Chapter I

INTRODUCTION

1.1 Background of the Study
1.2 Mathematics Learning
1.3 Experiential Learning Theory
1.4 Need and Significance of the Study
1.5 Statement of the Problem
1.6 Operational Definition of Key Terms
1.7 Objectives of the Study
1.8 Hypotheses of the Study
1.9 Methodology in Brief
1.10 Scope of the Study
1.11 Limitations of the Study
1.12 Organization of the Study
INTRODUCTION

1.1 Background of the Study

“The mediocre teacher tells
The good teacher explains
The superior teacher demonstrates
The great teacher inspires”

-- William A. Ward

The most distinctive feature of modern society is its science based technology which has been making a professional impact not only on the economic and political life of the country, but on its educational system. The recent changes in the concept of teaching - learning process have led to the development of new areas of educational endeavour. It is the awakening of curiosity, the stimulation of creativity, the development of proper interest, attitude and values and the building of essential skills such as independent study.

Now a days the teaching – learning to a great extent, is a process in which the individual learner is expected to take up challenges through an inevitable intellectual revolution. The learner is the person who creates new understanding for him/herself. The teacher coaches, moderates, suggests, but allow the
learner to experiment, ask questions and try things that don’t work. An important part of the learning process is that learners reflect on and talk about their activities and also set their own goals and means of assessment. They control their own learning process, and they lead the way by reflecting on their experiences.

The process of learning has been a source of amazement, fascination, and study for centuries. Investigators have continually attempted to describe both animal and human learning in a wide variety of interactions and contexts. More recently, large number of actual experiments has been conducted and numerous theories have emerged, many describing in minute detail with respect to the learner and the manner in which learning can be enhanced. Others have chosen to adopt a comparatively broad interpretation of the learner and have satisfied themselves with a rather general description of the learner as a passive recipient in the learning process. Others have contented that children must be actively involved both mentally and physically (Post, 1992).²

1.2 Mathematics Learning

Mathematics is a self-contained mental discipline, with its own language, tools, structure and mode of operations. Besides being an independent subject, it has its applications in other branches of knowledge and is a mental tool for the training and experience of intellectual functions. Unlike many sciences,
mathematics causes permanent changes in people’s life, and affects their interpretation of the world.

Mathematics plays an integral role in the lives of every member of our society. The need for mathematical knowledge is increasing as our culture becomes more saturated with technology and information. Everyone in our educational system must have an opportunity to learn mathematics and to achieve a level of knowledge commensurate with his/her personal potential needs and aspirations. Mathematical knowledge opens doors of opportunity. Thus, mathematics education must be accessible to all. Today's society is technological in nature, resulting in an increasing demand that citizens possess an adequate understanding of mathematics

Mathematics is a difficult subject to learn, and an even more difficult subject to teach well. Mathematics understanding is difficult to define precisely in any given context. It is worth noting that whilst some aspects of mathematics require deep reflection and mental restructuring and other aspects of mathematics require different approaches. Mathematical knowledge includes a number of distinct aspects or elements which require different teaching approaches to develop best effect.

The very aim of Mathematics education has to be viewed differently. It should no longer be taken as concerned primarily of
imparting knowledge, but a process of awakening curiosity, development of proper interest and attitude. There are many means of arousing and maintaining interest. One of the ways is through experiencing.

Teaching of Mathematics has been a challenge to the teachers since the origin of human race. Traditional Mathematics teaching is based on an authoritative figure (usually the teacher) giving out information in a non-contextual way without relevance to the life of most of the students. Learning is based on remembering and correctly applying often complex and unconnected algorithms. The examples, exercises and problems used are usually contrived and bear no relevance to or reflect few of the issues relevant to young people. Mathematics classrooms are predominantly arranged in ways that encourage students to work individually. The opportunity to discuss and talk through issues to form knowledge is often rare. Students often get the feeling that Mathematics classrooms are different to their experiences in other subjects. In Mathematics classrooms the answers are always known and this offers students little opportunity for creativity and discovery. Such a view of mathematics classrooms suits the preferred learning style of separate knower but is in contrast to the preferences of connected knower.
To teach mathematics in schools is a highly creative and complex endeavor. Debates over the nature of good mathematics teaching are as old as teaching itself. According to Simmons (1993), Good Mathematics teaching should lead across into a number of activities designed to build confidence, improve awareness of teaching situations and strategies, higher knowledge of the processes involved in learning and doing mathematics, help to gain experience of available resources.

