CHAPTER 1

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INTRODUCTION

Today science is progressing at a furious pace and it has surpassed all the miracles of mythology. There is not even a single area which is left out by the magical touch of science. By exploiting the inquisitive nature of man science goes on changing minute by minute and constructing new knowledge day by day. It has reached to such a dimension that it nearly doubles every ten years.

This is an age of knowledge construction and it is an alarming fact that in India knowledge is more received than constructed. Our schools also stick to conventional methods of teaching which gives importance to receiving. It is time that we bring about a sea change to this strategy. It is rightly said that to know how to suggest is the art of teaching. Since science is an advancing subject students are finding it hard to cope with the immense amount of data that is being generated. The teachers too must devise new strategies and methods to assimilate the scientific knowledge and disseminate it among the students. The known knowledge of the teacher about the concerned subject must be presented as a problem before the students from which they must be able to derive a solution. Such an experience will lead the students to know about the unknown.

We are living in a century which has witnessed the tremendous growth of science and the radical changes it has brought into our life.
Nowadays, Biology and Biotechnology are the fastest growing branches of science in which immense research work is being conducted. Innovative methods of teaching can be effectively implemented in teaching Biology so that it improves the grasping power of students and makes the subject more interesting.

"Link education to life, associate it with concrete goals, establish a close relationship between society and economy, invent or rediscover an education system that fits its surroundings ..... surely this is where a solution must be sought" (cited in The New Indian Express).

This is also the century of the child. Montessori, Froebel, Piaget all gave importance to child-centered teaching. Science as a subject differs from all other subjects in that it cannot and should not be taught as facts. It should be taught through a process of experimentation and investigation wherein students are encouraged to do experiments and are guided in their investigations leading them to the facts. The process part of science should be given more importance than the product. Theory and practical should not be mutually exclusive. There should be enough scope for observation, experimentation, discovery and individual activities. Progressive educators like Dewey, Montessori, Gandhi, Piaget and Vygotsky stressed the need for activity methods and experimental pedagogy as compared to conventional methods.
According to Johannesen, (Advisor, Life Science Project), "in learner-centered teaching we have to focus on the child, to be more precise on how a child learns. Over a period of time the teachers may have told the students a great deal about different subject matter. Often they are given this information and asked to recall it a few days later. If the students are able to do so, it is assumed that they have learnt what they were supposed to learn. However, the only thing which can be proved by this is the student’s ability to store a certain number of facts in his short-term memory. To be able to remember facts is only a small part of learning. There is enormous difference between knowing something and understanding it."

While learning science, the students should be able to solve problems independently and to apply the theories learnt in practical situations. He should develop a scientific attitude, interest and curiosity. We cannot develop these qualities by giving only factual information. Science students should be considered as little scientists working in laboratories, the teacher should guide and lead students to discoveries and to solving problems. This is the first step to scientific literacy. Students gain a lot by doing experiments individually and also in groups. The discussions, experimentation, observations all help the students to attain higher educational objectives. The task of science teachers is to develop and experiment new strategies which will help the students to acquire the ever increasing knowledge of science.
1.1 **THE ACTIVITY CURRICULUM AND ITS IMPORTANCE**

"Activity curriculum means curriculum design in which the interests and purposes of children determine the educational programme of activities being planned co-operatively by teacher and pupils and activity learning/ teaching means any learning or teaching situation, such as project work which is characterized by participation on the part of learner, as opposed to passive learning of information from a lecture, talk or observed demonstration." (International Dictionary of Education).

Activity curriculum is also called 'Project curriculum or Experience curriculum' whereas its origin can be traced back to the beginning of the twentieth century, its fundamental ideas date back to Rousseau and a few others as far back as even to Plato. In 1897, Dewey used the term 'activity programme', a form of activity curriculum. In the same year, Dewey established a laboratory at the University of Chicago which was a joint venture of parents, teachers and educators. They placed emphasis on occupations (cooking, sewing, embroidery, carpentry etc.) rather than on conventional subjects, but at the same time, it may be mentioned that this does not mean vocational training.

This approach thus provides a sound base of experimental background. According to the opinions of Bruner, Piaget and other advocates of scientific revolution, the children are to be given first hand experiences suggested under play category. This approach, especially in
the developing countries, is likely to close the gap between elementary knowledge and the advanced knowledge.

