Chapter I

Introduction

1.0 Introduction:

Mathematics is very important subject for human society. It is a subject which has its own culture. Mathematics helps person to develop his logical abilities. It also plays an important role in development of civilization.

The National Policy on Education (1986) has also considered the importance of mathematics in general education and suggests that 'mathematics should be visualized as the vehicle to train a child to think, reason, analyze and to articulate logically. Apart from being a specific subject it should be treated as concomitant to any subject involving analysis and reasoning'. In the recent past there have been tremendous developments in theories of learning and the science of teaching. Though mathematics occupies a place of importance, the researches in this area have been scanty.

‘How to teach’ is a really difficult problem for the teacher. Teaching, as it is generally said is an art. The methods are the ways to understand and practice the art. ‘How to impart mathematics knowledge? How to enable the child to learn?’ are the questions to be answered.

It is said and accepted by all that the science and mathematics are very important subjects. In the subject of Science students learn so many things by doing experiments in laboratory. For division of Science such as physics, chemistry, and biology laboratories are compulsory. Without laboratory practical teaching of science is not possible. But for mathematics subject, laboratory teaching is not compulsory. One can teach mathematics without laboratory teaching. But with a view of developing student’s interest and attitude towards the subject, it is thought that the use of laboratory teaching will be beneficial in mathematics teaching. Generally it is believed that mathematics is an abstract subject but it is also an experimental subject. Through laboratory teaching, the teachers can help students to understand the abstract concepts of mathematics.

The idea of mathematics laboratory is very new for school teaching. Recently the mathematics laboratories are compulsory in all CBSE schools for classes IX and X from 2006-07. So this is the right time to think that GSEB should introduce mathematics laboratory and mathematics practical to enhance the knowledge of our students. If this
can be done definitely student’s interest and attitude towards mathematics subject can be raised up, on the other hand we have to check the effects of laboratory teaching on achievement of students in Mathematics.

The present study is concerned with the development and implementation of laboratory teaching programme which can make positive effect on achievement of students of standard VIII in mathematics.

1.1 Goal of teaching of mathematics:

The process of education can be kept on right lines only with the help of clear-cut aims. Aimlessness in teaching would result in the wastage of time, energy and other resources. According to Kulbir Singh Sidhu-

“Knowledge of education values helps the teacher to avoid aimlessness in teaching. Value is the spring board of aim and vice-versa” [23, P2]*

There are three main values of mathematics, Practical or utilitarian value, Disciplinary value, Cultural value. Aim will be based on the educational values of the subject. One can prepare a long list of goals of teaching mathematics. These aims pertain to the entire school stage. Apart from enabling the student to acquire essential mathematical knowledge, skills, interests and attitude, the teaching of mathematics has to help them in many ways. Aims of teaching mathematics are as follows-

Utilitarian aim:

Mathematics will be taught primarily for its practical values and aims. The students will be given mathematical knowledge and skills needed in his day-to-day life and enabled to make use of that knowledge and skill. This aim makes the study of mathematics functional and purposeful and establishes relation between the subject and practical life.

Disciplinary aim:

The subject has also to be taught for its disciplinary and intellectual values. It has to aim at providing training to the mind of the learner and developing intellectual habits in him.

Cultural aim:

This aim helps the learner to understand the contribution of mathematics in the development of civilization and cultural.

It has enabled him to understand the role of mathematics in fine arts and in beautifying human life.

Adjustment aim:

It is help the learner to develop a healthy, purposeful, productive, exploratory and controlling adjustment with environment.

Social aim:

It is to help the learner to imbibe essential social virtues.

Moral aim:

It enables the learners to imbibe the attribute of morality.

Aesthetic aim:

It is to develop their aesthetic sensibilities, meet their varying interest and help them in the proper utilization of their leisure time.

International aim:

To develop in them international outlook and understanding.

Vocational aim:

It is to prepare them for technical and other vocations where mathematics is applied.

Inter-disciplinary aim:

To give them insight into the application of mathematics in other subjects.

Self-education aim:

It is to help them to become independent in learning.

Educational preparation aim:

It is to prepare them for higher education in science, engineering, technology, etc.

Development of powers aim:

It pertains to the development of powers of thinking, reasoning, concentration, expression, discovery, etc.

Harmonious development aim:
Ultimately the overall aim of teaching all the subjects including mathematics is to ensure all-round and harmonious development of the personality of the child.

1.2 Present Status of Mathematics teaching and learning:

The present status of teaching and learning of mathematics is far from being satisfactory and is not due to limitations on any one single component at work. In understanding the present status of mathematics teaching and learning, we need to introspect, the areas such as faculty problems, text books, syllabus, and lack of interactive methods of teaching.