Educational research has provided clear evidence from a variety of different sources about a number of features and approaches which are common to most successful lessons in mathematics. For the last 25 years, research has been focused on teaching and learning in mathematics classrooms (Tanner and Jones, 1999). Research in effective teaching supports the use of a variety of teaching strategies (Brophy & Good, 1986). There are two reasons why it is useful to employ variety in the way to teach Mathematics. Firstly, the student responds differently to various ways of teaching. Some students learn effectively through silent reading, others do not and some students benefit from direct instruction, others seem to learn more from inquiry methods. It indicates a degree of sensitivity to make provisions for a wide range of learning styles. Secondly, gain from variety in instruction. A class is simply more interesting and appealing when students
can look forward for discussions, hands on projects, games, demonstrations and other strategies.

Constructivism has emerged as one of the main philosophies of mathematics education (Ernest, 1991; Von Glasersfeld, 1991). In using constructivism as a philosophical basis of mathematics education is beneficial because there are genuine insights available that could dramatically transform the current practice of mathematics education. Reciprocally, the practice of mathematics education stands to transform and enlarge aspects of constructivism that can be achieved by no other means.

1.3 Experiential Learning Theory

Experiential Learning Theory (ELT) draws on the work of prominent twentieth century scholars who gave experience a central role in their theories of human learning and development – notably John Dewey, Kurt Lewin, Jean Piaget, William James, Carl Jung, Paulo Freire, Carl Rogers and others. The theory detailed in *Experiential Learning: Experience as the source of learning and Development* (Kolb, 1984), is built on six propositions that are shared by these scholars.

- Learning is best conceived as a process, not in terms of outcomes.
- All learning is relearning.
• Learning requires the resolution of conflicts between dialectically opposed modes of adaptation to the world.

• Learning is holistic process of adaptation to the world.

• Learning results from synergetic transactions between the person and the environment.

• Learning is the process of creating knowledge.

Experiential Learning Theory defines learning as “the process where by knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience” (Kolb, 1984). Experiential learning is a process of constructing knowledge that involves a creative tension among the four learning modes that is responsive to contextual demands. This process is portrayed as an idealised learning cycle or spiral where the learner “touches all the bases” – experiencing, reflecting, thinking, and acting – in a recursive process that is responsive to the learning situation and what is being learned. Immediate or concrete experiences are the basis for observations and reflections. These reflections are assimilated and distilled into abstract concepts from which new implications for action can be drawn. These implications can be actively tested and serve as guide in creating new experiences. ELT proposes that this idealised learning cycle will vary by individuals’ learning style and learning context.
ELT posits that learning is the major determinant of human development and that how individuals learning shape the course of their personal development. Previous research (Kolb, 1984) has shown that learning styles are influenced by personality type, educational specialisation, career choice, and current job role and tasks. The concept of learning style describes individual differences in learning based on the learner’s preference for employing different phases of the learning cycle. Because of the hereditary equipment, life experiences, and the demands of present environment each one develops a preferred way of choosing the learning modes. Learning Style Inventory has identified four learning styles that are associated with different approaches to learning – Diverging, Assimilating, Converging, and Accommodating (Kolb, 1971, 1985, 1999).

1.4 Need and Significance of the Study

The value of experience as a tool in the creation of knowledge and the fostering of human development was seen as early as 4th century B.C. It is primarily with the work of John Dewey (1987) that learning through experiences has been valued as an important foundation in formal educational setting. Dewey challenged educators in the 1910’s, 1920’s, 1930’s to develop educational programmes that would not be isolated from real life experience. There was a boom in the 1960’s and 1970’s with the
work of many Psychologists, Sociologists and Educators who believed in the value of experience not necessarily as a replacement to theory and lecture but in addition to it. Among these are Piaget, Bloom, Friere, Gardner, and Lewin.