(a) **Relationship between the theory and the practical work**

"Since the professional scientists work in laboratories at some or all stages of their careers, then student scientists must also work in laboratories. So runs the rationale of laboratory work as a unique feature of science education at secondary and tertiary levels. Student laboratory work has been regarded as an essential step in the socialization of students into the state of scientific literacy, or even into professional science. The laboratory work not only provides the setting for students to acquire technical and manipulative skills but can also be used to achieve a myriad of other educational objectives.

The effects of the practical laboratory matriculation examination in Israel point out the place that laboratory has occupied in the high school Biology curriculum and it clearly shows that the impact of this enquiry-oriented problem-solving examination has been two-fold. It simulated and forced school to build and operate well-equipped laboratories run by specially trained laboratory technicians and more importantly, it has resulted in students and teachers actively spending a substantial portion of their time working in their laboratory and performing genuine investigation."
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The activity-based and enquiry-oriented laboratories are significantly different from conventional ones: teachers are less direct, more planning takes place, processes of science receive more emphasis, there is more post-lab discussion and teachers give fewer instructions in front of the whole class, but move around more, checking, probing and supporting. Students are usually more active and they initiate ideas more frequently" (Hegarthy, 1990). “Holt, in his book, ‘How children fail’, says regarding some of the well known American schools that “school is a place where children learn to be stupid because the natural atmosphere of learning is absent. Children are barely curious about life and reality, engaged half-heartedly in activities, are always afraid of committing intelligent mistakes. They show little eagerness of experiment, and are unable to endure failure.

Teachers can solve such problems by conducting classes with active student-participation. Bigge and Hunt, in defining reflective thinking, write that “perhaps it could be summarized by describing the classroom atmosphere as one of teacher-student mutual inquiry within which genuine problems are developed and solved.” (cited by Vaidya, 1992).

“The major trends of science teaching for the future clearly prove that the traditional role of the teacher has to be radically different, that is the old tradition of science teaching strictly based on textbooks is to be replaced by an approach where students and teachers
work in collaboration on the voyage of discovery where students are gradually led to the final answer as far as possible unaided; where the teacher's duty does not end, of course, when he has only stimulated his students, that is acted like a catalytic agent.” (Vaidya, 1992).

In an attempt to define the process of science, the American Association for the Advancement of Science (AAAS) asked scientists to say what they actually do. The following list of 13 processes came from this inquiry:

(1) Observation  
(2) Classification  
(3) Number relations  
(4) Measurement  
(5) Space/time relations  
(6) Communications  
(7) Predication  
(8) Inference  
(9) Making operational definitions  
(10) Formulating hypotheses  
(11) Interpreting data  
(12) Identifying and controlling variables  
(13) Experimenting
Activities which can be given in class room situation

According to Ediger, 1996 it is important for the science teacher to provide a variety of learning activities for pupils. This would be important for the following reasons:

1. pupils have different learning styles.
2. different levels of achievement in science exist within any class of pupils.
3. not all pupils, of course, benefit equally from the same activity.
4. teachers have different teaching styles.
5. selected learning activities capture the interests of pupils more than do other kinds of experiences.
6. individuals desire new experiences.
7. monotony in activities hinders pupils in developing proper motivation toward learning.

Educationists have identified many activities which can be given in class room situation. The activities listed below can easily be provided in one form or the other:

(i) Oral activities: such as inviting questions and answers, narrating experiences and participating in general class discussions.

(ii) Written experiences: such as selecting and copying relevant material from books and journals, seeking information,
making summaries, writing short book review, taking notes and drawing diagrams.

(iii) Visual activities: such as reading and interpreting charts, diagrams and graphs, studying apparatuses, specimens and pictures, seeing films and film strips, and gathering information from bulletin boards.

(iv) Practical activities: such as setting up experiments both in the laboratory and at science fairs and exhibitions, constructing and improvising apparatus, preparing charts and diagrams and finding matter for the bulletin boards.

In an attempt to divide activity-oriented method, the investigator has tried to divide the class room activities into small group activities (which can be done individually or by a very small group of students) and large group activities (activities given to the whole class where there is no scope for individualization).

