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CHAPTER I
INTRODUCTION

Education remains the most outstanding development priority area in the world today. The core purpose of education is human development. An educated person, who is well or relevantly positioned in the socio-economic cultural and political environment is expected to be a valuable asset to the society than another individual. This is the reason for researchers and scholars all over the world continue to do research into ways of improving human knowledge and development.

1.1 MATHEMATICS

Mathematics is the study of quantity, structure, space, and change. In the early 19th century, the German mathematician, Carl Friedrich Gauss, known as the prince of mathematicians, called mathematics as the "queen of the sciences" because it was so successful at uncovering the nature of physical reality. According to Young (1961) if Mathematics is removed the whole material civilization would inevitably collapse.

Mathematics is the subject which undoubtedly forms the very basis of entire world’s scientific, technological and commercial system. Mathematics is useful in the development of other fields of knowledge. There is no science, no art and no profession where Mathematics does not hold a key position.

Mathematics is the man-made science. A sound mathematics education can have a profound effect upon the development of rationality and which, in turn, may influence the total development of the learner to proceed much further.
1.2 IMPORTANCE OF MATHEMATICS

Mathematics education is central in developing a scientifically and technologically literate society. In a rapidly globalizing world, no society can compete without a vibrant scientific and technological sector. Mathematics is necessary as a foundation for all science and technology fields since, these draw on mathematical concepts and techniques.

Mathematics is an exact science and involves high cognitive abilities and powers. National Policy on Education (1986) has considered the importance of mathematics in general education and suggested that, “Mathematics should be visualised as the vehicle to train a child to think, reason, analyse and to articulate logically.

Mathematics connects directly and indirectly with many other domains of knowledge. Its applications to science and engineering are clear. Much of our economic growth stems from technological jobs that demand high mathematical competence. Our society as a whole benefits from having a mathematically fluent populace.

Mathematics is the gate and key of all sciences. Academic achievement in mathematics most likely seems to be one of the predictors of people's success in their career in particular. As our society becomes more and more dependent on high levels of computer- based technology, it becomes increasingly important that children should grow up with a basic competence and familiarity with numbers and they should feel at home in the world of calculation and computation.

1.3 EDUCATION SYSTEM IN INDIA

Education is the process of developing the capacities and potentials of the individual so as to prepare that individual to be successful in a specific society or culture. From this perspective, education is serving primarily as an individual development
function. Education begins at birth and continues throughout life. It is constant and ongoing. Schooling generally begins somewhere between the ages four and six when children are gathered together for the purposes of specific guidance related to skills and competencies that society deems important. In the past, once the formal primary and secondary schooling was completed the process was finished. However, in today’s information age, adults are quite often learning in informal setting throughout their working lives and even into retirement.

Education, in its broadest sense, may be defined as a process designed to inculcate the knowledge, skills and attitudes necessary to enable individuals to cope effectively with their environment. Its primary purpose is to foster and promote the fullest individual self realization for all people. Achieving this goal requires understanding of commitment to the proposition that education is a primary instrument for social and economic advancement of human welfare (Verma, 1990).

Parents desire that their children climb the ladder of performance to as high a level as possible. This desire for a high level of achievement puts a lot of pressure on students, teachers, schools and in general the education system itself. In fact, it appears as if the whole system of education revolves round the academic achievement of students, though various other outcomes are also expected from the system. Thus a lot of time and effort of the schools are used for helping students to achieve better in their scholastic endeavors.

Across the world, India is seen as an education powerhouse. Every nation develops the system of education to express and promote its unique socio-cultural identity and also to meet the challenges of the times. School education is an important segment of the whole educational structure and it is considered as a powerful instrument to develop students’ behavior and hence the society.
There have been many studies related to education issues in India. While discussing the education in India, Chauhan (2008) pointed that low school enrolment and completion rates, high dropout and failure rates are reported are the characteristics amongst the weaker section of the society. Shortcoming related to teaching staff has also been identified as the major problems in effective teaching learning (Desai, 1999). Despite of government’s effort to provide uniform level of education for its citizen, non-uniform academic experiences of students belonging to different schools are evident in India. Such differences are not only between urban and rural schools, but also amongst the schools having similar location. The existences of varying academic experiences like rich and poor, rural and urban in India are also reported (Banaji S. 2005). The micro level investigations are also conducted to assist effective teaching-learning in India. The importance of curriculum reform through changes in evaluation process in effective teaching-learning process is evidenced by such study (Agrawal, 2004). A multi-level structured education system prevails in India.

