Chapter 1

INTRODUCTION

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INTRODUCTION

1.1 INTRODUCTION

Education is a process of all round development that helps an individual to become a productive and responsible member of the society. The function of education is to equip each individual with various skills and competencies for successful living. It is one of the important building blocks for the nation, serving as an instrument of economic and social development. Education formally takes place through teaching and learning processes; these processes are as old as civilization. The psychological as well as practical aspects underlying teaching learning processes have been investigated extensively in the face-to-face classroom mode. It is through investigations and researches that there are new trends set up in teaching learning process and paradigm shift is observed from teacher-centered classroom to student-centered classroom and from passive to active participation of learners. These investigations have been formalized as pedagogy, which is the art and science of teaching. Teaching includes different classroom activities carried out by the teacher aiming towards the expected behaviour of the students. Learning is a modification of behaviour for the attainment of goals and it depends on three factors, viz. the nature of the learner, nature of the learning material and the learning situation.

The curriculum that a learner has to go through in the learning process consists of various subjects like Languages, Social Studies, Science, Mathematics, etc. Different subjects are being taught for achieving definite goals. Education and National Development (1964-66), report of the Education Commission laid great emphasis on making Science an important element in the school curriculum and therefore recommended that Science and Mathematics should be taught on a compulsory basis to all pupils as a part of general education during the first ten years of schooling. National Policy of Education (1986) has considered the importance of mathematics in general education and suggested "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 a concomitant to any subject involving analysis and reasoning". National Curriculum Framework (2005) "Individual and group exploration of connections and patterns, visualisation and generalisation, and making and proving conjectures are important at the Secondary stage, and can be encouraged

through the use of appropriate tools that include concrete models as in Mathematics laboratories and computers." So mathematics holds an important position in school curriculum.

Mathematics holds the mirror upto civilization. It is no exaggeration to say that the history of mathematics is the history of civilization. From earlier times mathematics has been one of the most useful of all the subjects. It was used by ancient people like Babylonians and Egyptians in connection with calculations about the calendar, so that they knew in advance when to sow their crop, or when the Nile was going to flood. Mathematics at school level consists of three major branches viz. Arithmetic, Algebra and Geometry. Arithmetic and Algebra were used in trade for exchange of money and goods and for keeping accounts. Geometry was used for marking out boundaries of fields and for building of monuments like the pyramids. Since then mathematics has continued to be used by more and more people, and has been developed by mathematicians so that it has an ever-increasing number of uses. With high-speed electronic computers calculations can be performed in a fraction of the time in which people could do them using other methods, so their invention has revolutionized the type of things for which mathematics can be used.

Though Mathematics being so important subject and occupying a central position since the Ancient period still it has not been the interest of many students. The gaps are found between aspiration and achievement. Weakness of students in mathematics can be a major factor that causes the gap between the expected achievement and actual achievement in mathematics. According to Kothari(1998) students of eighth standard were able to solve on an average 24.31 items out of 67 items based on basic arithmetic of fifth, sixth and seventh standard. Mathematical concepts are hierarchical and interconnected, much like a house of cards. Unless lower level concepts are mastered, higher-level concepts cannot be understood. So, it is important to diagnose the learning difficulties faced by the students before moving to the higher-level concepts. The generality of the abstract nature of mathematics is the underlying power of mathematics. However, it is also the basis for one of the greatest dangers in teaching of mathematics - the danger that the teacher may overlook the importance of understanding/diagnosing the learning difficulties of the students

that impede the mathematics learning of the students.

1.2 NATURE OF MATHEMATICS

According to Sidhu (1995) "Mathematics is the science of number and space. Mathematics is the science of measurement, quantity and magnitude. Mathematics is also called the science of logical reasoning. Mathematics may also be defined as the science of abstract and imaginative form." According to Britannica Concise Encyclopedia "Mathematics is Science of structure, order, and relation that has evolved from counting, measuring, and describing the shapes of objects. It deals with logical reasoning and quantitative calculation." Mathematics is commonly defined as the study of patterns of structure, change, and space; more informally, one might say it is the study of "figures and numbers". In the formalist view, it is the investigation of axiomatically defined abstract structures using symbolic logic and mathematical notation.