Experimental group-I was taught by activity-oriented method-I which include written experiences like selecting and copying relevant material from books, seeking information, making summaries, taking notes and drawing diagrams. Practical activities such as setting up experiments, preparing charts and diagrams etc. were also given. All activities were to be done individually.

Experimental group-II was taught by activity-oriented method-II which includes oral activities like inviting questions and
answers and participating in general class discussions. Some visual activities like reading and interpreting charts and diagrams are also included. But only one or two students did the above activities representing the whole class. There was no individualization. Students were selected in random to participate in the activities. The rest of the class was asked to listen and observe the activities. Charts and diagrams were shown to the whole class. One or two students were invited to interpret the charts and diagrams.

The Control group was taught in the conventional textbook approach.

Traditionally the principal aim of practical work has been to help the pupil to understand the theoretical ideas being taught by the teacher. Finagrin and Ingram (1988) explain many opportunities to allow pupils to experience biological phenomena, solve problems and develop laboratory and analytical skills. Many of the opportunities can also be used for assignment purpose (for the work sheets given by the authors). 37 specific scientific skills have been analyzed by the authors which are given in the following pages:
HANDLING MATERIALS AND APPARATUS
HMA 1 Following instructions to complete a procedure
HMA 2 showing appropriate initiatives
HMA 3 Working safely
HMA 4 Assembling common apparatus
HMA 5 Using a light microscope
HMA 6 Preparing temporary microscope slide
HMA 7 Using materials and apparatus correctly

MAKING ACCURATE MEASUREMENTS AND OBSERVATIONS
AMO 1 Measuring temperature accurately
AMO 2 Measuring length accurately
AMO 3 Measuring volume accurately
AMO 4 Measuring time accurately
AMO 5 Measuring mass accurately
AMO 6 Counting accurately
AMO 7 Assigning objects to groups
AMO 8 Observing major similarities and differences between specimens
AMO 9 Observing detailed similarities and differences between specimens
AMO 10 Making accurate observations

RECORDING OBSERVATIONS AND RESULTS
REC 1 Drawing
REC 2 Completing tables
REC 3 Recording accurately
REC 4 Plotting graphs
REC 5 Selecting the appropriate methods of presenting results

INTERPRETING EXPERIMENTAL RESULTS
INT 1 Drawing appropriate conclusions
INT 2 Extracting relevant information from tables and chart
INT 3 Extracting relevant information from graphs
INT 4 Performing simple calculations
INT 5 Recognizing experimental error and variation in results
INT 6 Recognizing patterns in experimental results

DESIGNING AND CONDUCTING EXPERIMENTS
EXP 1 Forming hypotheses
EXP 2 Devising an experiment to test a hypotheses
EXP 3 Specifying the apparatus for an experiment
EXP 4 Specifying the sequence of an experiment
EXP 5 Suggesting appropriate experimental control
EXP 6 Suggesting appropriate levels of replication
EXP 7 Conducting the experiment
EXP 8 Interpreting the result of the experiment
EXP 9 Evaluating the experiment

The investigator has tried to incorporate and evaluate almost all the skills mentioned above in activity sheets, instruction cards and tables given to Exp.Gp.-I taught by activity-oriented method-I. (Some of the skills mentioned under 'Designing and conducting experiments' could not be included since the study was done in Standard VIII). There were enough opportunities for students in Exp.Gp.-II (taught by activity-oriented method-II) also to develop many of the skills. The control group was taught by conventional textbook approach.
According to Bruner (1960) "the dominant approach in science education thus far has been in line with the dictum that for the child at school, learning science was not (and should not be) different in kind from the research physicist".

In a reception given to the UNESCO mission, two papers by Buschbaum and Kirkpatrick on Biology and science teaching in India was presented. The recommendations made remind us painfully of our extreme backwardness in science. The experts' recommendations are grand, but taking all things into consideration, we cannot implement them unaided (N.C.E.R.T., 1964).

The Kothari Commission Report points out the state of science education in India. The commission has recommended linking of science to the child's environment. Attempts should be made to develop active and varied methodology of science teaching, viz., emphasis on problem-solving and 'investigatory approach and the understanding of basic principles'. (Kothari Commission's Report, 1966).