(i) It is a widespread defect in any educational format that, teaching profession is least preferred for well qualified and befitting individuals. Usually qualified entities take up this job as a last resort to win the bread and butter. Apart from this, in some schools, besides teaching, teachers are given other responsibilities and as a result the teacher shows less interest towards his fundamental duty. Owing to the undue pressure of completing the administrative work assigned sometimes teachers miss the classes leading to complacency and sometimes overlook their duty. In some cases teaching is carried out as a mere formality and other works take priority.

(ii) There is too much of dogmatism in the gist provided in text books. Practical utility of the concepts learnt by children is totally missing. Students learn the concept by rote memory and reproduce the same either as homework or in tests. However a slight change is seen after NCF – 2005. This framework has revamped the curriculum to make few additions such as mathematical modeling, which directly deals with the implications of mathematical knowledge in real life situations.

(iii) The methods of teaching adopted are teacher-centered. Teachers follow age old methods such as lecture method (Chalk & Talk) in a classroom. As a result, the power of thinking, understanding and retention are not developed amongst students. Owing to which, the students show less interest towards mathematics learning. It is a known fact that, quality in teaching is directly proportional to student’s performance. However the methods of teaching being followed by teachers have left no scope for an effective communication between them and students and it goes to negative significance when a large chunk of 45 to 50 students are being handled by a mathematics teacher in the present day classroom. Furthermore, teaching of any subject in an interesting way is subject to an appropriate pedagogy. Undoubtedly, the traditional methods being used all along have served the society. However, these methods at large have failed to develop the skills such as (i) Skill of formulating, modeling, and solving problems from diverse and changing areas; (ii) Interest in, knowledge of, and flexibility across applications; (iii) Knowledge of and experience with computation, (iv) Communication skills, spoken and written and (v) Adeptness at working with colleagues (teamwork). It is therefore, an
alternate method of Instruction is require (teaching) which acts like a concomitant between teacher and learner to have effective and meaningful communication so that learning of mathematics is realistic in terms of achieving the aims and objectives laid down by National Curriculum Framework 2005, besides becoming a pleasant activity.

1.3 Justification of the present study:

Pupils who are good in mathematics consists one of the nation’s most valuable assets. The future of any nation depends upon the pupils who are good in mathematics. Hence mathematics is an important subject for development of a country. So mathematics teaching is also very important.

According to Mohammad Miyan in a trend report

“'The commission points out that, 'In the teaching of mathematics emphasis should be more on the understanding of basic principles than on the mechanical teaching of mathematical computations. Commenting on the then prevailing situation in schools, it observed that in the average school today instruction still conforms to a mechanical routine, continues to be dominated by the old besetting evil of verbalism and therefore remains as dull and uninspiring as before.”’ [47, P1]

This remark shows that there is a scope of research in mathematics teaching. In the same report Mohammad Miyan pointed out.

“The major issues before teacher educators in mathematics are in-depth study of the mathematics curriculum, curriculum renewal, refining teaching methods in mathematics in the light of the advances in the science of pedagogy on the one hand and educational technology on the other. Currently, the scope of the study remains limited and the validity of conclusions remains restricted. What is needed is a proper selection of problems, especially in the area of methods of teaching mathematics, planning long-term studies, trying out various methods of teaching and measuring multi-dimensional outcomes among students as a result of the teaching exercise. After all, each method of teaching has its limits in developing abilities and skills among students with respect to various branches of mathematics.” [47, P9]

The traditional didactic method of teaching is no longer adequate to meet the demands of mathematics education in line with National Education Policy 1986. In the light of National Education Policy 1986, to develop the skills reiterated in the policy and to provide practical experience of mathematical concepts, assumption, assertions and rules an appropriate method of instruction or a suitable platform to use such strategies is the need of the hour.

According to A.R.Rao
“The unpopularity of the subject may be due to the extremely abstract nature of subject or deficiencies in our teaching methods. Mathematics is abstract and we do not decry this aspect. But, we felt that, as a remedial measure, providing the pupil some experience in mathematics laboratory cannot give insight, but enable one to understand better, appreciate and even enjoy the study of the subject.”[20, Preface]

Hence above all reference, it is necessary to do research in laboratory teaching method. There are several method of mathematics teaching like Lecture, Dogmatic, Inductive - Deductive, Heuristic, Analytic-Synthetic, Laboratory, Project, Topical, Concentric and problem solving. Among these methods in laboratory method students will do experiment. Mathematics is such a subject which has to be learnt by doing rather than by reading. The doing of mathematics, give rise to the need of a suitable method and a suitable place. Laboratory method and mathematical laboratory are the proper answer to it. This activity method leads the students to discover mathematical facts. This method is based on the principle of ‘learning by doing’, ‘learning by observing’ and the proceeding from concrete to abstract. In one sense, it is only the extension of Inductive method. It is more elaborated practical form of Inductive method. In this method students do not only listening information but do something practically, also principle have to be discovered generalized and established by students. This method helps to decrease the abstract nature of mathematics. It makes the subject interesting as it combines play and activities.