Mathematics is highly abstract. It is concerned with ideas rather than objects; with the manipulation of symbols rather than the manipulation of objects. It is a closely-knit logical structure in which ideas are interrelated. Students who discover some of the structures of mathematics, are often impressed by its beauty. They note the lack of contradiction, and they see how a new technique can be derived from one that has already been learned but most of the students fail to understand and discover the abstract structures of mathematics.

Another most important characteristic of mathematics that distinguishes it from many other subjects is its peculiar language and symbolism. It has a different grammar and syntax and uses many words from every-day language but in a different sense. Symbols facilitate thinking for some, but they impede it for those students to whom they are meaningless.

Every subject to be learnt at school can be thought of being made of three kinds of knowledge: ***Concepts*** i.e. conceptual knowledge, ***Skills*** i.e. procedural knowledge and ***Information*** i.e. factual knowledge. Each of these kinds of knowledge needs a different style of learning: concepts have to be understood, skills have to be mastered by practice, information have to be remembered or memorized. Different subjects have different mixes of concepts, skills and

information. Mathematics is predominantly concepts, followed by skills and very little information. One needs to master the basic concepts of mathematics for the better comprehension and further application of the concepts.

1.3 OBJECTIVES OF TEACHING MATHEMATICS AT THE SECONDARY STAGE

Education is imparted for achieving certain ends and goals. Various subjects of the school curriculum are different means to achieve these goals. So with each subject some objectives are attached that are to be achieved through teaching of that subject. According to National Curriculum Framework (2000) the objectives of teaching mathematics at secondary stage are as below:

- To further enhance the capacity of the student to employ mathematics in solving problems that they face in their day-to-day life.
- A systematic study of mathematics has to be started here and continued further.
- The curriculum may include the study of relevant arithmetical concepts, number system, algebra, geometry, trigonometry, coordinate geometry, mensuration, graphs, statistics etc.
- The idea of proof should be developed with thrust on deductive reasoning.
- Emphasize is to be laid on wider application of mathematics by way of making data based problems pertaining to actual data on population, agriculture, environment, industry, physical and biological sciences, engineering, defense etc.
- Student should attain proficiency in presenting information available in their environment in the form of graphs and charts and be able to do calculation with speed and accuracy.
- Student should acquire the ability to solve problems using algebraic methods and apply the knowledge of simple trigonometry to solve the problems of height and distance.

- The history of mathematics with special reference to India and the nature of mathematical thinking should find an importance.

- Students may be encouraged to enhance their computational skill by the use of vedic mathematics.

The aims of teaching Mathematics given by Kumar and Ratnalikar(2003) are as follows:

- To enable the child to solve mathematical problem of everyday life.

- To develop in the child acquaintance with his culture.

- To provide a suitable type of discipline to the mind of the pupil.

- To prepare the child for technical professions like accountants, teachers, researchers, auditors, engineers, cashiers, scientists, statisticians, etc.

- To prepare the child for economic, purposeful, productive, creative and constructive living.

- To develop in pupil a sense of appreciation of cultural arts.

- To prepare the child for elementary as well as higher education in science, economics, engineering and psychology.

- To develop in the pupil such habits as concentration, self-confidence and discovery.

- To help the child to follow the maxim "Work is Worship".

- To develop in the child the power of thinking and reasoning.

- To develop the learner's power of expression.

- To enable the child to understand and enjoy popular literature in

Mathematics.

- To develop in child a scientific and realistic attitude towards life.

- To bring about all-round harmonious development of the personality of the child.

From the above enunciated objectives it's very clear that mathematics is seen as a process of developing productive individual for the development of society and is also seen as a product in itself leading to the further research. It has a capacity to bring a positive change and innovations in the society.

Further moving from overall objectives of teaching mathematics to the objectives of teaching a specific branch of Mathematics – Geometry, the contribution of it to the development of child in a very specific direction is seen. It leads to the development of certain mathematical skills associated with the nature of Geometry.

According to Sidhu (1995), UNESCO(1973), and NCTM(2000) reasons for teaching geometry in school are as follows:

- To enable the learner to acquire a mass of geometrical facts.

- To help in understanding the geometrical principles of equality, symmetry, and similarity that are implanted in the very nature of things.

- For mathematization of physical space and direct applications – give geometric schemes to real situation.

- For the applications of geometric knowledge to other disciplines viz. architecture, physics, astronomy, geography, technology.

- For the initiation into the study of fundamental structures of contemporary mathematics and the refinement of geometric intuition.

