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INTRODUCTION

1.1.0. Introduction

Mathematics is said to be the numerical and calculation part of man's life and knowledge. It helps man to give the exact interpretation of his ideas and conclusions. It deals with quantitative facts and relationships as well as with problems involving space and form. It deals with relationship between magnitudes and enables man to study various phenomena in space and to establish relationships between them.

Mathematics can be seen in various ways, as a body of knowledge, a collection of techniques and methods, the product of human activity, and even as the activity itself, namely, the solving of problems. Although Mathematics is often considered to be a collection of facts and procedure, current thinking in the field supports a view of Mathematics as the activity of constructing patterns and relationships (National Council of Teachers of Mathematics, Commission on Standards for School Mathematics, Curriculum and Evaluation, 1989; National Research Council, 1989).

Lovers of Mathematics have given it many a epithet and described in numerous ways. It is the 'epitome to human
thought' exclaim some, while others visualise it as, 'a symbol of pure beauty'. Some have experienced ecstasy and perceived in Mathematics the eternal glow of truth, while others consider it as the final stage in God-realisation. Enthralled by its beauty, a lover once said that if you wish to realise Truth and Beauty, it is this grand garden where even a stroll is like a great yatra for the realisation of reality, for Mathematics is Truth and Truth the God personified (Sharma, 1985).

To most people, Mathematics is the process of counting, calculating, measurement and so on, and is considered to be the science of numbers only. To scientists, it is the 'Queen of all the Sciences' or 'a Vehicle of Sciences'. To others, it is a process of free invention.

Mathematics is the science of measurement, quality and magnitude. According to New English Dictionary, "Mathematics in a strict sense is the abstract science which investigates deductively the conclusions implicit in the elementary conceptions of spatial and numerical relations" (Sidhu, 1984).

The New Oxford Encyclopedic Dictionary (1983) defines Mathematics as the "abstract science of space and number".

According to Servais, "Mathematics is an abstract
science; we could say, it is the science of abstraction". Learning Mathematics, he believes, is learning to abstract and to handle abstractions (Rappaport, 1977).

In the words of Sidhu (1984),

"Mathematics is the science of abstract form. The discernment of structure is essential no less to the appreciation of a painting or a symphony than to understand the behaviour of a physical system; no less in economics than in astronomy. Mathematics studies order abstracted from the particular objects and phenomena which exhibit it and in a generalised form."

According to Everyman's Encyclopedia (Volume 8, 1967),

"Mathematics is the basis of all other sciences. For practical purposes Mathematics is divided into Pure Mathematics, of which the principle branches are arithmetic, algebra, geometry, trigonometry and calculus and Applied Mathematics, which includes mechanics, kinetics, thermodynamics, the theories of light and electricity, astronomy, statistics, relativity, quantum theory and indeed every branch of physics. Pure Mathematics is abstract and can be developed and studied without reference to physical laws, whereas Applied Mathematics is frequently based on experimental discovery, and is designed to elucidate it, but is also often the precursor of new advances in natural sciences."

Hirst & Peters (1970) regarded Mathematics as one of the seven forms of knowledge. Mathematics is characterised by its distinctive concepts, propositions, and the method
of verifying its propositions, namely, logical proof. This can be described as an abstracted, theoretical view of knowledge, in which knowledge is regarded as a product.

Lindsay says, "Mathematics is the language of physical sciences and certainly no more marvellous language was ever created by the mind of man", whereas Locke has said, "Mathematics is a way to settle in the mind a habit of reasoning" (Sidhu, 1984).

Mathematics is exact and true to the point knowledge. It trains or disciplines the mind. Its study results in the development of power rather than the acquisition of knowledge; and knowledge comes as a natural consequence or by-product.

It has also been said that, Mathematics is the "mirror of civilization". It has got its cultural value, and this value is steadily increasing day-by-day. It helps man to overcome difficulties in the way of his progress. It has played a major role in bringing him to such an advanced stage of development. The prosperity of man and his cultural advancement have depended considerably upon the advancement of Mathematics.
1.2.0. Importance of Mathematics in Life

The knowledge of Mathematics was born out of the felt needs of man. Right from human existence on this earth, it has been a faithful companion. When man first wanted to answer the questions like - How many? How much? How big? How long? etc., he invented arithmetic. Algebra was devised to simplify arithmetical computations. For measurement and form geometry was invented. To find the position of high mountains and stars trigonometry was invented and developed, and so on in the case of numerous other branches of Mathematics. The knowledge of Mathematics is therefore indispensable. As the needs grow, the knowledge is bound to grow. Mathematics has become the basis of the world's entire business and commercial system.