The levels and major governing bodies of education prevailing in India are
1). Pre- Primary - It consists of children of 3-5 years of age studying in nursery, lower kindergarten and upper kindergarten.
2). Primary - It includes the age group of children of 6-11 years studying in classes from 1st to 5th
3). Middle - It consists of children studying in classes from 6th to 8th
4). Secondary - It includes students studying in classes 9th and 10th
5). Higher Secondary - Includes students studying in 11th and 12th classes
6). Undergraduate - Here, a student goes through higher education, which is completed in college. The duration of undergraduate course may vary according to the subject pursued by the student.
7). Postgraduate - After completing graduation a student may opt for post graduation
The Indian Government has initiated several plans such as 'Sarva Siksha Abhiyan (SSA), District Primary Education Program (DPEP), Operation Blackboard, Mid Day Meal etc, mainly to improve the level of primary education and to reduce illiteracy. Government also made plan and policy to address issues related to upper levels of education including secondary education. The national policy of education (1986) and program of action (1992) states that the curriculum of secondary education should expose the students to differentiated roles of science, the humanities, and social science. The roles of teacher and infrastructure facility for effective education are also realized and mentioned in the policy documents. Progress in education scenario is remarkable in India probably due to Government policy and programmes. However, some areas still require attention.

1.4 MATHEMATICS EDUCATION IN INDIA

The quality of education is such an area which needs special intervention and attention. There are several subjects taught at school e.g. language, literature, social studies, science and mathematics. Subjectwise performance variations are generally reported. Amongst the subjects taught in schools, mathematics is considered as one of the toughest subjects with poor performances of students. The lower level of pass percentage has been a matter of serious apprehension. Thus, science subject in general and mathematics in particular has been a problem area for majority of secondary schools in India.

Appointments in local and national sectors also demand competitive academic skill. It is true that secondary school curriculum is prepared to impart necessary academic training for higher education as well as for such academic skill. The course curriculum is only one factor responsible for imparting quality education. There are other academic environment factors governing the success of secondary education to achieve its goal.
It is being often told that there exists fear towards mathematics learning amongst the student communities of secondary schools. Mathematical skill is essential not only for the higher education aspiring section, but also success in several competitive examination for jobs depends upon the basic understanding in mathematics. Thus, perfect teaching-learning in secondary schools in all subjects in general and mathematics subject in particular has been a serious issue needing investigation in India. Mathematics is embedded deeply into the life and culture of people in the Indian subcontinent, attested by a long history of engagement with mathematics in art, craft, work and abstract disciplines of thought.

With the Right to Education legislated by the Indian Parliament in recent years, universalization of school education is becoming an imminent reality. On the other hand, the need for strengthening Mathematics education at school level is acknowledged by all policy planners. While the overall expansion and development of higher education remains an important issue, problems of curriculum and pedagogy, assessment and teacher professional development have their roots in mathematics at school. India is characterized by diversity and cultural riches, as well as endemic poverty and social division, and this is reflected in mathematics education as well.

PISA stands in a tradition of international school studies, undertaken since the late 1950s by the International Association for the Evaluation of Educational Achievement (IEA). Much of PISA's methodology follows the example of the Trends in International Mathematics and Science Study (TIMSS, started in 1995), which in turn was much influenced by the U.S. National Assessment of Educational Progress (NAEP). The reading component of PISA is inspired by the IEA's Progress in International Reading Literacy Study (PIRLS). PISA aims at testing literacy in three competence fields: reading, mathematics, science.
The Programme for International Student Assessment (PISA) is a worldwide study by the Organisation for Economic Co-operation and Development (OECD) in member and non-member nations of 15-year-old school pupils' scholastic performance on mathematics, science, and reading. It was first performed in 2000 and then repeated every three years. It is done with view to improving educational policies and outcomes. The data have increasingly been used both to assess the impact of educational quality on incomes and growth and to understand what causes differences in achievement across nations.