- To precisely describe, classify, and understand relationships among types of

two- and three-dimensional objects using their defining properties

- For the initiation to mathematical logic and reasoning for a deeper comprehension of deduction.
- To analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.
- To develop visualization, spatial reasoning, and geometric modeling for solving problems.
- To develop the ability to draw accurate plans.
- To create and critique inductive and deductive arguments concerning geometric ideas and relationships
- To provide content that is objective and non-controversial
- To use in engineering, machine-shop, construction industries, landscape architecture, interior decoration and other areas of appreciation
- To demonstrate the nature and power of pure reason
- To provide a key to mathematical thinking

1.4 TEACHING AND LEARNING OF MATHEMATICS

For the question "What is Mathematics?" There are innumerable answers. The misconception about mathematics leads to the misconceptions in Mathematics. For many people mathematics is about formulas and cranking out computations. It is the unconsciously held delusion by many students that mathematics is a set of rules and formulas that have been worked out by some great masters, and the student's duty is to memorize all this stuff. It's important to make students realize that Mathematics is not about answers, it's about processes. This is possible through the teaching-learning process of Mathematics.

According to the Reader's Digest Universal Dictionary (1988) "Mathematics when used with a singular verb, means the study of number, form arrangement and associated relationships, using rigorously defined literal, numerical and operational symbols. When used with plural verb, means the application of Mathematics to calculation or a problem." From this its clear that mathematics as a subject taught to the students should not only focus on the singular verb meaning but should consider this plural verb meaning.

Mathematics has been a part of the human search for understanding. Yet it is not seen during the teaching learning of mathematics in the classrooms. During the instructional process in the classroom it should be understood that the teaching of mathematics is not to make students learn formulas and how to plug into them. It is not setting students to learn mechanical techniques for solving certain mathematical equations or exercises. All of these things are just the scaffolding. They are necessary and useful, sure, but by themselves they are useless. Teaching of mathematics should actually take students beyond the mechanical work. It should create an environment for learning mathematics in broader sense of the term. The real teaching of mathematics is developing the true mathematical understanding among the students, the true ability to think, perceive, and analyze mathematically.

Mathematics involves more than computation. Mathematics is a study of patterns and relationships; a science and a way of thinking; an art, characterized by order and internal consistency; a language, using carefully defined terms and symbols; and a tool. Mathematics is a product and a process to further mathematics. Teachers and teaching of mathematics must explore a broader scope of mathematics. Learning Mathematics should include experiences that help students to shift their thinking about mathematics from product to a process; an abstract subject to an interesting subject; mechanical training to intelligent learning.

For this there should be a shift in the teaching-learning process of Mathematics in the classrooms. It should create an opportunity for the students to demonstrate apply, use and extend their learning. Mathematics should be related to daily life examples. Students should be provoked to think and ask questions. The logic and reasoning; "How" and "Why" should be explained to the

students related to each mathematical concept. Teaching and Learning of mathematics should result in a joyful activity.

1.5 PRESENT SCENARIO OF TEACHING AND LEARNING OF MATHEMATICS

Teaching of mathematics should focus on the higher level of objectives underlying the mathematics subject, like critical thinking, analytical thinking, logical reasoning, decision-making and problem-solving. Such objectives are difficult to be achieved only through verbal and mechanical methods that are usually used in the class of mathematics. Teachers think teaching must imply logic, and logic being linked to language, or at least to verbal thought, verbal teaching is supposed to be sufficient to constitute this logic. This method leads to series of explanations and students at the initial steps of logical explanations trying to understand and grasp but slowly the gap is created between the explanations transmitted by teacher and received by students which lead to the poor understanding on part of students and they develop a fear of the subject: *Math-phobia.* National Curriculum Framework (2005) points out "Problems, exercises and methods of evaluation are mechanical and repetitive, with too much emphasis on computation. Areas of Mathematics such as spatial thinking are not developed enough in the curriculum. A majority of children have a sense of fear and failure regarding Mathematics. Hence, they give up early on, and drop out of serious mathematical learning." as the problems in school mathematics education. Jain & Burad (1988) found that one of the reasons for low results at secondary examinations is lack of child-centered teaching. The silly mistakes and errors committed by students while doing mathematics and the mathematical weaknesses faced by students' hampers the purpose of mathematics education and results in the low achievement of students in mathematics. Rastogi (1983) found that when command over basic arithmetic skills improved, attitude towards mathematics become favorable and achievement in mathematics increased. The Education Commission (1964-66) 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".