Reviews of comparative learning studies (Cunningham, 1946; Bradley, 1968; Bates, 1978; Blosser, 1980) suggest that choices of goals for laboratory class work should be made from among the following:

1. Teaching manipulative skills and increasing understanding of the apparatus;
2. Fostering understanding and experience of scientific enquiry;
(3) Practice in designing and executing experiments, generating data for analysis and interpretation;

(4) Developing attitudes to science, laboratory, resourcefulness, creativity;

(5) Introducing a new discipline, providing for individual differences, providing concrete learning experiences;

(6) Fostering a sense of success, motivation and control in science.

(b) **The influence of laboratory experiments on memory and the acquisition of scientific knowledge**

Hegarthy, 1990 citing a few studies describes the influence of laboratory experiments on memory and acquisition of scientific knowledge. A brief description about the works as explained by Hegarthy is given below.

In a study carried out by Atkinson, 1980, with 78 tenth class science students in four classes in a co-educational city high school, a set of five programmed booklets was written for use in teaching the gas laws, two laboratory experiments were included. Half of the students saw the two experiments demonstrated by the class teacher while the others carried out the experiments in groups of two to four students.

Two days (retention 1) and also six weeks (retention 2) after the instruction, students were individually given the same retention test comprising 18 scientific knowledge questions associated with the
instructional programme. After completing each question an interviewer asked the student to verbalize the thoughts and pictures which flashed through the mind while deciding how to answer the question. Responses were tape recorded. Overall many students recalled various steps in the experimental procedure; few students referred to the purpose of the experiments which was to show the relationships between the volume, pressure and temperature of a gas under different conditions.

The above experiment clearly shows that there exist a wide gulf between theory and practice.

In school science the laboratory appears not to be providing the link with theory which had been expected. Teachers must not assume that students are making the link between the theory and practice. Continually stressing the purpose of the practical work and the relationship with theory is one way teachers can enhance the learning of scientific knowledge in the laboratory.

Recent research provide science educators with challenging opportunities to develop innovative and manageable practices within the classroom to foster intended learning outcomes of scientific knowledge.

Students reactions to practical work

In South Australia, Keightley and Best (1975) reported that practical skills were regarded as the most important of twelve
objectives by Grade II Biology students. Comparative studies (Zvi, Hofstein and Samuel, 1976; Zvi et al. 1976) indicated that lab work was regarded as more interesting than teacher demonstrations, lectures or filmed experiments. This finding held for both traditional and new chemistry curricula.

Comparison of Student's and Teacher's Views

Keightley and Best (1975) asked Grade II Biology students in Australia (N=2616) to rate their liking for twelve educational objectives. One objective was practical skills (for example, learning to use a microscope, to dissect animals, to use laboratory apparatus). This was accorded the highest mean rating of all twelve objectives; 47% of students responded that they 'very much like to learn' this and 32% that they 'like to learn'.

Interestingly, teachers (N=82) had a somewhat different view of the importance of laboratory work. Asked to rate the importance of the twelve objectives, the most valued objective was 'understanding of the biologist's view of the world', regarded as a major aim of 94% of the teachers. Another item, 'Scientific ways of thinking (for example: learning to observe to analyze experiments to see what conclusions are justified; to think logically)', was almost equally valued (875). The objective 'Interest and Attitudes' was considered a major aim of 80% of the teachers, whereas the practical skills item was regarded as of major importance by only 24%.
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The evidence in this study would suggest that both students and teachers value laboratory work, but that perhaps they do so for different reasons. The discrepancy between what teachers hope to teach and what the students hope to learn suggests that the students are instrumental in their approach to biology than the teachers. The teachers, on the other hand, are more conceptual in their approach.

Individualization

One of the claims made for the experimentation or activity method is that the teachers can treat students as individuals. In the Teacher's Resource Book for the PSSC course, for example, Haber-Schaim (1976) argued that the laboratory provides an ideal setting where you can adjust your role as instructor to the individual needs of your students. Some require individual guidance, some are left best undisturbed, and still others may enjoy an extra challenge.

The issues relating to the purposes and uses of laboratory work introduced above have much in common. It may well be helpful to see them more as a whole than as discrete ideas. All are underpinned by a view of learning as an act of construction by the individual. In this view learning science is a disciplined creative process. Even when a teacher gives a pupil an explanation for how and why something behaves as it does, the pupil must still actively create meaning from the explanation. Teaching involves helping pupils to generate appropriate meanings from incoming information, to link these meanings to other ideas in
memory, and to evaluate both newly constructed ideas and the way old ideas are related in memory. (Osborne and Wittrock, 1983).

