CHAPTER I

INTRODUCTION

1.1 BACKGROUND OF THE STUDY
1.2 MATHEMATICS EDUCATION
1.3 PEER TUTORING - A POTENTIAL INSTRUCTIONAL STRATEGY
1.4 NEED AND SIGNIFICANCE OF THE STUDY
1.5 STATEMENT OF THE PROBLEM
1.6 DEFINITION OF KEY TERMS
1.7 HYPOTHESES
1.8 OBJECTIVES OF THE STUDY
1.9 METHODOLOGY IN BRIEF
1.10 SCOPE OF THE STUDY
1.11 LIMITATIONS OF THE STUDY
1.12 ORGANISATION OF THE REPORT
Chapter 1 Introduction

1.1 BACKGROUND OF THE STUDY

We are in an age of knowledge explosion. Rapid changes are taking place in all spheres of life. As a result, new methods and strategies are evolving in the educational area also. The older concept of education is no more relevant in meeting the challenges of the present time. This shift in emphasis from conventional approach in teaching to that of re-conceptualization techniques of instruction and evaluation is relatively new and developing at a faster rate. Today there is a new trend in perspective to consider learning as experienced by the learner and not as perceived by the teacher.

The No Child Left Behind (NCLB) Act of 2001 requires universal student achievement of state standards. The strength of NCLB is its challenges to educators to confront disparities in student achievement. The weakness is NCLB’s assumption that improvement of students learning is continuous and consistent and can be accomplished in a fixed amount of time, regardless of students starting place (Rose, 2004). To meet the challenges of NCLB, teachers increasingly face the instructional dilemma of bringing whole group of students 'to standard' on high stakes test while finding ways to individualize instruction to meet the needs of students whose performance is not continuous or consistent.

One of the functions of education as perceived by the public today is to prepare the youth of today into citizens and workers for the world of tomorrow. Successful learning depends on a constant flow of information that helps the students not only to check on their learning but also to improve it (Singh, 2004). Teachers can help students to
understand the achievement target they need to hit. Teachers can use classroom activities and assessments to build student’s confidence in themselves as learners, provide students with constructive guidance and frequent feedback, adjust instruction to meet student’s needs and engage students in self-assessments and self-management. An instructional strategy like peer tutoring can help the teachers to meet the challenges of successful students learning.

Education has undergone multifaceted growth and progress in the present globalized scenario (Fiter, 2002). The new Activity Oriented Approach of instruction gives more emphasis to the learner’s ability to construct knowledge, how to interact with others and also test his ability to formulate tentative solutions to problems. Students expect challenging and activity-based learning experiences and only by integrating new methods and strategies of teaching-learning activities can they attain full-fledged knowledge in its totality. Hence the teacher as well as the student has to cope with the advancement in the education scenario through implementing innovative instructional strategies.

Instructional strategies are not long term and permanent paradigms to effect proper generation of knowledge. Instructional strategies and innovative approaches are to be implemented in the classroom for stimulating interest, retaining knowledge and challenging the thoughts of students. The students of today are living in a cyber-tech environment where paper and pencil often have little appeal. We know that learners differ in many ways. So the teachers have to rise to the challenge of meeting the needs of these diverse
learners, while keeping the integrity of quality and targeted standards, knowing the when, why and how of the method of teaching especially a subject like Mathematics. Today with the advent of modern information and communication technology devices, education concentrates on teaching students 'how to learn things and develop skills'. Knowledge without innovation is of no value. It is through the process of innovation alone that new knowledge can be created and which converts knowledge into wealth and social goods. In fact, innovation must become a way of life. Since 1990 innovative practices have been a part of education. It is converted by scientific thought, capabilities and techniques including strategies, methods, models and approaches. Enhancing the quality of the product of education – namely our students – has been a critical motive for change through years. The teachers have to instill in their students the spirit of scientific temper and rational thinking. All these point towards the holistic purpose of education, which is the intellectual, physical, emotional, social, moral, economic and artistic development of the student or child (Wadhwa, 2004).

Mathematics is considered to be one of the most difficult subjects in the school. The transaction in the ordinary Mathematics classroom is largely in the blackboard work of the teacher and in the notebook of the student. There is no emphasis on thought, understanding, initiative, judicious study and power. The mathematical concepts are treated mainly as heavenly concepts and never seem to come down to the earth. This is what makes Mathematics dull and difficult. So, in the Kerala secondary school examinations, a large
number of students fail in Mathematics. The wastage due to this failure in Mathematics has to be analysed and a strategy has to be developed.