Sharma (1978) found various factors responsible for low achievement in

Mathematics. One of them was approach of classroom teaching. Commenting on the prevailing situation in schools, it is observed that in the average school today instruction still confirms to a mechanical routine, continues to be dominated by the old besetting evil of verbalism. Undue stress is given on memorization and mechanical work. Also, many a times the instructions given by the teacher are based on rules, formulas and its use without understanding. This results in one way and un-thoughtful instructional process. Little or no attention is paid on the process of learning mathematics. It is taught as a culture free, context free body of absolute truth with its formal algorithms, rigour and structure. The individual differences in intellectual ability among the students in the classroom are not considered during the teaching of mathematics. According to Backhouse, et.al. (1992) "No learner can be expected to think as his or her teacher. No two learners in a class can be expected to think in the same way as each other." The process of teaching of mathematics in the class is organized by considering average students and its unidirectional. Teachers are not interested to reach out to an individual student by identifying the errors committed and the mathematical weaknesses faced by the students, therefore teaching-learning of mathematics remains dull and uninspiring.

According to Cobb, et.al. (1995) "Individual student's mathematical interpretation might give rise to conflicts and resolving of these conflicts would precipitate mathematical learning." Teacher is to create an environment in the class where each individual is autonomous learner where they learn by participating in the discussions. Teacher instead of being the transactor of the content is more of a facilitator in the class. There has to be a shift from teaching of mathematics to actual learning of mathematics which is evident from the participation and involvement of the students in doing mathematics.

1.6 DIAGNOSIS AND REMEDIATION OF LEARNING DIFFICULTIES

Elif (2003) "Learning mathematics with understanding is the vision of school mathematics recommended by the National Council of Teachers of Mathematics (2000). In order to design and develop learning environments that promote understanding efficiently, teachers need to be aware of students' difficulties in learning mathematics."

Learning difficulties are referred in terms of understanding the content. It is seen as difficulty in:

- acquiring the knowledge of different geometrical symbols and statements
- understanding about different geometrical terms and concepts
- misconceptions related to different geometrical concepts

Developing understanding in mathematics is an important but difficult goal. Being aware of student's learning difficulties and the sources of the learning difficulties, and designing instruction to diminish them, are important steps in achieving this goal.

Students differ in intellectual ability to abstract, generalize, reason and remember. Because of these varying abilities, dispositions and interests, some students learn readily and usually understand what they are taught for the first time while others are not quick to catch on and need review and re-teaching. Teaching of mathematics should not just focus on imparting of knowledge but should help students in realizing the objectives of studying mathematics and developing positive attitude towards mathematics. Diagnosis and remediation is an important step towards this and help students for good achievement in mathematics.

According to Curriculum Framework for Quality Teacher Education (2005) "A true professional is capable of perceiving complexities and uncertainties in the society, has a thorough grasp of the subject, possesses skills to make critical diagnosis, takes decisions and has courage and conviction to implement such decisions." It also emphasized on a practical work at the secondary stage to make the teacher-trainee acquainted with the techniques of diagnosis and remediation. A teacher should assess the abilities, values and interest of students and adjust so that most of the students understand what they are learning and are able to apply it in solving problems and making decisions. If some students have trouble in understanding, the teacher can diagnose the trouble and provide appropriate remedial instruction. According to Cooney, Davis and Henderson (1975) the process of Diagnosis and Remediation of Learning difficulties can be particularize in the four steps as below:

1. To discover which students are having learning difficulties. It is these to whom the teacher gives attention.
2. To find out what kind of errors a student or a group of students are making.
3. To infer the causes that explains the errors. Errors are observable but why an error is made i.e. its cause is not observed and can only be inferred.
4. To accept the cause of a difficulty and provide remedial teaching.

The purpose of diagnosis is to find the cause of student's learning difficulties so that subsequent teaching can be directed at removing the cause. Often diagnosis and remedial teaching go hand in hand. Remedy is not only important but necessary for students.