In terms of learning, experiential learning can be described as a process by which the experience of the learner is reflected upon, and from this emerge new insights or learning. Each person represents a unique combination of personality traits, intellectual aptitudes, and cognitive tendencies. As a result, people prefer to learn in different ways. Differences in perceptual preferences for learning, tendencies towards kinesthetic Vs tactile cognition, and aspects of individual personality characteristics define individual learning style. Research in the field of individual learning styles can benefit the process of developing instructional material by identifying the needs of learners who possess the full range of human cognitive tendencies.

More recently, David A. Kolb (1971) has taken the gauntlet in support of experiential learning stating that learning is multi-dimensional process. Kolb (1971) developed the most established model of experiential learning and in his model, the process begins with an experience (concrete experience), followed by reflection (reflective observation). The reflection is then assimilated into a theory (abstract conceptualization) and finally these new
hypotheses are tested in new situations (active experimentation). The model is a recurring cycle within which the learner tests new concepts and modifies as a result of the reflection and conceptualization.

The term “learning style” refers to a variety of theoretical constructs and cognitive models. Some of these various paradigms differ from each other in significant ways, however, most of the theoretical structures that use the term “learning style” relates to the concept of individual differences in the dominant cognitive modality used for the learning process. Some of the most significant studies on learning style theory include Fox (1984)\(^\text{13}\) and Armstrong & McDaniel (1986)\(^\text{14}\) who assess learning styles among adult learners in various post secondary environments, Eiszler (1982)\(^\text{15}\), who studies the learner’s preferred sense modality.

Research in education and applied psychology has produced a number of insights in to how students think and learn, but all too often the resulting impact on actual classroom instruction is uneven and unpredictable. Research in mathematics education has been no less productive (Schoenfeld, 2000).\(^\text{16}\) Decades of research in education suggest that students utilise individual learning styles (Bloom, 1956;\(^\text{17}\) Felder, 1996;\(^\text{18}\) Gardner & Hatch, 1998)\(^\text{19}\) and instruction should therefore be multifaceted to
accommodate a variety of learning styles (Bodi, 1990; Dunn & Dunn, 1993; Felder, 1993; Liu & Reed, 1994).

There has been considerable interest in the study of international practices for Mathematics teaching in Asia. Recent assessments have indicated that students in several Asian countries such as Japan, Hong Kong, Korea and Singapore have intended to score above international averages (Kelly, Mullis & Martin, 2000). In order to explore possible explanations for these achievement differences, an international study has been conducted to examine cultural factors, such as Mathematics curriculum and content, student characteristics and learning styles (International Commission on Mathematical Instruction, 2000).

In the modern mathematics movement, the old mathematics curriculum was replaced by the new curriculum in the form of new school mathematics text-books, and institutes were held for mathematics teachers to prepare them to teach the concepts and principles of the new curriculum. But little attention was given, in either the institutes or the new textbooks, to the nature of mathematical knowledge that would influence the practice of mathematics education. As a consequence, teachers simply taught modern mathematics in the same way that they had taught the old mathematics. Achievement in mathematics of students is significantly lower than other subjects. The interest and attitude
towards mathematics is deteriorating day by day. Hence there is
a need to think of a new strategy which will improve
achievement of students in mathematics. David A. Kolb’s (1984)\textsuperscript{8}
theory of experiential learning provides a model for the process
of knowledge acquisition and posits a typology of individual
learning styles. Kolb’s typology describes individual learning
style in terms of both the preferred modality for “apprehensions”
of new information and the preferred modality for processing
new information.

In many countries, Kolb’s experiential learning and learning
style studies are conducted in various disciplines especially
Management Education, Nursing Education, Social science and
Adult Learning. A careful review conducted by the investigator of
the earlier studies in India and abroad could find that not much
has been done in Kolb’s experiential learning on achievement in
mathematics. Thus the investigator made concerted efforts to
study the effect of Kolb’s experiential learning model on
achievement in mathematics of students at secondary level. Hence
the importance of the study.

1.5 Statement of the Problem

In terms of learning, experiential learning can be described
as a process by which the experience of the learner is reflected
upon, and from this emerge new insights of learning. Therefore the
topic for investigation is entitled as **EFFECTIVENESS OF KOLB’S EXPERIENTIAL LEARNING MODEL ON ACHIEVEMENT IN MATHEMATICS OF STUDENTS AT SECONDARY LEVEL.**

1.6 Operational Definition of Key Terms

1.6.1 Effectiveness

Use of a plan for instruction or presentation which causes a desired change in learner’s behaviour (Good; 1973).\(^6\) Effectiveness refers to a favourable learning outcome.