Some of the students do not enjoy studying Mathematics because they do not know how to study that subject. Then the learning Mathematics becomes drudgery and even an average achievement level becomes an uphill skill. In order to study Mathematics effectively, it is not only necessary for students to be interested in the subject of study, but it is also necessary for them to possess the knowledge of effective method of study.

In process-oriented conception of teaching, the learner should construct knowledge actively. Whereas, when teacher is transmitting facts and procedures, learning tends to be mainly absorption of knowledge. Most of the teachers of today would like to teach everything and students also would like to be spoon-fed. Such teacher dominant practices have been followed in the teaching of Mathematics and as a result, Mathematics has become the most difficult subject for students.

The art of mathematics teaching is the novelty that the teachers use to include learners in the learning process based on their needs. It will be a very interesting and fruitful exercise if situations familiar to the students are analysed and explored their mathematical possibilities. A person who is helped to climb a coconut tree will require someone to help him climb another coconut tree. But a person who is taught how to climb a tree will climb any tree at any time without assistance from others. For this, in Mathematics learning appropriate pedagogic practices and episodes of teaching and learning need to be evolved.
Chapter 1 Introduction

besides keeping track of child’s interest and needs (Rao, 2004). Now the educational system focuses on Gardner’s (1983) Multiple Intelligence (MI) Theory which had undertaken the significance of shifting from teacher-centered learning to learner-centered education.

1.2 MATHEMATICS EDUCATION

Mathematics, the science of quantity and space, plays a vital role in life (Burton, 1999). Mathematics has got an honoured place among the sciences. It is the most powerful tool ever developed by man. Its contribution to the development of science, the place it occupies in contemporary society as an indispensable working tool of common man, its vital role in the affairs of man, all give it a position of pre-eminence among the different areas of knowledge. It has helped to advance the frontiers of knowledge to an unprecedented degree. No single subject can claim the universal application just like Mathematics. Mathematics is thus the foundation of the whole development of modern civilization. Mathematics of today is the result of the efforts made by a group of men for centuries and it reflects the culture and civilization of human race. It is said that the history of Mathematics is the history of human civilization. A perusal of human civilization reveals that Mathematics has its influence at every stage of human progress and development (James, 2006).

Mathematics is directly involved in all types of human action. Man in the primitive society was forced to recognize and manipulate numerical relationship. Thus he became a mathematician by necessity (Budd& Sangwin, 2001). Gradually measurement and evaluation grew
Chapter 1 Introduction

out of social demands. Thus the mathematical rules and principles came into existence. Commercial necessity was the force behind all mathematical inventions. Arithmathics developed as a result of man’s need to assess his wealth and geometry from surveying land. Similarly trigonometry and logarithm grew up to assist astronomy. One cannot ignore the contributions of various civilizations in the development of history of Mathematics, especially Greeks in geometry and Indians in arithmetic.

The cave man in need of numbering his possessions, the primitive man in need of exchanging his articles with others and the architect of early days attempting the construction of a building were all compelled to develop facially with numbers and measurements (Seruais& Varga, 1971). To the early astronomer, the sky itself presented a mathematical problem. Thus the number system, including fractions and decimals, the areas, volumes and time came into use. The mathematical relations conditioned and fashioned man’s existence.

Mathematics is an inevitable part of an individual’s life, in long planning and day-to-day planning. This subject has been a faithful companion of human beings right from human existence on this earth. In the present world, it seems impossible to live without having a basic knowledge of Mathematics. No other science can be substituted for Mathematics. The ignorance of Mathematics in the masses is a formidable obstacle in the way of the country’s progress. So it is the science of all sciences and art of all arts (Frunke, 2001).

Mathematics occupies a paradoxical position in our society. It is universally revered and everyone recognizes its utility. The wonderful
Page 8

Chapter 1 Introduction

achievements of Mathematics have glorified the modern world and illuminated the human creative potential (Selinger, 1994).

Mathematics fulfills the educational values such as practical, disciplinary, culture, intellectual, moral, vocational, aesthetic, social, interdisciplinary etc. Accuracy, exactness and precision compose the beauty of Mathematics. The study of Mathematics cures mental distraction and cultivates the habit of continuous attention. Also the habit of clarity, brevity, precision and certainty in expression are formed and strengthened by the study of Mathematics.

