difference between the students of the control and experimental groups in terms of their primary process skills, integrated process skills and scientific communication skills as measured by the mean scores of pretest at the demonstration stage of the study.

2. There is significant difference between the mean scores of the pre and posttest of the control group in terms of their primary process skills, integrated process skills and scientific communication skills at the demonstration stage of the study.

3. There is significant difference between the mean scores of pre and post-tests of the students of the experimental group in terms of
their primary process skills, integrated process skills and scientific communication skills at the demonstration stage of the study.

4. There is significant difference between the students of the control and experimental groups in terms of their primary process skills, integrated process skills and scientific communication skills as measured by the posttest at the demonstration stage of the study.

5. There is significant difference in the mean scores of performance in pretest of control group in terms of their primary process skills, integrated process skills and scientific communication skills at the demonstration stage of the study.

6. There is significant difference in the mean scores of performance in posttest of control group in terms of their primary process skills, integrated process skill and scientific communication skills of the demonstration stage of the study.

7. There is significant difference in the mean scores of performance in pretest of experimental group among the primary process skills, integrated process skills and scientific communication skills at the demonstration stage of the study.

8. There is significant difference in the mean scores of performance in posttest of experimental group among the primary process skills, integrated process skills and scientific communication skills at the demonstration stage of the study.

9. The students show favorable reaction towards the learning package at the demonstration stage of the study.
10. There is significant difference between the students of the control group and experimental groups in terms of their primary process skills, integrated process skills and scientific communication skills as measured by the pretest scores at the extension stage of the study.

11. There is significant difference between the students of the control and experimental groups in terms of their primary process skills, integrated process skills and scientific communication skills as measured by the scores of posttest at the extension stage of the study.

12. There is significant difference between the pretest and posttest scores of the students of the control group in terms of their primary process skills, integrated process skills and scientific communication skills at the extension stage of the study.

13. There is significant difference between the pre and posttest scores of the students of the experimental group in terms of their primary process skills, integrated process skills and scientific communication skills at the extension stage of the study.

14. There is significant difference in the mean scores of performance in pretest of control group among the primary process skills, integrated process skill and scientific communication skills at the extension stage of the study.

15. There is significant difference in the mean scores of performance in post-tests of control group among the primary process skills,
integrated process skills and scientific communication skills at the extension stage of the study.

16. There is significant difference in the mean scores of performance in pretest of experimental group among the primary process skills, integrated process skills and scientific communication skills at the extension stage of the study.

17. There is significant difference in the mean scores of performance in posttest of experimental group among the primary process skills, integrated process skills and scientific communication skills, at the extension stage of the study.

18. The students show favorable reaction towards the ABL package at the extension stage of the study.

19. The teachers show positive attitude towards the ABL package.

**METHODOLOGY IN BRIEF**

**CONTROL GROUP**

The group of students who are taught the content by the conventional method of teaching and do not receive any reinforcement through self instructional methods of teaching is called control group in the study.

**EXPERIMENTAL GROUP**

The group of students who learned the content and develop the skills through activity based learning method of teaching is called experimental group.
A research process consists of series of actions or stages necessary to carry out the research effectively and the desired sequencing of these stages. To fulfill the objectives of the study, it was carried out in five stages.

DEVELOPMENT OF ACTIVITY BASED LEARNING (ABL) PACKAGE

SELECTION OF CONTENT AREA FROM IX STD SCIENCE

Selection of content area is very important because some of the areas would not involve practical activities for the development of the skill. The area should be such that it should utilize their cognitive level. Keeping this in mind, the investigator has analysed and finally selected the following lessons for the preparation of Activity Based Learning package. The content analysis is given in the Appendix (1).