470,000 15-years-old students representing 65 nations and territories participated in PISA 2009. An additional 50,000 students representing 9 nations were tested in 2010.

The Trends in International Mathematics and Science Study (TIMSS) and the Progress in International Reading Literacy Study (PIRLS) by the International Association for the Evaluation of Educational Achievement are similar studies.

India ranked second last among the 73 countries that participated in the Programme for International Student Assessment (PISA), conducted annually to evaluate education systems worldwide by the OECD (Organisation for Economic Co-operation and Development) Secretariat. The survey is based on two-hour tests that half a million students are put through. The states of Tamil Nadu and Himachal Pradesh, showpieces for education and development, were selected by the central government to participate in PISA, but their test results were damning.

Of the 74 countries tested in the PISA 2009 cycle, the two Indian states came up 72nd and 73rd out of 74 in both reading and maths, and 73rd and 74th in science. The poor result was greeted with dismay in the Indian media. The BBC reported that as of 2008, only 15% of India's students reach high school.
Mathematics education is not an established discipline in this country and few systematic studies exist in this area. Due to the efforts of many, a substantial amount of work has happened by way of improving teaching and learning of mathematics. But a lot more needs to be done. Impressions of researchers or teachers involved in developing alternative curriculum and carrying out the classroom interventions indicated significant improvements in children’s attitudes towards mathematics. They also indicated better understanding of the content but systematic studies are required to assess their actual impact on students’ learning.

India is a developing country with vast portion of human resources. The Indian Government has realized the importance of educational development and therefore, provides required importance in education.

1.5 MATHEMATICS EDUCATION IN TAMILNADU

Tamil Nadu is one of the most literate states in India. The state's literacy rate is 80.33% in 2011, which is above the national average. A survey conducted by the Industry body Assocham ranks Tamil Nadu top among Indian states with about 100% Gross Enrollment Ratio (GER) in primary and upper primary education. There were a total of 1,28,55,485 children enrolled across the state as of 2010, with the split up of 97,97,264 students in primary, 18,73,989 in secondary and 11,84,232 in higher secondary classrooms. During the year 2015, the pass percentage of students in SSLC 10th Board Examination is 92.9%, among which 95.4% girls and 90.5% boys.

Samacheer Kalvi or Tamil Nadu Uniform System of School Education or equitable education system is a School Education Department of Government of Tamil Nadu, India programme to integrate the various school educational systems within the state. There were over 1.2 crore students in four streams of school education comprising about 45,000 state board schools, 11,000 matriculation schools, 25 oriental schools and 50 Anglo-Indian schools, with different
syllabus, textbooks and schemes of examinations. Uniform System of School Education was implemented by Tamil Nadu Uniform System of School Education Act 2010 which paves way for quality education to all children without any discrimination based on their economic, social or cultural background.

The main goal of mathematics education in schools is the mathematisation of the child’s thinking. Clarity of thought and pursuing assumptions to logical conclusions is central to the mathematical enterprise. There are many ways of thinking, and the kind of thinking one learns in mathematics is an ability to handle abstractions, and an approach to problem solving. In our vision, school mathematics takes place in a situation where: (1) Children learn to enjoy mathematics, (2) Children learn important mathematics, (3) Mathematics is a part of children’s life experience which they talk about, (4) Children pose and solve meaningful problems, (5) Children use abstractions to perceive relationships and structure, (6) Children understand the basic structure of mathematics and (7) Teachers expect to engage every child in class.

On the other hand, mathematics education in our schools is beset with problems. We identify the following core areas of concern: (a) A sense of fear and failure regarding mathematics among a majority of children, (b) A curriculum that disappoints both a talented minority as well as the non-participating majority at the same time, (c) Crude methods of assessment that encourage perception of mathematics as mechanical computation, and (d) Lack of teacher preparation and support in the teaching of mathematics and solutions for the same is still under evaluation by many researchers.