Mathematical knowledge required today is far higher than what was required a century back. Also in many cases, its value portrays the social and economic conditions of the society. In this complex world passing through scientific and technological age, the practical value of Mathematics is increasingly felt and recognized. This has got its implication in the teaching of Mathematics in the beginning stage.

Mathematics is isolated from life. It is actually required in every aspect of human life, activity, knowledge, understanding and interest. Some of the important aspects of our cultural heritage have been preserved in the form of Mathematics knowledge only, and the learning of Mathematics is the only medium to pass on this heritage to coming generations. Hence the mathematical teaching in all levels and in all stages should be always related to practical life applications. Thus Mathematics has a vital role and its importance cannot be denied in school curriculum.
Chapter 1 Introduction

1.3 PEER TUTORING - A POTENTIAL INSTRUCTIONAL STRATEGY

Concurrent with the process of globalization, the pendulum in education is swaying towards interactive ways of learning or teaching. Education, in the past decades, has experienced a shifting paradigm from text-based pedagogy towards contest-focussed andragogy. And some modern approaches like peer tutoring are rapidly evolving by virtue of the demand of such context. Peer tutoring strategies enlist the use of classmates to promote or mediate learning and engagement of other children (Polirstok, 1986). The most succinct definition of peer tutoring comes from Damon and Phelps (1988): "Peer tutoring is an approach in which one child instructs another child in material on which the first is an expert and the second is a novice".

It is likely that peer tutoring has been part of human existence since the Hunter Gatnerer times. As Jenkins and Jenkins (1987) write, "Tutorial instruction (Parents teaching their offspring how to make a fire and to hunt and adolescents instructing younger siblings about edible barriers and roots) was probably the first pedagogy among primitive societies". Wanger (1990) on the other hand, traces the historical origins of peer tutoring in Western civilization back to Greece in the first century A.D. and through Rome, Germany, other European locales and finally America. Topping’s (1988) history dates the formalized use of peer tutoring back to the 1700s. Other academics trace peer tutoring back to the 'Monitorial System' of the early nineteenth century (Bland&Harris, 1989). So the concept of peer tutoring is not new. Pioneered in the late 18th and early 19th centuries by Andrew Bell and Joseph Lancaster, peer tutoring has been revived,
particularly in United States of America and in developing countries, to meet situations of crisis in education process (Smith, 1983).

Peer tutoring is a way of facilitating and equipping students to learn through team-building, critical and innovative thinking and win-for all dynamics shared in the role of the teacher as a facilitator who at the same time monitors, intervenes and evaluates group and individual performance (Goodlad et al. 1989). Any teacher can readily arrange for abler pupils (tutors) to help less able ones (tutees) within a single class. In such circumstances, students are motivated to attain learning in groups of varying sizes, negotiating, planning and evaluating together. Instead of working as individuals in unfair competition with every other individual in the classroom, students are given the responsibility of creating a learning community where all students participate in meaningful ways such as learning from one another, peer pair assessment, team processing etc. In short, when students are motivated to act as resources for each other, learning becomes an enjoyable experience and teachers can meet the challenge of successful students learning.

Peer tutoring is not one defined procedure that fits all learning situations. According to Webb (1989) the most widely used formats of peer tutoring are: class wide, cross-age, small group, one-to-one, and home-based tutoring.

The process of implementing peer tutoring depends on the specific instructional approach you choose. Regardless of the strategy you choose, it is important to follow the process strictly to ensure positive outcomes for all students. It is strongly related to the cognitive
learning theory. Effective peer tutoring is not a haphazard volunteer programme. It requires a purposeful programme of specific learning objectives, activities and assessment for developing and determining student’s mastery of concepts and skills. To be effective tutors, students need to learn how to interact with peers as 'learning partners'. Edward (2005) pointed that peer tutors are more successful if their role is highly structured, if they are made aware of basic learning principles, if they understand curricular goals, and they are trained in the appropriate use of tutoring activities and materials.