LESSONS

1. Measurements
2. Force and motion
3. Newton’s Law of Motion
4. Work, Power, Energy
5. Heat and Temperature
6. Wave motion and Sound
7. Light
8. Nature of Matter
9. Chemical Reactions
10. Coal and Petroleum
11. Reproductive Biology
12. Our Environment

SELECTION OF THE COMPONENTS OF SKILLS

In spite of the fact that the practical skills to be developed among the students are plenty, the investigator has selected a few skills for his study after reviewing the practical skills Science A Process Approach (SAPA) format considering the age, nature and level of the students. Observation, Identification, Classification, Measuring and Inferring are considered as primary process skills whereas Formulation of hypotheses, Experimental setup, Testing hypotheses, Revision of hypotheses, and Generalization are considered as integrated process skills. Scientific communication skills include Inquiry, Tabulation, Drawing, Graphical, Representation, and Interpretation.

STRUCTURE OF ABL PACKAGE

With the ultimate aim of promoting individualized instruction, this ABL package is developed, considering the level of students, materials and facilities available in the school considering the level of the students, materials and facilities available in the schools and attitude of the teachers. Fifteen scientific skills are identified to be developed in IX std students. The structure of ABL package specifies the title, defines the objectives, describes the activities and outlines the feedback followed by the post test.
DEVELOPMENT OF CRITERION REFERENCED TEST (CRT)

Criterion – Referenced Test (CRT) tells us about student’s level of proficiency in or mastery of some skills or set of skills. The investigator has selected test retest (pre-test, post test) method because it is the most often used technique for determining reliability and validity.

PILOT STAGE

INDIVIDUAL TRYOUT

In order to determine the effectiveness and feasibility of the ABL package, the programme was tried with a single student at a time and he was observed for his reaction and the part of the package that needed revision was found out. Six students of different levels namely two- bright, two average and two below average were selected through an interview from C.S.I. Boys Higher Secondary School, Coimbatore. A pretest was administered to confirm that they do not process previous knowledge on the skills. Each activity of the ABL package was written on a sheet of paper. Correct responses for the practical activity, which will not be visible to the pupils were given separately. Materials to be used while experimenting or learning were supplied to them. Bright students were selected first and they were given all the instructions which were in the written form. Average students were involved next and finally below average students were involved. The students were then asked to go through each activity. At the end of the programme, posttest was administered and the effectiveness of the learning packages was analysed.
DEMONSTRATION STAGE

The investigator had done the field work under classroom conditions at Sri. Baldevadas Kikani Vidyamandir Higher Secondary School, Coimbatore. 66 students from class IX were selected for the experimental treatment. The method used for the present stage was quasi-experimental design known as pretest-posttest, parallel equated group method. Group ‘A’ was considered as the control group which was treated with conventional method used by the regular school teachers. Group ‘B’ was considered as the experimental group which received the experimental treatment by the investigator using ABL package. The following tools were used in this stage.

1) ABL package

2) Criterion Reference Tests (Pre, Post-tests)

3) Students Reaction Scale for ABL package.

EXPERIMENTATION

Pretest

On the first day, control and experimental groups were diagnosed for their primary process skills through the pre test. While Integrated process skills were tested on the second day, scientific communication skills were tested on the third day.

The three divisions of skills consist of five skill components and each component carries a maximum of 4 marks and the time allotted was 45 minutes. A copy of pre-test question paper and scoring key are given in Appendix (4) and (5).
Treatment

The investigator had given the treatment to the experimental group using ABL packages. The control group was taught by the concerned science teacher with regular lesson plan for the same content. Copy of ABL package is given in appendix (2).

Post Test

At the end of the treatments, the control and experimental groups were administered the post test by the same criteria as in the protest. A copy of post test and scoring key are given in appendix (6) and (7).

The scores obtained in the pre and post-tests by the 62 students were collected, tabulated (See Appendix -10A, 10B, 10C, 10D) and analyzed by the investigator.