Laboratory method is interesting and joyful for learner. He likes to do something with his hands. The learner acquires a clear understanding of the subject. He finds and discovers fact with his own effort. It provides great scope for independent work and individual development. It helps in the growth of self reliance. It inculcates the spirit of cooperation and exchange of ideas when the students are required to perform laboratory work in group. A successful experiment is a source of joy and encouragement to the learner. Shyness of hand is removed as the learner has to handle apparatus and material. The application of mathematics becomes increasingly evident to learner. Thus the subject becomes functional and meaningful to him.

Present study is concerned with the development and implementation of laboratory teaching programme which can produce above benefits of this method for students. Also in this study investigator checks the effect of this programme on students’s achievement in mathematics.

1.4 Title of the study:

The problem under study could be stated as:

“A study of the effectiveness of laboratory teaching programme on the achievement of the students of standard VIII in mathematics”
1.5 Key word and their meaning:

(i) Effectiveness

Effectiveness means bringing out of the result intended. Here effectiveness means the effect of laboratory teaching method on the achievement of the students of standard VIII in mathematics.

(ii) Laboratory teaching programme :( LTP)

Laboratory: A room or place with appropriate equipment for teaching or doing scientific work. [46]

Laboratory teaching programme: Here LTP is a set of 10 programmes which are used to teach mathematics. These programmes are constructed on the basis of laboratory teaching method. Each programme contains worksheets, mathematic models (Kit) and reading materials (if require). Hence LTP is a sequence of some lessons of mathematics subject which are constructed on the basis of laboratory teaching method.

(iii) Achievement:

“Achievement is generally used in the sense of acquired abilities to do, capacity to do or tendency to do.” [45, P1465]

According to International Dictionary of Education

“Performance in school or college in a standardized series of educational tests. The term used more generally to describe performance in the subject of the curriculum.” [25, P10]

(iv) Mathematics:

“Science of magnitude and number.” [25, P216]

Mathematics is such a school subject through which the mental faculty of human being is developed to think logically. Therefore, it is a must subject in education system.

1.6 Variables:

One of the objectives of the study is to study effect of LTP on the student’s achievement toward mathematics. So, treatment was chosen as an independent variable.

Several studies have shown that sex is an important biological factor that influences other variable like achievement. Hence, sex was taken as independent variable.
Intelligence quotient is an effective variable in nurturing the achievement of the students. So I.Q. was taken as independent variable.

Socio- Economic factors like standard of living, parent income and parental education have much influence on student’s achievement and his school performance. Hence, social economical status was also chosen as an independent variable.

Thus, there are four independent variables each of two levels. Achievement is the dependent variable. The details of these variables are shown in table 1.1

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of the variable</th>
<th>Nature of the variable</th>
<th>Number of level</th>
<th>Name of the level</th>
</tr>
</thead>
</table>
| 1       | Treatment(LTP)*      | Independent            | 2               | 1. Treatment (A<sub>1</sub>)  
               |                      |                        |                 | 2. No treatment (A<sub>2</sub>) |
| 2       | Sex                  | Independent            | 2               | 1. Boys(B<sub>1</sub>)       
               |                      |                        |                 | 2. Girls (B<sub>2</sub>)       |
| 3       | IQ*                  | Independent            | 2               | 1. High IQ(C<sub>1</sub>)    
               |                      |                        |                 | 2. Low IQ(C<sub>2</sub>)       |
| 4       | SES*                 | Independent            | 2               | 1. High SES(D<sub>1</sub>)   
               |                      |                        |                 | 2. Low SES (D<sub>2</sub>)     |

Achievement is considered as dependent variable.

* LTP: laboratory teaching programme, I.Q: Intelligence Quotient, SES: Social Economical Status

1.7 Objectives of the study:

Every work is base on certain objectives because without objective one can not get idea to plan his work. The purpose of this study was to investigate the effects of LTP on achievement of students in mathematics. This study was undertaken with the following objectives:

1. To construct the laboratory teaching programme in mathematics of standard VIII.
2. To implement the laboratory teaching programme and to study its effects on pupil’s achievement in mathematics.
3. To study the main effect of factors like sex, intelligence and social economical status on the achievement.
4. To study the interaction effect of treatment, sex, intelligence and social economical status on achievement of students in mathematics.
1.8 Hypotheses:

In present study, the hypotheses are formulated on the bases of objectives and variables. They are as mentioned below.