Peer tutoring or peer instructions should not be viewed as solution to all academic and behavioral problems teachers face. Rather, it is a set of instructional options, among a variety of teacher-led, student-regulated, and technology-assisted alternatives. Peer tutoring over the years has proven its efficiency in the classrooms although some may adopt the assumption that children are not learning while they are engaged in peer teaching activities which is simply erroneous. The success of peer tutoring is due to the capacity of the method to combine crucial elements for learning process. One of these elements is making the students more active and involved in their own learning, so they question and receive feedback (Ehly, 1998). The advantages of peer tutoring are not limited to only students, but also they extend to the teachers. Regardless of the types of peer tutoring, a teacher is applying; he or she must make sure that he or she provides the elements necessary for the effective and the successful implementation as preparing the tutor and the material to be taught (Moustapha, 2004).
1.4 NEED AND SIGNIFICANCE OF THE STUDY

The Industrial revolution of the 16\textsuperscript{th} and 17\textsuperscript{th} centuries and the scientific and computer revolutions of the 19\textsuperscript{th} and 20\textsuperscript{th} centuries have done a great deal to bring material prosperity to mankind and have also resulted in an intellectual revolution. The world of today demands more mathematical knowledge than in the past. It is against this background that we have to look at the teaching of Mathematics. It is important to learn Mathematics with understanding, so that students today will be able, in later life, to learn new mathematical skills, which the future will surely demand of them (Elaine, 2002).

Mathematics has its own language and style. It needs a special mindset to assimilate the concepts. The saying "Concept must be caught, not taught" is much true in the context of learning Mathematics. It is said that the Mathematics trains the mind. It improves the power of imagination, which is the best key to develop creativity. Hence the primary aim of a teacher of Mathematics should be to provide the learner with ample learning situations in order to interact with learning material and to develop the ability to ask questions to each other.

As a result of explosion of knowledge in Mathematics, the dependence of Science and Technology on Mathematics and the research in Psychology of learning, it was found necessary to revise the school Mathematics Curriculum and to introduce modern Mathematics and teaching techniques in schools. (The word 'Modern Mathematics' is used in two senses: The old Mathematics treated and viewed in a modern way and Mathematics, which is of new origin. The first focuses on the shifting of emphasis from the development of cognitive
Chapter 1 Introduction

process to the development of a deeper understanding of the structure of Mathematics).

Mathematics learning is a process in which the cognition of the learner is more important. A successful learner should be knowledgeable, self determined, strategic and an empathetic thinker. The thought of the learner should be guided and directed in a particular way so as to help them to channelise their divergent thinking. Mathematics learning should be an active process whereby the learners assimilate the information and relate this new knowledge to a framework of prior knowledge and content organisation. In Mathematics learning brighter level concept cannot be mastered unless all the related lower level concepts have been understood. Mathematical concepts have to be presented in a visual form with activity material and situation so that children can manipulate and form images and patterns in their mind easily and can relate it with their daily life.

In traditional classroom or in conventional method of mathematics teaching, the teacher has the role of a donor or giver. Whatever information the teacher has poured in to the ears of the learner, the learner becomes a silent listener. The flow of the knowledge is from the teacher to the learner. So Mathematics learning requires a challenge that opens the door for the learner to actively engage with his/her peers and to process and synthesize information rather than simply memorize and regulate it. The inborn abilities of the learner should be considered and learning should be directed to the path of development of the learner. Here the learner gets benefit when exposed to diverse view points from people with varied backgrounds.
and self and group assessments are possible at the same time. Also the responsibility of the learning was shifted to students, and the faculty only acted as a facilitator. For that there arises a need for innovative approach like peer tutoring in Mathematics. This will make the task of teachers much easier and also learning more effective too.

According to Ginsburg, Fantuzzo et al. (1995), peer tutoring is a "Systematic, peer mediated teaching strategy that consists of students partnerships, linking high achieving students with lower achieving students". Research done by Goodlad and Hirst (1989) revealed that peer tutoring strategy can enrich the education of participants in peer tutoring by

- Reconciling traditional and progressive approaches to education, including a strategy to combine the intellectual (cognitive) structure of instruction.
- Moral education through the exercise of responsibility.
- Flexibility of education at reasonable cost especially on working hours and man power.
- Easing the strain on teachers.
- Solving problems in co-operation.

While Thurston (2007) argues that peer tutoring can take place through two main processes. It can take place between peer with an older, or more able peer will tutee a younger peer (or a peer at an earlier stage of cognitive development). This leads to cognitive conflict and is the basis of Piagetian theories of cognitive constructivism. Peer tutoring can also take place with an emphasis on co-construction. In
Chapter 1 Introduction

this context the peers will still be at different stages of development, but their relative levels will be closer together. This allows them to co-construct new meaning and cognitive structure from experience. They combine and splice ideas. This is the basis of Vygotskian co-construction. Hence the basis of peer tutoring is from co-construction and cognitive constructivism.