1.6.2. Kolb’s Experiential Learning Model

David A. Kolb developed the most established model of experiential learning. In this model the process begins with experience (concrete experience), followed by reflection (reflective observation). The reflection is then assimilated into a theory (abstract conceptualization) and finally the new or reformulated hypotheses are tested in new situations (active experimentation). The model is a recurring cycle within which the learner tests new concepts and modifies them as a result of the reflection and conceptualization.

1.6.3. Achievement in Mathematics

Achievement in mathematics refers to the total scores obtained by an individual as measured in the achievement test constructed by the investigator.
1.6.4. Secondary Level

Secondary level as used in the study refers to students attending standards VIII, IX and X in schools of Kerala. For the present study, the investigator has selected students of standard IX.

1.7 Objectives of the Study

1. To identify the learning style of students at secondary level.

2. To find out the achievement in mathematics of students taught using Kolb’s Experiential Learning Model and Activity Oriented Method.

3. To compare the achievement in mathematics of students taught using Kolb’s Experiential Learning Model and Activity Oriented Method.

4. To compare the achievement in mathematics of students taught using Kolb’s Experiential Learning Model and Activity Oriented Method with respect to their learning styles.

5. To find out the mathematics interest of students taught using Kolb’s Experiential Learning Model and Activity Oriented Method.
6. To compare the mathematics interest of students taught using Kolb’s Experiential Learning Model and Activity Oriented Method.

7. To compare the mathematics interest of students taught using Kolb’s Experiential Learning Model and Activity Oriented Method with respect to their learning styles.

8. To find out the mathematics attitude of students taught using Kolb’s Experiential Learning Model and Activity Oriented Method.

9. To compare the mathematics attitude of students taught using Kolb’s Experiential Learning Model and Activity Oriented Method.

10. To compare the mathematics attitude of students taught using Kolb’s Experiential Learning Model and Activity Oriented Method with respect to their learning styles.

11. To assess the retention of achievement in mathematics of students taught using Kolb’s Experiential Learning Model and Activity Oriented Method.

1.8 Hypotheses of the Study

Keeping in view of the objectives of the study, the following hypotheses were formulated.
1. The students at secondary level belong to different learning style categories.

2. The achievement in mathematics of students taught using Kolb’s Experiential Learning Model is significantly higher than that of those taught using Activity Oriented Method.

3. The achievement in mathematics of students taught using Kolb’s Experiential Learning Model is significantly higher than that of those taught using Activity Oriented Method with respect to their learning styles.

4. The mathematics interest of students taught using Kolb’s Experiential Learning Model is significantly higher than that of those taught using Activity Oriented Method.

5. The mathematics interest of students taught using Kolb’s Experiential Learning Model is significantly higher than that of those taught using Activity Oriented Method with respect to their learning styles.

6. The mathematics attitude of students taught using Kolb’s Experiential learning Model is significantly higher than that of those taught using Activity Oriented Method.

7. The mathematics attitude of students taught using Kolb’s Experiential Learning Model is significantly higher than
that of those taught using Activity Oriented Method with respect to their learning styles.

8. The students taught using Kolb’s Experiential Learning Model have better retention of achievement in mathematics than that of those taught using Activity Oriented Method.

1.9 Methodology in Brief

Experimental verification was necessary to determine the effectiveness of the Kolb’s Experiential Learning Model of teaching over the Activity Oriented Method. Thus the study was conducted by using experimental method and the design selected was pre test-post test non-equivalent group design (Best & Kahn; 2004).27

For the experimental study, four schools were selected from Kottayam district, giving due weightage to gender, and type of school. The sample for the experiment consisted of 326 students of standard IX from eight divisions of the four secondary schools (two divisions from each school) selected for the study. Four divisions (one from each school) were considered as experimental group and the other four divisions (one from each school) were considered as the control group. Both the experimental and control group consisted of 163 students each. These students were selected by considering the gender and type of school. The experimental group was taught using the Kolb’s Experiential learning Model and the control group was taught using Activity Oriented Method.
**Tools Used**

The most important tools used for the study are

(1) Lesson Transcripts Based on Kolb’s Experiential Learning Model of teaching (prepared by the Investigator)

(2) Lesson Transcripts Based on Activity Oriented Method of teaching (prepared by the Investigator).