The tremendous impact of Mathematics in the modern era is significantly visible in every aspect of human activity. Even a mere carpenter, driver, mason, farmer, chowkidar, labourer, cleaner, vendor, salesman, clerk, etc., or to say, any earning person has to calculate his/her wages and buy things from the market and adjust the expenditure to his/her income. Any person ignorant of Mathematics will be at the mercy of others and will be easily cheated. An elementary knowledge of the simplest branch of Mathematics, 'arithmetic', is the daily requirement of every man and
woman in the ordinary affairs of life. The knowledge of its fundamental processes and the skill to use them are the preliminary necessities these days. Thus, it is clear that without having some knowledge of Mathematics, a modern man is a total misfit in this affluent society.

In many occupations such as accountancy, banking, taxation, insurance, business, postal jobs etc., by which the needs of man are fulfilled, direct or indirect use of Mathematics is made. These social agencies depend upon Mathematics for their successful functioning. Also most individual and group projects in life fail for want of sense of calculation. Mathematics is useful for people as workers, as consumers, and as educated citizens. The study of Mathematics helps people to develop the ability to reason which in turn helps them to become better problem solvers. Not only students should see how Mathematics is applied in the real world, but they should observe how Mathematics grows from the world around them.

With the increased complexity of modern living and the pressure of economic circumstances, it has become impossible for any individual to conform to the society without having some knowledge about Mathematics. It has played an outstanding role and has become a part of our life. Its
importance and influence has increased considerably in the present century. Today almost all the disciplines need a strong foundation in Mathematics. The knowledge of Mathematics helps us to a better understanding of the process in nature and society. It is also used directly or indirectly in industry and business, as it solves not only technological problems but also commercial and organisational problems through operations research and computers. Mathematics pervades every study, technique and profession in our present computer age which sharply brings into focus the responsibility laid upon those whose difficult task is to teach Mathematics.

During the age of education of Three R's, Mathematics was one of the three subjects of study. Its importance in the present is no less. There can be no true schooling without Mathematics because it is an indispensable part of education. Mathematics is essential for efficient and successful living. Man utilises knowledge of Mathematics in one form or another. The need of a good command over arithmetic by even a housewife is too obvious to need any discussion. Counting, notation, addition, subtraction, multiplication, division, weighing, measuring, selling and buying are the mathematical operations that needs systematisation and simplification with greater diversification of man's
economic activities. They are the fundamental processes of Mathematics which have got an immense practical value in life. Whosoever earns and spends uses Mathematics. A person can get on sometimes very well without learning how to read and write but he/she can never pull on without learning how to count and calculate.

As we move from the industrial society of the 20th Century to the information society of the 21st Century, knowledge of Mathematics is becoming increasingly important for individuals who wish to have options for careers and higher education. Almost all careers require a background in Mathematics as most majors involve some statistics. Knowledge of Mathematics is essential for all members of our society. To participate fully in our democratic processes and to be unrestricted in career choice and advancement, people must be able to understand and apply mathematical ideas. As it is a sequential subject, unless one is clear about the previous units, it will not be possible for him/her to understand the next unit. The schools have generally been responsible to the needs of society. Because society demands acceptable levels of numeracy from all its members, Mathematics is compulsory in classrooms throughout the world. Society needs the maximum cultivation and utilization of this human talent wherever found and in all fields of human
endeavour in order to improve the quality of life for all of us.

Mathematics is so intimately related with man's life that a close relationship and interdependence is seen between the advances in Mathematics and in civilization. In fact, all civilizations flourished on the strong foundations of Mathematics laid by its thinkers. Mathematics is also playing a crucial role in the wonders of modern science. That is why sometimes Mathematics is eulogised as the 'Queen of all Sciences' but sometimes it is also designated as the 'Maid of all Sciences'. Mathematics is the Queen and also the Maid rolled in one. It is the epitome of all human thought, easily the first among all sciences. Mathematics is essential in all sciences for even ordinary purposes. In physical sciences a very high order of Mathematics is absolutely necessary. Mathematics has entered the arena of many a social science as well, like economics, in which it is not possible to move beyond a point without a good knowledge of Mathematics.