Moreover the strategy like peer tutoring flourishes only in a social environment where conversation between learners takes place. During this intellectual gymnastics, the learner creates a framework and meaning to discourse. The Zone of Proximal Development (ZPD) should be considered on every activity done by the learner. The limited source in learner will not help him to fulfill learning. But they sit in small groups, different mental abilities join together and collective knowledge is formed. So in peer tutoring learners have opportunity to converse with peers, present and define ideas, exchange diverse beliefs, question each other, develop framework for study, produce new learning experiences, develop higher level of thinking, reach the Zone of Proximal Development (ZPD) and engage actively (Bennet, 1995).

Diny et al. (2007) reported that there was a need to ensure that peer learning was effective in classroom context, and concluded that education was not just an activity which takes place in a group, but was a group activity. The caliber of discussion is enhanced by this technique, and all students have an opportunity to learn by reflection and verbalization. In peer tutoring grouping of learner is essential for achieving collective knowledge. We can use various grouping techniques like random, mixed, ability etc. for heterogeneous grouping.
in the classroom. Duties like group leader, recorder, presenter etc. can be allotted to the group members and shifted frequently.

In order to improve the learning in peer tutoring method, students should be arranged in a small and manageable group (Topping & Thurston, 2007). Small group interactions also permit youngsters to solve problems in co-operation with other students so that they need not have fear of failure or embarrassment. Even if errors are made, sharing the responsibility with a group of peers sharply reduces tension or trauma. Further, the small group techniques help students to understand how other people reach decisions and work towards solutions. Finally, interaction with peers creates soundbonds which reflect ideas, build solutions and suggest conclusion to the group and to the teacher. Although peer help focused originally on academics, it becomes clear that social adjustment, behavior in consistencies, and indeed self-concept could be enhanced by the use of peer models.

The recognized cause and deficiencies of learning difficulties in Mathematics may be grouped into personal, instructional and social factors. Among them one of the major causes of difficulty in learning Mathematics is lack of interest. To arrange and maintain the student’s interest in Mathematics is a major problem for the teachers. If the students are taught properly, the natural curiosity among them could be awakened. This awakened curiosity would create interest in them and would develop their attention towards the subject. This can be done for elementary classes by introducing play-way method and later on according to their psycho-physical requirements.
Chapter 1 Introduction

The elements of novelty, usefulness and curiosity are the first things which help to awaken the interest in Mathematics. The work in Mathematics should challenge the intellect of the students. This stimulates their curiosity and mental powers and helps in awakening their interest. The forgoing discussion reveals that the need of the hour is the application of modern techniques of teaching that results in better learning outcomes in Mathematics. Of the very few modern techniques of teaching, the researcher felt the importance of peer tutoring in Mathematics.

Moreover, research evidences of Wills (2007) show a good number of pupils of our schools fail to get high marks in Mathematics, the students undergo a passive type of learning and it does not help to understand the subject effectively. Elementary and Secondary Mathematics are the foundations of higher Mathematics. But teachers and educationists give more emphasis to higher Mathematics. They seem to deny the fact that the higher Mathematics depends on elementary and secondary Mathematics. Due to lack of understanding the subject, the students who reached secondary classes have crammed for the content. But the lower level Mathematics has remained static too long and passive learning continues. Hence, there arose a need to go deeper into this pertinent issue and find a solution to overcome the difficulties in learning Mathematics.

Teachers can simultaneously engage all students in learning and practicing basic math or problem-solving skills using peer tutoring. This instructional strategy reinforces computational skills,
Chapter 1 Introduction

mathematical concepts and facts. Many contents in Mathematics can be practiced using peer tutoring. Peer tutoring method can be implemented in Indian conditions without much extra efforts and expenditure (Russel, 1998). This method requires no elaborate and expensive technology, except the technology of developing instructional material. This method can be easily implemented in classroom situations. This approach relies primarily on human beings for their success, rather than on any mechanical or technological device, which a developing country like India can easily afford. Here the student (tutor) is free to use his own instructional techniques and materials, which suit the needs of his learning.