EXTENSION STAGE

SAMPLING PROCEDURE

Ten high schools which follow State Board Syllabus were identified for the present study. Among the schools, one class each was selected from eight schools, two classes from the ninth school and four classes from the tenth school with a total number of 14 classes from 10 schools were selected for the experiment. Applying parallel equated group, technique, 822 number of students were taken from standard IX as the sample for the present study.
TOOLS

The following tools were used at this stage

1. ABL package

2. CRT (Pre and post-tests)

3. Student Reaction Scale for ABL package

4. Attitude Scale for IX standard science teachers.

EXPERIMENTATION

The investigator had arranged orientation program for science teachers from 10 experimental schools to train in ABL package, CRT and their procedures. The time slot was given as in the demonstration stage. These teachers were requested to adopt the procedure to give the ABL as well as conventional treatment to the needed students. Frequent visits were made by the investigator during the pre-test, treatment and the post-test activities to observe the experimentation and positive suggestions were made wherever needed. The scores obtained in the pre and post-tests by the 822 students from the 10 schools were collected, tabulated and analyzed by the investigator.

TOOLS USED IN THE STUDY

i) Activity Based Learning packages

ii) Criterion referenced tests (pre and post-tests)

iii) Low cost improvised materials

iv) ABL package Evaluation Proforma

v) Attitude Scale for IX std Science Teachers
vi) Students reaction scale for ABL package.

STATISTICAL TECHNIQUES USED IN THIS STUDY

i) Mean and Standard Deviation

ii) t-test

iii) F-test

DELIMITATIONS OF THE STUDY

The following are the delimitations of the study

1. The study is limited to the performance of IX Std students only in science subjects.

2. Only a few units from IX Std science curriculum are considered for the study.

3. Due to the constraints of time, money and administrative difficulties, the investigator has decided to take only conventional and ABL method of instruction for research.

SUMMARY OF FINDINGS AND CONCLUSION

The following are the major findings and conclusion emerged from the present study.

DEMONSTRATION STAGE

From the analysis of hypotheses 1, it is evident that there is no significant difference between the control and experimental groups in the achievement of primary process skills, integrated process skills and scientific communication skills. It is also concluded that the control and
experimental groups are identical in terms of the achievement in the primary process skills, integrated process skills and scientific communication skills before the treatment of conventional and ABL methods of instructional strategies.

From the analysis of hypotheses 2, it is found there is significant difference between the control and experimental groups with regard to the achievement in primary process skills, integrated process skills and scientific communication skills among the high school students. In all the three sub-skills, the experimental group has scored high values which show that teaching science through ABL methods of instructional strategies has resulted in higher achievement. This may be due to the possibility of total involvement of the students in the ABL method of instructional strategy which has enhanced absolute learning.

From the analysis of hypotheses 3, it is found that there is no significant difference between the mean scores of pre and posttest of the control group. This inference points out that control group which is exposed to conventional method of teaching science does not show any development of practical skills in the post-test.

From the analysis of hypotheses 4, it is found that there is significant difference between the achievement scores of pre and post test of the experimental group with regard to the primary process skill, integrated process skills and scientific communication skills among the high school students at the demonstration stage. This establishes the criterion validity of the test. It is obvious from the result that the learning package has a good impact on the students in developing their practical
skills in science. It may be due to the fact that activity based learning ensures total participation of the students which enhances better learning outcomes.

From the analysis of hypotheses 5, it is found that there is no significant difference among the primary process skills, integrated process skills and scientific communication skills of the control group as measured by the pre-test at the demonstration stage.

From the analysis of hypotheses 6, it is found that there is no significant difference among the primary process skills, integrated process skill and scientific communication skills of control group as measured by the posttest at the demonstration stage. This result indicates that teaching through conventional method does not favourably affect any of the practical skills in science. This may be due to the fact that conventional method is usually suitable for teaching theory-based content.

From the analysis of hypotheses 7, it is found that there is no significant difference among the primary process skills, integrated process skills and scientific communication skills of experimental group as measured by the pretest at the demonstration stage.