**Teacher's Organizational Ability**

There is evidence that teachers who are cognitively well organized, with good understanding of their subject matter and a capacity for effective planning, appear to enhance student interest in science. Gardner (1972) found a positive relationship between student's enjoyment in physics and the organizational ability of their teachers (cited by Hegarthy, 1990).

**New trends in learning strategies**

Norman and Spohrer (1996) views that the last years have witnessed a rapidly growing interest in learner-centered approaches to education which aim at replacing passive lecture attendance and textbook reading by active exploration and construction. This recent renaissance of well-established problem-based learning strategies such as learning by doing or training on the job is due to the advanced computer technologies available now. Hoist et al (2000) argues that an activity-oriented approach to represent knowledge is most suitable to support learner-centered learning in a collaborative setting. Williams (2000) explains the difference between "child-centered" education and "child-led" education. In a "child-centered" education it is important to consider the learning style and particular interests of the child. "Child-
led" education on the other hand does not necessarily offer a structure or opportunities but instead waits for the child to ask or initiate. The problem with this is that there are so many opportunities the child does not even know about or cannot imagine. Because the adult is more aware, more mature, and hopefully more focused than a child, it is up to the adult to provide a suitable structure within which the child can learn in an enjoyable manner suited to the needs and temperament of the child.

"Researchers have identified four types of learning styles: activists who learn best from activities while they are engrossed in them; reflectors, who learn from activities which they have had the chance to review; theorists, who benefit from activities when they are offered as part of a concept or theory; and pragmatists, who learn best when there is a direct link between the subject matter and a real-life problem" (The New Indian Express).

1.2 NEED AND SIGNIFICANCE OF THE PROBLEM

There has been tremendous progress in science in this century. Many innovations took place in the field of science education too. If science is not taught and learnt properly it will create a generation of misfits in today's world.

Activity-oriented method is very effective in teaching science. Much research has been done in this area. Almost all of the research
indicate activity-oriented method as superior to conventional approaches in teaching not only science but also many other subjects.

There is a belief that all types of activities may produce significant difference in achievement when compared to conventional textbook approach. The investigator strongly believes that a thorough research is necessary before selecting suitable activities and modifying the teaching methods. Activity-oriented method is a term which is often used to mention all types of activities which can be given to students. But the results may be different when taught by giving different types of activities. The investigator has tried to divide the activities into two sections and compare the effectiveness of each type of activity. Comparisons are made on the basis of achievement and retention tests which are given after subjecting the students to experimental treatments. The scores of achievement test and retention test (total and objective-wise) was computed to check the effectiveness of each type of activity.

The activities are divided into (i) individual and small group activities and (ii) large group activities

For convenience the investigator has named it as activity-oriented method-I and activity-oriented method-II.

The conventional textbook approach lay emphasis only on textbooks and it is based only on theory classes which help to memorize the facts without any experimentation.
The following defects pointed out by the Secondary Education Report (1952-53) are relevant even today. They are:

(1) The present curriculum is narrowly conceived
(2) It is bookish and theoretical
(3) It is over-crowded without providing rich and significant contents
(4) It makes inadequate provisions for practical and other kind of activities which should reasonably find room in it, if it is to educate the whole of the personality.
(5) It does not cater to the various needs and capacities of the adolescents.
(6) It is dominated too much by examinations
(7) It does not include technical and vocational subjects which are so necessary for training the students to take part in the industrial and economic development of the country.

About 13 years later, the Education Commission (1964-66) also confirmed the above mentioned defects in the secondary curriculum. To overcome these difficulties a new curriculum DPEP is introduced in our state which is activity-oriented. But the researcher does believe that the effectiveness of different types of activities needs to be analyzed separately. This is to determine the type of activities to be given to students in order to ensure achievement and retention and to select appropriate activities according to the topic. The activities
should help to achieve various objectives in science teaching and it should suit all students belonging to different levels of intelligence and socio-economic status (SES). The effectiveness of different activities needs to be checked to ensure their usefulness to students.