Mathematics has been clearly justified as a compulsory subject in our school education. There are vast dimensions of problems related to Mathematics teaching and learning. The traditional way of learning Mathematics has been found not so much effective. Intrapersonal dimensions of learning mediated through interaction with others. Peer tutoring strategy support the idea that students learn best when they have to explain a concept of problem to others and this is the basis of group work. The need to develop a continuing productive work in the relationship with the group provided a context in which proctors / tutors could experience the reward and frustrations of teaching.

Teacher plans information in Mathematics topic to develop active learning through work collaboratively with a partner, measure to the nearest geometrical cubics, compute the fractional part of the whole, calculate the measurement of geometrical figures, experiment with abstractness and analyze data and graph class results.
Chapter 1 Introduction

Confrontation with the interactive abstractness, fractional abstraction of Mathematical ideas leads to fascinating discovery.

Being a Mathematics teacher educator, the researcher felt the need for devising a suitable model for the dimensionalities of learning Mathematics which should help students to develop spatial sense, encourage students to follow the stages- framing, forming, flocking, flaming and feedback, solving problems, provide opportunities for students to explore transformation and use the symmetry to analyze Mathematical relationship. The following research questions were formed on the basis of the study:

1. Can peer tutoring be effectively adopted for learning Mathematics and allow students to the opportunity to explore other avenues and approaches to learning Mathematics?

2. How can secondary school students be made to explore actively and thus connect abstract ideas through peer tutoring abstraction?

3. What select peer tutoring strategy can enable secondary school students to integrate the sequence of activities that focus on concrete operational models and ability to resolve symbolic ambiguity and connections across content strands?

4. How can the interactive roles of tutors and tutees change through the adoption of Peer Tutoring Model in Mathematics class room?

1.5 STATEMENT OF THE PROBLEM
"To improve education, we must change schools. To improve schools we must change the individuals. To improve individuals we must change the ways we attempt to create change" (Madewell, 2004).

The most important aim of introducing modern Mathematics at school is to improve teaching of Mathematics. Students receiving education today should be competent to face the realities of tomorrow. Today the quality improvement of education is of great importance and can be achieved only by improving the quality of education. Even though great advancements in Science as well as Educational Technology are made in our country, the methods of teaching prevalent are not enough to meet the requirements of students at all levels. As per the need of the hour, new strategies and techniques are evolving in educational area also.

The older concept of education is no more relevant in meeting the challenges of the present time. Yet, to a large degree, we continue to teach as our grand parents were taught. To train reflective and totally active world citizens, many of our traditional educational practices must be seriously questioned and novel approaches based on sound objectives must be implemented. Hence, it is necessary to refine and improve the teaching methods to realize the fullest potentialities of individual learner (Brophy, 2002).

Recent researches conducted in advanced countries show that peer tutoring is one of the most effective strategies for teaching various school subjects. The literature indicates positive effects of peer tutoring on students, especially in the area of achievement, attitude towards learning and the retention of content. School systems that have
implemented peer tutoring, found it to be a very effective teaching and learning method. Efforts to undertake studies in this line were attempted recently in India also. In educational institutes, peer tutoring is attractive in drawing the maximum possible number of pupils into the process of sharing knowledge and can transform learning from a private to social activity.

Keeping this view in mind and on the basis of the studies referred earlier the present study is entitled as

“PREPARATION AND TESTING OF A MODEL FOR PEER TUTORING IN MATHEMATICS AT THE SECONDARY LEVEL”

1.6 DEFINITION OF KEY TERMS

1.6.1 Preparation
In the words of Geddi (1959), Preparation is the "Act of operating or fitting for some use or purpose". That means a thing done to make ready for something. The state of having been made ready or prepared for use or action.

1.6.2 Testing
According to Paul (1986), Testing means "examining, questioning, analyzing, investigating, assessing and checking the new product". That means evaluation of a student’s understanding of a lesson, module or course.

In the present study, group and individual testing refer to the manner in which tests are administered. Group tests are designed to be
administered to a number of examinees at once while individual tests are administered to one individual at a time.

1.6.3 Model

Shukla (1992) has defined model as "Constructing alternative, usually simpler forms of objects or concepts, in the expectation that the study of the model will shed light on the nature of those objects or concepts".

"A model is a pattern of something to be made or reproduced and means of transferring a relationship or teaching process from its actual setting to one in which it can be more conveniently studied". (Mujibuletal., 1991).