As knowledge was gathered by man bit by bit and as its stock grew, the use of Mathematics became inevitable to provide it in elegant forms and make it amenable to comprehension. It cuts short the lengthy statements and helps
the expression of ideas or things in exact form. The scientific advances which have captured people's imagination such as space travel, the harnessing of atomic power, and so on, would have been impossible without Mathematics. Also without Mathematics, statistical records cannot be kept accurately and hence the study of history will be impossible. There will be no economic development without Mathematics.

At the base of all the scientific and technological knowledge lies the learning of Mathematics. It sharpens the reasoning powers of a person and increases his mental alertness. On the whole, a mathematically minded man is usually more dependable than one who is otherwise disposed. The application of Mathematics in different fields like navigation, warfare, astronomy, economics, biology, physics, chemistry and geology need not be over-emphasized. It has also become the fundamental basis of medicine, engineering and technology. Thus, with the increasing quantitative base in all facets of our life, the knowledge of Mathematics amongst common people is bound to increase at a great pace.

Mathematics has acquired a special significance in the modern world. Sidhu (1984) cites what Napoleon had said, "The progress and the improvement of Mathematics are linked to the prosperity of the State." There can be no
doubt about the validity of the statement that mathematical processes were invented in accordance with the requirements of mankind. Human beings cannot pull on without satisfying his/her needs. In all major and minor activities of life, the number imparts system to our life. Ignorance of Mathematics among the masses is a formidable obstacle in the way of a country's progress. Thus, Mathematics will continue to occupy a prominent place in man's life.

1.3.0. Place of Mathematics in School Curriculum

Mathematics commands the highest subject priority rating in a school. The nature of the subject makes it worthy of a place for its own sake. Mathematics is a self-contained mental discipline, with its own language and structure. It acts as a mental tool for the training and exercise of intellectual functions. It provides methods which, when applied to a mass of data, can extract broad generalizations resulting in the economy of human time and thought. Besides being an individual subject, it is a medium of instruction for almost all other subjects. Secondary school Mathematics lays the foundation on which the superstructure of higher Mathematics may be built. Due to its unique role in solving every day problems, it has acquired special significance in the school curriculum.
As far back as 1802, the Universities of Oxford and Cambridge realized the significance of Mathematics and gave it a prominent position by making it compulsory for any one who desired to obtain the B.A. degree (Onyemunwa, 1989).

In 1901, Perry advanced many obvious reasons why Mathematics must be taught in schools and colleges. According to him, among others, they are useful in:

i) Producing the higher emotion and giving mental pleasure.

ii) Brain development and producing logical views of thinking.

iii) Teaching a man the importance of thinking things out for himself and so delivering him from the present dreadful yoke of authority, and convincing him that whether he obeys or commands others, he is one of the highest of beings (Education Pamphlet, Number 36, 1968).

Sir Wilfred Cockcroft, (The Times of India, January 25, 1989) Chairman of the Secondary Examinations Council, the U.K., has justified the learning of Mathematics in schools because it plays a special role as a means of precise, unambiguous communication.
The importance that Mathematics claims in the school education is brought out by Bazzini (1988) as,

"Mathematical education helps in forming a child's thought in its various aspects, as it concerns intuition, imagination, the act of planning, of making a conjecture, of reasoning and of verifying a hypothesis. It specifically develops concepts as well as methods and attitudes which enable the children to produce skills of ordering, quantifying and measuring real events and making a critical examination of reality".

Mathematics should be visualised as the vehicle to train a child to think, reason, analyse and to articulate logically. Apart from being a specific subject, it should be treated as a concomitant to any subject involving analysis and reasoning (Caption 8.16, National Policy on Education, 1986).

The days when a student could say good-bye to Mathematics at the lower level of education and switch over to other disciplines are gone. Now, in almost all States of our country, Mathematics is one of the core subjects to be studied upto 10 years of schooling. This can be said by quoting from the National Policy on Education (1986),

"Perhaps the most notable development has been the acceptance of a common structure of education throughout the country and the introduction of the 10+2+3 system by most States. In the school curricula, in
addition to laying down a common scheme of studies for boys and girls, Science and Mathematics were incorporated as compulsory subjects and work experience assigned a place of importance." (Caption 1.6)

Discussing over the teaching of Mathematics in Schools, Sir Wilfred Cockcroft (1989) said,

"Mathematics teaching at all levels should include opportunities for exposition by the teacher, discussion between the teacher and the pupils, appropriate practical work, consolidation and practice of fundamental skills, problem solving, and investigation".