There are also many other defects for conventional textbook approach. It is wrong to assume that the student may be familiar with a particular topic if she/he can state it verbally. The student will master the content only if it is discovered through activities. The investigator hopes that both activity-oriented methods I and II will help to increase the knowledge and its retention by pupils. The effectiveness of both methods should be verified to prove this. This particular study was undertaken with this objective in mind.

Students tend to copy experimental results from other students and mug them up without understanding the procedures and principles when the activities are given to a large group of students. Besides students tend to manipulate their observation to cook up correct answers if large group activities only are given. Doing experiments individually and observing them carefully will help to arrest this practice to some extent. The student should be made to understand that the methods and procedures adopted, observations made and finding out solutions by themselves are more important than getting expected results.
When the teacher demonstrates an experiment or when other teaching aids like charts and models are shown, only some students from the whole class participate in the learning activities. If we want the whole class to participate in the learning activity, the activities should be given individually. The investigator in the study has given maximum individual activities to Exp.Gp.-I except in cases where costly apparatus need to be used or adequate facilities were not available in the school. In such situations students were grouped into small groups of 3 or 4 students. Even in such cases the students were asked to record observations individually.

Large group activities too have merits of their own. The positive aspect is that regular classes are not interrupted. There is no need to provide separate learning materials and apparatus to each student. Large group activities can be given along with regular class. The investigator is of the opinion that activity-oriented method-II is more suitable in our school environment. But its effectiveness needs to be checked.

The investigator has tried to take theory classes and practical simultaneously. In Exp.Gp.-I there was no separate theory classes. Each concept is learned through activities. In Exp.Gp-II theory and practical classes were combined. To teach the content in one class and to demonstrate the practical in some other class may not be beneficial
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to students. This work can also be considered as a small effort to bridge the gap between theory and practical.

In most schools activities are given to the whole class to be done as a single group (large group activities). Individual and large group activities are given randomly by teachers. The usefulness of giving such individualized and group activities in a haphazard manner is never gratified. Giving activities to students without evaluating their effectiveness is worthless. This experimental study is a small step in this direction. The investigator has tried to bifurcate the activities which can be given in schools and their effect on the total and objective-wise achievement and retention is studied. Achievement is also compared on the basis of intelligence and SES.

1.3 STATEMENT OF THE PROBLEM

The problem is entitled, 'EFFECTIVENESS OF ACTIVITY-ORIENTED METHOD IN TEACHING BIOLOGY IN SMALL GROUPS AND LARGE GROUPS OF SECONDARY SCHOOL STUDENTS'.

1.4 DEFINITION OF KEY TERMS

(a) EFFECTIVENESS

"Educational effectiveness is concerned with whether or not a specific set of resources has a positive effect on achievement and
if so how huge this effect is". (The International Encyclopedia of Education)

In this study the effectiveness is measured on the basis of post-achievement test score and retention test score. Retention test was a delayed achievement test. Total and objective-wise marks were taken to test the effectiveness.

(b) ACTIVITY-ORIENTED METHOD

"Play or work that involves investigation, experience or study and in which pupil is allowed to develop and expresses his/her own ideas, thoughts and activities. Activity methods supplement or replace formal or traditional class room procedures. Activities may also be completely free and creative, eg. Self expression in art. In any activity method, the central point stresses pupil participation in learning." (International Dictionary of Education).

In this study, investigator refers to two types of activities:—
(i) Individual and small group activities and
(ii) Large group activities which are given to the whole class.

(c) SMALL GROUPS

Small groups mean student groups with 3-4 students. To this group maximum individual activities were given.

(d) LARGE GROUP

In this study by large group the investigator refers to the whole class of students as one large group.
1.5 **OBJECTIVES OF THE STUDY**

1. To find out the achievement of pupils when taught by activity-oriented method-I.

2. To find out the achievement of pupils when taught by activity-oriented method-II.

3. To find out the achievement of pupils when taught by conventional textbook approach.

4. To compare the achievement (total and objective-wise) of pupils taught by activity-oriented method-I with conventional textbook approach.

5. To compare the achievement (total and objective-wise) of pupils taught by activity-oriented method-II with conventional textbook approach.

6. To compare the achievement (total and objective-wise) of pupils taught by activity-oriented method-I with activity-oriented method-II.

7. To compare the retention (total and objective-wise) of pupils taught by activity-oriented method-I with conventional textbook approach.