According to Joyce and Weil (1992)"A model of teaching is a plan or pattern that we can use to design face-to-face teaching in classroom or tutorial settings and to shape instructional materials-including book, films, tapes, and computer mediated programmes and curricula".

In this study 'model'is used in the sense of an alternative processing of mathematical concepts, principles and procedures using peer tutoring experiences as the points of departure. It implies simple peer tutoring pedagogic construct. It also includes material to bridge peer tutoring situation and Mathematics learning situation. Moreover, here model refers to a strategy for designing, predicting, working and testing in Mathematics learning situation.
1.6.4 Peer Tutoring

Peer tutoring can be defined as the activity of individuals from a given age group, profession, condition or station in life assisting or guiding individuals from corresponding categories (Husien, 1994).

Peer tutoring is an instructional method in which one child tutors another in material on which the tutor is an 'expert' and the tutee is a 'novice' (Edward, 2005).

In this study peer tutoring refers to a system of instruction in which learners help each other and learn by teaching. It is a highly motivating and reinforcing technique to develop skills. It provides a framework for review in which every one learns more or solidifies what he or she has already mastered.

1.6.5 Mathematics

"Mathematics is an expression of the human mind which reflects the active will, the contemplative reason and the desire for aesthetic perfection. Its basic elements are logic and intuition, analysis and construction, generality and individuality" (Robinson et al., 2005). "Mathematics is the Science of order and measure" (Descrates, 1630).
"Mathematics is the gateway and key to all Sciences" (Bacon, 1275).

In the present context Mathematics is one of the core subjects of the school curriculum: Mathematics learning is the effort of the learner to attain the predetermined objectives of behaviour modification which ultimately helps the learner to analyse mathematical concepts,
formulate hypothesis, draw inferences and thereby arrive at conclusions.

### 1.6.6 Secondary Level

Any one of the standards VIII, IX, or X in a school which is recognized by Government of Kerala State for providing instruction and following the state curriculum now in force. In this study, the secondary level refers to standard VIII of a school.

### 1.7 HYPOTHESES

Keeping in view the objectives of the study, the following hypotheses are formulated.

**Hypothesis I:** The performance of pupils in Mathematics taught by Peer Tutoring Model (PTM) is significantly higher than that of pupils taught by the prevailing method.

**Hypothesis II:** The self-concept of pupils taught by Peer Tutoring Model is significantly higher than that of pupils taught by the prevailing method.

**Hypothesis III:** The achievement motivation of pupils taught by Peer Tutoring Model is significantly higher than that of pupils taught by the prevailing method.

**Hypothesis IV:** The mathematics interest of pupils taught by Peer Tutoring Model is significantly higher than that of pupils taught by the prevailing method.

**Hypothesis V:** There is no actual difference between the observed frequencies showing the opinion expressed by the
Chapter 1 Introduction

tutors and expected frequencies derived on the basis of normal distribution.

**Hypothesis VI:** There is no actual difference between the observed frequencies showing the opinion expressed by the tutees and expected frequencies derived on the basis of normal distribution.

**Hypothesis VII:** There is no actual difference between the observed frequencies showing the opinion expressed by the experts and expected frequencies derived on the basis of normal distribution.

1.8 **OBJECTIVES OF THE STUDY**

1. To prepare a Model for Peer Tutoring in Mathematics at secondary level.

2. To compare the effectiveness of Peer Tutoring Model with the prevailing method on achievement in Mathematics of secondary school students.

3. To identify the skilled tutors among the secondary level students.

4. To test the socio-economic status of the secondary level students.

5. To study the feasibility of implementing Peer Tutoring Model at secondary level.

6. To find out the effect of Peer Tutoring Model on the self-concept, mathematics interest and achievement motivation of secondary school students.

7. To analyze the opinion of secondary school teachers and experts regarding Peer Tutoring Method at secondary level.
Chapter 1 Introduction

8. To suggest remedial measures for successful implementation of the selected Peer Tutoring Model.

1.9 METHODOLOGY IN BRIEF

Experimental study comprising of both qualitative and quantitative methodology was employed in the study.

1.9.1 Sample

The sample selected for the study comprised of 400 students of standard VIII from eight schools coming under three districts of Kerala – Thiruvananthapuram, Kollam and Pathanamthitta and 50 teachers and experts from various institutions like Secondary schools, District Institute of Educational Training (DIET), State Council of Educational Research and Training (SCERT).