1.7 IMPORTANCE OF GEOMETRY

Willoughby (1967) "Most people who love and understand mathematics caught their first glimpse of ***real mathematics*** in a course in plane geometry". In arithmetic, they were asked to memorize rules and compute quickly and accurately; in algebra, there were more rules, more tricks, and more computations. Not until geometry were there reasons. Never was there a discussion of *'why';* there were only a great number of statements and examples as to *'how'.* Then geometry came on the scene with its axioms, its proofs of theorems, and its original exercises that allowed the students to try his own hand at creating proofs. Here was an opportunity for the students who wanted to think. Here was an opportunity to see the beauty of mathematics. Here, in short, was the student's first opportunity to do some mathematics that one could do better than a machine.

On the other hand, when a child first begins to crawl, he knows what the shortest distance between two points is; in fact, he knew before this time, he just did not have the physical facility to demonstrate his knowledge. When children see railroad tracks going off into the distance, they really know, though it may not *look* that way, that the two tracks will never meet unless one or both of them bend in towards the other. In general, the basic assumptions and many of the theorems of geometry are about familiar objects, and the facts involved in them seem to be obviously true, for the most part. Therefore, the study of geometry has much of its basis in what might be thought of as obvious facts about physical objects that are familiar to all of us. Rather than deterring the

study of geometry, knowing many of the facts of geometry actually aids it. The idea that we can prove statements that do not seem at all apparent (the Pythagorean Theorem, or some of the theorems about circles, for example) from obvious statements is exciting to children and many adults.

Geometry, then, offers an opportunity to study proof and mathematical structure in a setting that is familiar to the pupil. It offers the chance to prove non-obvious facts from obvious ones. That the mathematician does not really insist on the axioms being more obvious than the theorems; the child insists on this if he is to be impressed with the structure we are building. Then, once the student appreciates the concepts of proof and mathematical structure, he will have enough time to go back and reduce the number of postulates to a minimum. Furthermore, those who go on to more formal mathematical education find few places where their study of basic geometry is of help, and they usually knew the few facts that are helpful prior to beginning the higher level of geometry course. Later, the study of proof and structure is being taken over by algebra courses in which the proofs and the structure are much simpler, and more easily understood.

Geometry still has a place in the mathematics curriculum of the school. It is a place which cannot be taken by the abstract study of algebra and arithmetic, a place it will not satisfactorily fill if it becomes so abstract and so preoccupied with considerations of a trivial nature that it is no longer concerned with the mathematics of the space surrounding the pupil.

1.8 RATIONALE OF THE STUDY

Mathematics contributes a great deal of the development and research of all disciplines. It deals with the numerical, calculation and reasoning part of man's life and knowledge. Whether one is a homemaker, shopkeeper, tailor, carpenter, daily wager, economist, scientist, banker, engineer or doctor, one cannot do away without mathematics and numbers. Mathematics teaches the pupils to think. The pupils who are able to understand basic principles will be able to use these in thinking about other sorts of problems in day-to-day life. *Mathematics is important because it is useful.*

Mathematics involves analytical reasoning, but spatial reasoning also plays an important role in mathematical thought. In studying young children's mathematical worlds, an understanding of their use of imagery becomes important. Mathematics is the activity of creating relationships, many of which are based on visual imagery. Geometry is a branch of mathematics that deals with the visualization and spatial reasoning skills. The word *geometry* comes from two Greek words meaning *earth measurement.* Geometry began as a study of ways to measure parts of the Earth as in map-making or to measure the Earth in relation to the rest of the universe as in astronomy. Such measurements are still necessary. Geometry nowadays is more a mathematician's study of space and the interesting problems that can arise from it. The fundamental reason for studying spatial relationships is to develop the individual's intuitions about space. Both as a child and later as an adult-whether it be as architect, engineer, bus driver or housewife-one needs an intuitive group of the properties of space and of objects in it.

Std. VIII is a threshold of secondary education, it is a crucial class, wherein students are expected to learn more comprehensive and abstract concepts in all arithmetic, algebra and geometry of mathematics on the basis of amount of knowledge imported and internalized by them in terms of basic principles, skills and fundamentals upto now. Students, however, are unable to grasp abstract structure, so if we want to stress them we must find concrete realizations of such structures in the real world, which is being done by studying the basic plane geometry at the primary level. Spatial relationships are rich in such structure at the primary level in terms of basic plane geometry which is being extended to the abstract structure at secondary level and Std. VIII is the transition phase between these two levels. So the students are likely to have a tendency to commit errors if they are weak in the interrelated learning of mathematics up till now. Bhardwaj (1987) found that the error rate at middle standard in all the three areas that is arithmetic, algebra and geometry came out to be 30.4 percent, 50.6 percent and 51.4 percent respectively and there was a significant improvement in achievement of the students after they had gone through the remedial exercises. Adding to this, the new mathematics text-book is introduced recently in the year 2004-2005 for std. VIII, following the CBSE pattern syllabus, so it is contemporary to carry out this study.