Mathematics education is essentially a practical discipline, where the underlying goal is always to promote better learning of mathematics by students. It benefits both society and the individual through its contribution to the economy, science, engineering etc. It can empower individuals in everyday life, bring them personal fulfillment through studying its beautiful patterns and working on its magnificent problems.
1.6 SCHOLASTIC ACHIEVEMENT

Scholastic achievement has become an index of child’s future in this highly competitive world. Scholastic achievement has been one of the most important goals of the educational process. It is also a major objective, which every individual is expected to perform in all cultures. Scholastic achievement is a key mechanism through which adolescents learn about their talents, abilities and competencies which are an important part of developing career aspirations (Lent et al., 2000). Hence scholastic achievement occupies a very important place in education as well as in the learning process.

Scholastic achievement is defined by Crow and Crow (1969) as the extent to which a learner is profiting from instructions, in a given area of learning i.e., achievement is reflected by the extent to which skill and knowledge has been imparted to him. Academic achievement also denotes the knowledge attained and skill developed in the school subject, usually designated by test scores. Achievement is influenced by personality, motivation, opportunities, education and training. There are several other factors also which influence the scholastic achievement of student like study habit, self-concept, socio economic status, intelligence etc.

Education is considered as an important index to measure societal development. This is the reason that education is taken as priority sector for development, by all nations. Every nation develops the system of education to express and promote its unique socio-cultural identity and also to meet the challenges of the times. School education is an important segment of the whole educational structure and it is considered as a powerful instrument to develop students’ behavior and hence the society.

There have been many studies related to education issues in India. While discussing the education in India, Chauhan (2008) pointed that low school enrolment and completion rates, high dropout and failure rates are reported are the characteristics amongst the weaker section of the society. Despite of government’s effort to provide
uniform level of education for its citizen, non-uniform academic experiences of students belonging to different schools are evident in India. Such differences are not only between urban and rural schools, but also amongst the schools having similar location. The existences of varying academic experiences like rich and poor, rural and urban in India are also reported (Banaji S. 2005). The micro level investigations are also conducted to assist effective teaching-learning in India.

The interactions of a large number of socio-economic as well as academic environmental factors influence the student’s performance in school. Poor school performance not only results in the child having a low self-esteem, but also causes significant stress to the parents (Karande and Kulkarni, 2005). Identification of causes of poor performance and execution of corrective action plan so that the students can perform up to their full potential is required.

It has been found that the factors like parent’s education, parental occupation, type of family, family size, ordinal position and even gender and age of the child are found to have their impact on the academic achievement of every pupil. Studies dealing with the effect of family environment on student’s achievement suggest that several characteristics of family life are relevant also have its own effects on the academic performance of the student.

1.7 SCHOLASTIC ACHIEVEMENT IN MATHEMATICS EDUCATION

The importance of mathematics in most fields of human attempt cannot be underestimated. Its usefulness in science, mathematical and technological activities as well as commerce, economics, education and even humanities is almost at same level with the importance of education as a whole. Mathematics is one of the key subjects in both the primary and secondary school education system. The teaching of mathematics is very important to all human existence. Mathematics is all about finding solutions to problems. The technological development is highly rooted in the study of mathematics.
Kerlinger (1985) describe mathematics as a language of science. Okebukola (1992) said that mathematics is referred to as central intellectual discipline of the technological societies. Aminu (1990) argued that mathematics is not only the language of sciences, but essential nutrient for thought, logical reasoning and progress. Mathematics liberates the mind and also gives individuals an assessment of the intellectual abilities by pointing towards direction of improvement.