Tools and Techniques Used to Procure Data

1. Kerala Self concept Scale
2. Kerala Scale of Achievement Motivation
3. Mathematics Interest Inventory
4. Multiple Intelligence Inventory
5. Strategy Evaluation Proforma (Peer Tutoring)
6. Format for Tutor / Tutees Diary
7. Participant Observation Schedule for Researchers/Teachers
8. Check – list for the Evaluation of Peer Tutoring Model by
9. Lesson Designs Based on Prevailing Teaching Method

10. Achievement test in Mathematics

1.9.2 Statistical Techniques Used

As the study is experimental in nature, test of significance of difference between means was done and critical ratio was found out. Further the technique of Analysis of Covariance (ANCOVA) was applied to test the effectiveness of the experimental method over the conventional method. The Chi square test was also used in the study.

1.10 SCOPE OF THE STUDY

The major scope of this study is to evolve a new instructional strategy to teach Mathematics. "Peer tutoring" is considered as the new method. This method has been adopted in many countries to teach different subjects. Investigator assumed that the present system of teaching Mathematics is passive and uninteresting to the pupils, and results in low achievement. So the investigator decided to design an alternative.

Ideas and ideals cannot remain static; they are fluctuating. Innovations may imply a new idea of a new product. Innovations may be the introduction of something new or modification of the existing practice for meeting new challenges. It may even be the successful exploitation of new ideas.

The present study has been designed with the objective to test the Peer Tutoring Model in Mathematics at secondary level. The study
done on this aspect enables teachers to be proficient in teaching diverse range of students in their classrooms. Peer tutoring method encourages a student to adopt right thinking and learning. It develops the reasoning capacity of the student also. Peer tutoring model practiced by students holds promise for future, because schools in the future will be designed to cater to learning preferences of the student. The statistical techniques adopted for the analysis of data were sufficiently comprehensive to obtain the results. In the light of the conclusions arrived at, relevant suggestions are put forward. It is expected that the findings of the study will help curriculum planners to make the needed changes in Mathematics textbook. Moreover, it is hoped that they may serve as guidelines for teachers and students to make teaching and learning more easy and enjoyable. It will also help to find out new frontiers of educational practices.

This study is meant for developing peer tutoring skills among the secondary level students. As a corollary to the quantitative data, a qualitative coverage of the study was also done through semi-structured interview with teachers and experts in various institutions in this field. On the role and scope of peer tutoring the researcher strongly recommended that it should be incorporated into all school programmes.

1.11 LIMITATIONS OF THE STUDY

Despite making every attempt to make the study precise and objective as possible, certain minor limitations have crept into the study. Out of the prominent three dimensions of peer leaning
instructional methods (Co-operative Learning, Peer Tutoring and Peer Collaboration) only Peer Tutoring have been taken into account as they are endorsed to incorporate the entire ambit of Mathematical abilities of an individual.

The study is delimited to a sample of 400 students of standard VIII from seven schools coming under three districts of Kerala, namely Thiruvananthapuram, Kollam and Pathanamthitta. The result of the study can be more generalized if more students are included in the sample. The study is delimited to the curriculum framework of the Government of Kerala. The content selected to the study is delimited to a single unit. Out of the series of peer tutoring approaches, only one was followed for the implementation of this model. The study is delimited to Mathematics education.

In spite of these limitations, the investigator feels a sincere attempt has been made to study all the salient aspects of the problem as far as possible and believes that the findings of this investigation will be useful to study Mathematics at secondary level in a meaningful way.

1.12 ORGANISATION OF THE REPORT

The study was culminated in the presentation of a consolidated report, which is organised into six chapters.

**Chapter I** includes an introduction to the study, and it centres mainly on the aspects of background of the study, need and significance of the study, the objectives, hypotheses and finally the scope and limitations of the study.
Chapter II offers a detailed description of the theoretical background of peer tutoring strategy.

A review of the related studies that led to the emergence of the present study is included in Chapter III. It provided the investigator an opportunity to justify her endeavour.

Chapter IV, titled 'Methodology of the Study' presents a description of the design of the study.

A detailed analysis of data with interpretation of results is presented in Chapter V.

In the concluding Chapter VI along with a brief summary of the study, the findings are briefly summarised and suggestions as to how good these findings may be utilized for effective classroom practices are offered. It also offers suggestions for further research.