Also there exists a vertical relationship between the concepts learnt at primary stage and concepts to be learned at the secondary stage, for e.g. Concept of Line, line-segment is introduced in VI standard, which is extended to the parallel and perpendicular lines in VII and in VIII standard the structure of Geometry (Axioms, postulates), the concept of collinear points is introduced and different results regarding them are proved. Manika(1983) found the concepts of higher mathematical hierarchy could not be developed unless lower concepts are understood. So, it is important that the prerequisites are acquired to take students to the higher level of concepts like trigonometry, which is a bifurcation of geometry and is an important branch of mathematics. Trigonometry means "measurement of angles", and is concerned with relations between lengths and angles. In the event of lack of basic concepts it becomes a case of difficulty in learning higher concepts. For this the care should be taken that the students are not just loaded with the information, which has no meaning to them. Students should develop the sound understanding for the basic concepts and, diagnosing and remediation is an important component in this regard. Ashar (1972) found that the trends of errors continued to a greater extent in the higher grades and pupils committed the errors due to lack of systematic approach. Sashidharan (1992) found that the major reason for low achievement was the lack of essential pre-requisites. It is also mentioned by the National Curriculum Framework (2000) that Remediation and Proper Evaluation should constitute an integral component of teaching-learning of Mathematics. Before making remediation as a component of teaching-learning process, it is important that teacher should diagnose and identify the kind of difficulty a student has in understanding and using concepts or principles. Teacher should also locate the errors committed by the students in proving and solving problems.

UNESCO (1973) "....Modern conception of school Geometry is still open to pedagogical research, and that the establishment of an acceptable program of instruction in geometry is one of the most difficult curriculum problems today." Reflecting on this statement and comparing with the research trend it can be seen that the ratio of the researches in mathematics and the researches carried out in Geometry is not satisfactory. Also, for establishing an acceptable program of instruction in geometry there should be diagnosis of the learning difficulties faced by the students in learning geometry.

In the present study the units considered are Point, Line & Concept of Distance, Line-segment & Ray, Plane, and Angle as these are the basic and fundamental things and the complex structures in geometry cannot be studied without them. Hence, the interest of the investigator to conduct the present study.

1.9 STATEMENT OF THE PROBLEM

DIAGNOSIS AND REMEDIATION OF LEARNING DIFFICULTIES IN GEOMETRY OF STANDARD VIII STUDENTS

1.10 OBJECTIVES OF THE STUDY

1. To identify the errors committed by the students of standard VIII in geometry.
2. To identify the learning difficulties in geometry of standard VIII students.
3. To provide remedial measures to overcome the learning difficulties in geometry of standard VIII students.
4. To study the impact of remedial measures with reference to the learning difficulties in geometry of standard VIII students.

1.11 EXPLANATION OF THE TERMS

- **Errors:** Few topics of standard VIII geometry were identified viz. Point, Line, Concept of Distance, Line Segment, Ray, Plane and Angle. The achievement test was prepared and administered to the standard VIII students. Each item was associated to the specific instructional objective. And based on this the number of incorrect responses for each item identified the errors with respect to each topic and subtopics of geometry.

- **Learning Difficulties:** Based on the error identification and the commonly occurring errors the diagnostic test was prepared and administered to the standard VIII students. The errors committed by the students were analysed. Based on the analysis the probable causes for the errors were identified as learning difficulties.

- **Impact of Remedial Measures:** The scores of the students on the achievement test after the remedial measures were considered as the impact of the remedial measures.

1.12 DELIMITATIONS OF THE STUDY

- The present study is delimited to the four units of standard VIII geometry. The units are:
  i. Point, Line, and Concept of Distance
  ii. Line Segment and Ray
  iii. Plane
  iv. Angle
- The study is delimited to the English medium schools of Vallabh Vidyanagar and Anand city following the Gujarat Secondary and Higher Secondary Education Board Syllabus.