From the analysis of hypotheses 8, it is found that there is no significant difference among the primary process skills, integrated process skills and scientific communication skills of experimental group as measured by the posttest at the demonstration stage. It points out that the ABL package has similar impact on all the three skills and it may be because of the equal weight age given to the development of all the skills.
From the analysis of hypotheses 9, it is found that the mean of the actual score is significantly greater than the mean of the neutral score. So, it is concluded that 9th standard students have favourable reactions towards the Activity Based Learning package at the demonstration stage.

**EXTENSION STAGE**

From the analysis of hypotheses 10, it is found that there is no significant difference between the control and experimental groups with regard to the achievement in primary process skills, integrated process skills and scientific communication skills at Extension stage. It shows that the control and experimental groups are identical in terms of the achievement in primary process skills, integrated process skill and scientific communication skills before the experimental treatment.

From the analysis of hypotheses 11, it is found that there is significant difference between the control and experimental groups with regard to the achievement in primary process skills, integrated process skills and scientific communication skills measured by the posttest at the extension stage. Owing to the fact that the ABL package encourages learning through activities and self-learning strategy, it is found to have greater impact on students than the conventional method and it is proved by the above finding.

From the analysis of hypotheses 12, it is found that there is no significant difference between the mean scores of pre and post test of control group in terms of their primary process skills, integrated process skills and scientific communication skills at the extension stage. It is obvious that the conventional method is not very effective in achieving
practical skills in science since it is relevant only to content-based teaching.

From the analysis of hypotheses 13, it is found that there is significant difference between the mean scores of pre and post tests of experimental group with regard to the achievement in primary process skills, integrated process skills and scientific communication skills at the extension stage. The achievement score of experimental group in the post test is comparatively higher than that of the pretest which substantiates the positive impact of activity based learning package in teaching science. It also establishes the criterion validity of the test. ABL method is found to be more effective than the traditional conventional method of teaching science at high school level. Science it is competency – based and not content – based.

From the analysis of hypotheses 14, it is found that there is no significant difference among the primary process skills, integrated process skills and scientific communication skills of control group as measured by the pre test at the extension stage.

From the analysis of hypotheses 15, it is found that there is significant difference among the achievement of primary process skills, integrated process skills and scientific communication skills of control group in science as measured by the posttest at the extension stage. It shows that the conventional method has varied influence on the three practical skills in science.

From the analysis of hypotheses 16, it is found that there is no significant difference among the primary process skills, integrated
process skills and scientific communication skills of experimental group as measured by the pretest at the extension stage.

From the analysis of hypotheses 17, it is found that there is significant difference among the achievement of primary process skills, integrated process skills and scientific communication skills of experimental group as measured by the post test at the extension stage. It indicates that the impact of the ABL package on the development of the three skills is uniform. It may be due to the fact that ABL method is inclined to develop all the practical skills in a similar way.

From the analysis of hypotheses 18, it is found that 9th standard students have favorable reactions towards the Activity Based Learning package at the Extension stage.

From the analysis of hypotheses 19, it is found that the teachers have favorable attitude towards the Activity Based Learning packages at the extension stage.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations have been affixed to the practicing teachers as well as the administrators; In order to make the teaching learning process effective, Activity Based Learning method is found to be an efficient strategy at all levels of education. Based on the experiences gained in developing and evaluating the Activity Based Learning packages for teaching of science to develop practical skills at High School level. The ABL package may be designed so as to reveal the richness of the subject matter besides appreciation and
respect for the learners' ability to device original and creative solution for learning problems.

- Care may be taken to focus not only on the content but also on the experiences needed by the students so that they can become creative, involved and independent learners.

- Activity Based Learning packages may be analysed, planned, designed, developed, evaluated, implemented and properly documented with the help of the various experts. This will be helpful in the development of quality ABL packages in the teaching and learning of all the subjects.

- Remedial measures for practical difficulties in the implementation of ABL method at high school level should be taken by the concerned authorities. For example, the class size should be small in order to enable the teacher to concentrate on the practical activities of all the students.