Mathematics educators and researchers like (Ohuche 1978; Ale, 1989; Oshibodu, 1984 and 1988; Akpan, 1987; Odogwu, 1994; Edwards and Knight., 1994; Alele – Willaims 1988; Georgewill, 1990; Tella 1998) have over the years carried out researches on factors that responsible for poor performance in mathematics at primary and secondary school. These factors ranging from shortage of qualified mathematics teachers, poor facilities, equipment and instructional materials for effective teaching, use of traditional chalk and talk methods, large pupils to teacher ratio and mathematics fright/phobia. Several factors have generally been identified as predictor of poor academic achievement.

The report on mathematics education finds that a majority of countries have adopted an outcome-based approach, where the focus is on pupils' practical skills. The amount of mathematics content in curricula has decreased while the focus on problem-solving and the application of mathematics has increased. This approach better responds to the needs of students and pupils and clearly shows how they can apply mathematics in the real world.

People usually find fault with wrong government policies, incompetency of the teachers, lack of learning facilities in the school, absence of proper care at home etc. The investigator is of the opinion that each party mentioned above has a part to play. These considerations motivated the investigator to conduct study comprising the variables dealt here in relation to achievement in Mathematics of the pupils of standard X.
1.8 FACTORS AFFECTING SCHOLASTIC ACHIEVEMENT IN MATHEMATICS EDUCATION

By knowing and identifying the factors, which are affecting the achievement in Mathematics education among school students and make thorough investigation about them, we can find a remedy and can overcome the difficulties in understanding the subject and attaining success in the achievement of Mathematics. The important factors, which are affecting the achievement in Mathematics are listed hereunder:

I. Intellectual Factors

II. Personal Factors
   - Behaviour
   - Skills
   - Age
   - Sex
   - Community
   - Hobbies
   - Ability
   - Physical Characteristics
   - Physical Disability
   - Health
   - Physical appearance
   - Life Satisfaction

III. Personality Factors
   - Attitude
   - Anxiety
   - Self-concept
   - Cognitive Style
IV. School related factors

 School environment
 Class-room environment
 High student teacher ratio
 Medium of instruction
 Teachers’ instructional method
 Lack of theoretical clarity
 Type of Management

v. Home related factors

 Home Environment
 Parents’ occupation
 Parents’ education
 Parents’ income
 Parental motivation

vi. Other factors

 Learning Strategies
 Gender Differences
 Social Integration or Social Acceptance
 High expectation of parents and teachers
 Positive and negative relationship
 Athletic competence
 Cultural differences
 Lack of motivation
 Romantic Appeal
 Time
 Technology
Because of the factors mentioned above, there is a great fluctuation in the achievement of Mathematics education. Among all these factors, many researchers have already discussed about almost all the factors and since the researcher now propose to study about the attitude towards mathematics, anxiety, class room environment and home environment, in the view of the researcher which are the main factors affecting the achievement of Mathematics of high school level students.

1.8.1 ATTITUDE

Literature refers to attitude as a learned predisposition or tendency of an individual to respond positively or negatively to some object, situation, concept or another person.

Research on attitude has a long history in mathematics education. The construct was borrowed from the field of social psychology (Allport, 1935), where attitude is viewed as the predisposition to respond to a certain object either in a positive or in a non positive way.

Using a simple definition, attitude towards Mathematics is just a positive or negative emotional disposition towards Mathematics (Mc Leod, 1994). Using a multidimensional definition, attitude towards Mathematics comprises three components: an emotional respond to Mathematics, positive or negative, a conception about Mathematics, and a behavioral tendency with regard to Mathematics (Hart, 1989). Ma & Kishor (1997) propose attitude towards Mathematics as “an aggregated measure of a liking or disliking of Mathematics, a tendency to engage in or avoid mathematical activities, a belief that one is good or bad at Mathematics, and a belief that Mathematics is useful or useless”.
In the present study, the psychological object is Mathematics. The personal response to this object is measured. For this Aiken’s Revised Math Attitude scale (1974) was used.

### 1.8.2 CLASSROOM ENVIRONMENT

Classroom environment refers to the environment prevailing in a classroom when the process of teaching learning takes place. This includes the emotional, physical and intellectual climate set up by the teacher and students to create a wholesome learning situation.