H01: There is no significant difference between the achievement of control group and experimental group.

H02: There is no significant difference between the achievement of boys and girls.

H03: There is no significant difference between the achievement of pupils of low I.Q group and high I.Q group.

H04: There is no significant difference between the achievement of pupils of low S.E.S group and high S.E.S group.

Hypotheses for interaction effects:

First order interaction effects:

H05: There is no significant effect of the interaction of treatment and sex on the achievement of pupils in Mathematics.

H06: There is no significant effect of the interaction of treatment and I.Q on the achievement of pupils in Mathematics.

H07: There is no significant effect of the interaction of treatment and S.E.S on the achievement of pupils in Mathematics.

H08: There is no significant effect of the interaction of sex and I.Q on the achievement of pupils in Mathematics.

H09: There is no significant effect of the interaction of sex and S.E.S on the achievement of pupils in Mathematics.

H010: There is no significant effect of the interaction of I.Q and S.E.S on the achievement of pupils in Mathematics.

Second order interaction effects:

H011: There is no significant effect of the interaction of treatment, sex and I.Q. on the achievement of pupils in Mathematics.

H012: There is no significant effect of the interaction of treatment, sex and S.E.S on the achievement of pupils in Mathematics.

H013: There is no significant effect of the interaction of treatment, I.Q. and S.E.S. on the achievement of pupils in Mathematics.

H014: There is no significant effect of the interaction of sex, I.Q. and S.E.S on the achievement of pupils in Mathematics.
Third order interaction effects:

H015: There is no significant effect of the interaction of treatment, sex, I.Q. and S.E.S on the achievement of pupils in Mathematics.

Following hypotheses were formed to check effects of treatment on achievement of student of different groups.

H016: There is no significant difference in achievement of boys of treatment group and control group.
H017: There is no significant difference in achievement of girls of treatment group and control group.
H018: There is no significant difference in achievement of high I.Q pupils of treatment group and control group.
H019: There is no significant difference in achievement of low I.Q. pupils of treatment group and control group.
H020: There is no significant difference in achievement of high S.E.S pupils of treatment group and control group.
H021: There is no significant difference in achievement of low S.E.S pupils of treatment group and control group.
H022: There is no significant difference in achievement of high I.Q. boys of treatment group and control group.
H023: There is no significant difference in achievement of high I.Q. girls of treatment group and control group.
H024: There is no significant difference in achievement of low I.Q. boys of treatment group and control group.
H025: There is no significant difference in achievement of low I.Q. girls of treatment group and control group.
H026: There is no significant difference in achievement of high S.E.S boys of treatment group and control group.
H027: There is no significant difference in achievement of high S.E.S. girls of treatment group and control group.
H028: There is no significant difference in achievement of low S.E.S boys of treatment group and control group.
H029: There is no significant difference in achievement of low S.E.S. girls of treatment group and control group.

1.9 Limitation of the study:

The present study is delimited as follows:

1. The study is limited to Gujarati speaking pupils only.
2. The study is limited to the pupils of one of the secondary school of Ahmedabad.
3. The study is conducted on the small sample which consists of 220 pupils of std. VIII.
4. LTP is prepared on the basis of the content of mathematics of standard VIII.
5. The study of the effect of LTP is only restricted to some closely related variables like Sex, I.Q. and SES.

1.10 The plan of report:

The following matter is the brief outline of the thesis. All the details of study are included so that any investigator who wants to replicate the experiment can do it with the help of the thesis. It has six chapters followed by references and appendices.

The first chapter includes the need, importance and significance of the study. It provides a outline for the whole thesis. The key words used in the statement of the problem are defined. The objectives of the study are explained and the limitations are stated. Also variables are mentioned.

The second chapter describes the reviews of some research works in the area of mathematics education.

The third chapter deals with planning and programme construction.

The fourth chapter deals with experimental design and execution of the programme. How the design and samples are chosen is explained. The tools used to measure the dependent and independent variables were described. It includes the observations of the investigator during the experiment.

The fifth chapter contains the data and its analysis using ANOVA. The hypotheses for main effects and interaction effects were tested.

The sixth chapter contains the summary of research work, observations, conclusions, educational implications and suggestions for further study.

At the end of the report, book and references consulted with the present study have been listed. The appendices include the programme and tools used for measuring the dependent and independent variables.