8. To compare the retention (total and objective-wise) of pupils taught by activity-oriented method-II with conventional textbook approach.
9. To compare the retention (total and objective-wise) of pupils taught by activity-oriented method-I with activity-oriented method-II.

10. To compare the achievement of pupils at different levels of intelligence when taught by activity-oriented methods-I and II.

11. To compare the achievement of pupils at different levels of SES when taught by activity-oriented methods-I and II.

1.6 HYPOTHESES

1. Achievement and retention (total and objective-wise) of Standard VIII students in Biology when taught by activity-oriented method-I is significantly higher than that of students taught by conventional textbook approach.

2. Achievement and retention (total and objective-wise) of Standard VIII students in Biology when taught by activity-oriented method-II is significantly higher than that of students taught by conventional textbook approach.

3. Achievement and retention (total and objective-wise) of Standard VIII students in Biology when taught by activity-oriented method-I is significantly higher than that of students taught by activity-oriented method-II.

4. Achievement of Standard VIII students in Biology when taught by activity-oriented methods-I and II is positively related to the
intelligence and SES of the students.

1.7 SCOPE AND LIMITATIONS OF THE STUDY

The effect of activity-oriented method was experimented by many researchers in various classes and also in various subjects. Activity-oriented method includes variety of activities which are given to students. The investigator has tried to test the effectiveness of different types of activities in the achievement and retention of Biology in Class VIII and divided the activities into individual/small group activities and large group activities which have been conveniently named as activity-oriented method-I and activity-oriented method-II. In activity-oriented method-I maximum care is taken to give individualized activities as far as possible. There is no significance in giving different types of activities without studying the advantage of different activities.

Both activity-oriented methods will increase the observation skill of pupils and the idea of 'learning by doing' is stressed. This will create scientific attitude and inquiry among pupils. Individual activities will increase the problem solving ability since first hand experiences are given to students. Both the activity-oriented methods provide deeper understanding about the structure of science and help to achieve greater rapport between teacher and students. The classes will be active, the teacher's knowledge in the subject increases because the
teacher is facing a problem situation and it also helps to link theory and practice. Individual activities will help the teacher to cater to individual differences since the students can study at their own level and pace. Each child has unique capacities, personality traits, interests, needs, background, previous knowledge and learning methods. The effect of activity-oriented methods-I and II and also of conventional textbook approach at different levels of intelligence and SES was also identified in this study. Activity method as a whole will help to check the manipulation of practical work, habit of copying results and make students feel that results are not as important as the methodology adopted in doing experiments and also provides scope for post-lab discussions.

The difference in achievement when the students do experiments by themselves and when observing the experiments done by other students or the teacher is a very important aspect in Science Education. The investigator has tried to highlight this difference and its effect on achievement and retention of Biology. If the teacher plans some activities for the students, only those activities should be selected which can produce a significant difference from being taught in the conventional textbook approach.

The investigator hopes that this study will help to provide a deeper insight to science teachers about the effect of different types of activities. The study may also help to select and design suitable
activities for secondary school students.

Due to practical difficulties the effect of activity-oriented methods-I & II is studied by selecting a sample of secondary school students from the whole population. Only one topic could be taught due to time limitation and the results are based on it. Only one retention test could be administered.

The facilities in our schools are also a limiting factor even though the investigator has tried to provide specimens and apparatus to conduct the study.

1.8 ORGANISATION OF THE REPORT

The study is organized in five chapters. Chapter-I is an introduction to the study. The importance of activity curriculum and the theoretical background of activity method are discussed in this chapter.

Chapter-II is a review of related literature. Some of the related researches carried out by other research workers in this field are mentioned in this chapter.

Chapter-III presents a detailed account of the methodology followed by the researcher. The hypotheses of the study, variables, objectives, design and the data collection procedure is discussed in this chapter.

Chapter-IV analyses the data collected using suitable statistical
techniques. The interpretation of the results is also highlighted in the
4th chapter titled, “Analysis and Interpretation of the data”.

The last chapter gives the conclusions of the study. A summary
of the findings and the conclusions derived are mentioned. A brief note
about the study by the investigator is given in this chapter along with
suggestions for further study. The hypotheses, objectives and
methodology are also given in brief.

Bibliography and Appendices are given at the end.