(3) Kolb Learning Style Inventory (Adapted version).

(4) Raven’s Standard Progressive Matrices.

(5) Achievement Test in Mathematics (prepared by the Investigator)

(6) Mathematics Interest Inventory (prepared by the Investigator)

(7) Mathematics Attitude Scale (prepared by the Investigator)

(8) Delayed Memory Achievement test (prepared by the Investigator)

The investigator himself conducted classes in both the groups. Before the experimental treatment, the investigator compared the previous achievement in mathematics of students and their general mental ability. The different learning styles of students were identified using Kolb Learning Style Inventory (Adapted version). Pre-tests were also conducted by administering the achievement test, mathematical interest inventory and mathematical attitude scale in both the groups. After the experiment, the tests given as pre-test were administered again to
both the groups as post tests. In addition to that a delayed memory achievement test was also administered to both the groups about one month after the completion of the experiment.

**Statistical Techniques Used**

The scores obtained by the students in the pre-test and post-test were classified, tabulated and subjected to statistical analysis. This includes comparison of mean scores of pre-test scores, post-test scores, gain scores and post delayed achievement test scores using ‘t’ test with a view to get a formal conclusion of the comparative effectiveness of the treatment. More precise conclusion was arrived at using the technique - Analysis Co-variance.

1.10 Scope of the Study

The major scope of the present study is to evolve of a new instructional strategy to teach mathematics at secondary level. The Kolb’s Experiential Learning strategy was adopted as an effective means to attain the accomplishment in learning Mathematics. This necessitates the identification of the learning styles of each student and vivid treatment according to their learning styles. Enhancement of specific type of thinking and action according to their learning styles is made possible through the use of such a strategy. This strategy can help the secondary school students to learn more meaningfully and effectively the content of mathematics which is usually abstract in nature. This
will also help the young learners to develop an interest in mathematics and ultimately develop a positive and scientific attitude towards the study of mathematics.

The findings of the study would help the curriculum framers and those who are related to the field of education to understand the necessity and effectiveness of the application of this new model in teaching of mathematics. The study also gives opportunities for a wide range of learning activities according to students learning styles and to promote creativity in thoughts and actions of students in a quite natural way.

It is further hoped that the procedure adopted for the present study is adequate to throw light on the problem under investigation. It is hoped that the suggestions of the study may serve as guidelines for teachers and students to make teaching and learning a more enjoyable task.

1.11 Limitations of the Study

In spite of all possible precautions taken up, certain limitations have crept into the study.

- The study was confined to only four schools in Kottayam district. More generalized result would have been obtained if different districts had been taken for the study.
• The study was limited to students of standard IX studying in Kerala state syllabus

• The study would have been better if more models could be included in the study.

• The shortage of experimental duration was another limitation.

• The investigator selected the classroom intact groups for experimenting, as the one-to-one equalized group was not possible practically.

Despite the above mentioned facts, all possible attempts have been made to make the study as valid and reliable as possible. It is hoped that the results of the present study would be helpful in finding new frontiers in the field of education.

1.12  Organization of the Report

The report of the study is structured in six chapters

Chapter I is the introductory chapter contains background of the study, the need and significance of the study, statement of the problem, definition of key terms, objectives of the study, hypotheses formulated for the study, methodology in brief and scope of the study, limitations of the study and organisation of report.
Chapter II contains the theoretical background of experiential learning, learning styles, background and nature of Kolb’s Experiential Learning

Chapter III presents a brief review of related literature and reported research findings pertaining to experiential learning, learning styles, Kolb’s experiential learning, mathematics teaching strategies

Chapter IV is the methodology chapter gives the description of the method adopted, designs of the study, description of tools used, and sample selected for the study, data collection procedure, scoring, consolidation of data and the statistical techniques used in the study.

Chapter V gives a detailed analysis and interpretations of the results of the data.

Chapter VI contains a summary of the findings and major conclusions of the study together with educational implications and some suggestions for further research.
Reference