Baloglu and Kocak have claimed that more than half of variance of educational achievement in mathematics might be interpreted by several variables rather than intellectual potential (intelligence). Classroom environment is one of these variables, which may play vital and strong role in educational, cognitive, psychological and behavioral performance of students.

For the present study, classroom environment refers to the environment for learning the subject Mathematics characterized by the conceptual and pedagogical approach, innovative practices, interpersonal relationships and other classroom facilities which is measured by a classroom environment inventory for Mathematics constructed by Ancel Maria and Dr. Santhamma Raju (1998), Department of Education, University of Calicut.

### 1.8.3 HOME ENVIRONMENT

The home is the first place of learning for the child. The quality of home environment goes a long way in determining the personality and achievement of the child. Babara (1982) said that the children’s home environment influences attainment at
school. Also, Touray (1982) suggested that the home environmental variables could be manipulated to enhance students’ academic performance.

Taylor (1984) states that the family is a place in which the whole range of human experiences takes place. It can be say that lack of encouragement, low quality of parents' language and lack of stimulating activity in the home will reduce the home's effectiveness as a learning environment. Conditions and factors in the home of an individual which has the power to influence him constitute the home environment of the person.

The home has an important influence on the child’s academic achievement. What the child learns at home and how his family motivates him towards education, contributes to the child’s success in school, (Essien, 2002).

A home is a place where the pupils begin to learn the norms and values of the society in which they find themselves. The family is a social unit in any society and it is the source of early stimulation and experience in children (Collins, 2007). The home-environment is a most powerful informal learning situation in which the family, more especially parents, act as educators.

The home as an educational environment is considered as the social psychological contexts or determinants of learning. The term home environment refers to all the objects, forces, and conditions in the home which influence the child physically, intellectually and emotionally (Muola, 2010).

In the present study, the environment at home in terms of physical facilities consistency, parental behavior, achievement motivation and intellectual and cultural orientation related to the learning of Mathematics is measured by Home Environment Inventory of Mathematics constructed by Ancel Maria and Dr.Santhamma Raju (1998), Department of Education, University of Calicut.
1.8.4 ANXIETY

In general, anxiety is a feeling of worry, nervousness, or unease about something with an uncertain outcome. It can also be stated as strong desire or concern to do something or for something to happen. Math anxiety is a phenomenon that is often considered when examining students' problems in mathematics. Mark H. Ashcraft defines math anxiety as "a feeling of tension, apprehension, or fear that interferes with math performance" (2002).

By May (1950) and Drever (1958), anxiety can be defined as a persistent, distressing psychological state, arising from an inner fear. It is a complex of many conditions such as anger, fear, or grief, uneasiness, irritability or depression which the individual cannot account for.

Mathematics anxiety is one of the most important problems for many students. “Mathematics anxiety involves feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations” (Richardson & Suinn, 1972). The first math anxiety measurement scale was developed by Richardson and Suinn in 1972. Since this development, several researchers have examined math anxiety in empirical studies. Mathematics anxiety can be defined as a state of discomfort created when students are required to perform mathematical tasks (Cemen, 1987). In fact, mathematics anxiety is more than a dislike toward mathematics (Vinson, 2001). Generally, high level of anxiety is more closely associated with lower performance among low ability students (Sena et al., 2007).

In the present study, Mathematics Anxiety Scale constructed by Sadia Mahmood and Dr. Tahira Khatoon (2011), Department of Education, A.M.U., Aligarh is used to measure students’ anxiety.
1.9 OPERATIONAL DEFINITIONS OF THE TERMS USED

1.9.1 MATHEMATICS

In this study, the term Mathematics stands for the content of Mathematics text book prescribed for standard X of schools of Tamilnadu.

1.9.2 ACHIEVEMENT IN MATHEMATICS

Achievement in Mathematics refers to proficiency of performance of students in Mathematics as measured using a standardized test. In the present study, achievement in Mathematics is confined to the curricula areas prescribed for the pupils of standard X.

1.9.3 STUDENTS OF STANDARD X

Students of standard X refers to the students attending standard X of the recognized schools of Tamilnadu state.