The National Policy on Education (1986) claims,

"with the recent introduction of computers in schools, educational computing and the emergence of learning through the understanding of cause — effect relationships and the interplay of variables, the teaching of Mathematics will be suitably redesigned to bring it in line with modern technological devices." (Caption 8.17)

For the promotion of interest in Science and Mathematics among students, the Department of Education, Government of Meghalaya, has announced incentive awards for Science and Mathematics teachers in Primary and Middle English Schools of the State. The criteria for award being the performance of students from the concerned schools in their respective School Leaving Certificate Examinations. The Government hopes that the awards will generate a spirit of competition
among teachers to improve the teaching of Science and Mathematics and to strive for better results from their students (The Shillong Times, March 29, 1989).

1.4.0. Aims of Teaching Mathematics

The following are the major aims of teaching Mathematics in secondary schools:

1. To help students to know the mathematical terms, concepts, principles and processes required in carrying out their day-to-day problems.
2. To develop an awareness among students of the importance of Mathematics in their future work.
3. To prepare the students for economic, productive, purposeful, creative and constructive living.
4. To inculcate in students the habits of regularity, practice, patience, self-reliance and discovery.
5. To develop in students the power of concentration, critical thinking, reasoning, efficiency and hard work.
6. To acquaint students with mathematical language and symbolism.
7. To provide students the necessary background for the study of higher Mathematics.
8. To train students in approaching and solving problems, in making suitable representations and in interpreting and verifying results.
9. To develop in students those powers of understanding and of analysing relations of quantity and of space which are needed to develop an insight into and control over our environment.

10. To impart a working knowledge of practical arithmetical applications which are useful in life.

11. To enable the students to possess a mind informed by a body of organized knowledge, to have curiosity aroused, powers of observation trained and their judgement developed.

12. To promote habits of accuracy, exactitude and systematic thinking among students.

13. To develop in students an appreciation towards the role of Mathematics in the present day world.

14. To teach students the skills that would enable them to face life with courage and confidence.

15. To create in students a desire to continue the study of Mathematics and offer their contribution towards the advancement of civilization.

1.5.0. Achievement: Its Meaning

In a general sense the term 'to achieve' conveys the meaning 'to accomplish' or 'to attain'. In the field of education it is referred with respect to the success in the school subjects. The term is defined by many in different ways. Some of these definitions are given under:
According to Micheels and Karnes (1950), the term 'achievement' means relative accomplishment in a specified area of work.

Academic achievement is seen by Mellinger and Heggard (1959), "as an expression of one way the individual learns to utilize his energies, given certain innate potentials and a particular patterns of a socializing pressure." Wolman's Dictionary of Behavioural Sciences defines that "academic achievement is the level of proficiency attained in scholastic or academic work" (Mohan & Gulati, 1986).

Achievement is defined by Stagner (1962) "as the degree of proficiency or progress made by pupils in the mastery of school subjects."

According to Aggarwal and Bhushan (1967), "scholastic achievement is the achievement of the individual student in the subjects in which he is interested and possesses the capability of making his best performance to the best of his potentialities."

In the words of Crow and Crow (1969),

"Achievement means 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 or knowledge has been acquired by a person from the training imparted to him."
According to the Encyclopedia of Psychology (Volume I, 1972), 'achievement' means:

i) General term for the successful attainment of some goal requiring a certain effort.

ii) The degree of success attained in a task, e.g., solving a test.

iii) The result of a certain intellectual or physical activity defined according to individual and or objective (organizational) pre-requisites, i.e., proficiency.

Saxena and Dwivedi (1979), consider that the term 'scholastic achievement' refers to the attainment or accomplishment (what a person has done) in the field where a subject receives some instruction or training. It is personal motive as well. Thus, achievement is a motivating force which helps the subjects to do 'what he has done'. Without a need felt for achieving some goal performance is difficult, if not possible.

Verma and Upadhyay (1981) define,

"Achievement as the attainment or the accomplishment of an individual in some or particular branch of knowledge after a certain period of training. The achievement score of a student indicates towards the future success of the individual."
Spratt suggests that achievement in any field of life is a function of the interaction of various personality factors, whereas Cohen and Mark observed 'the competence to achieve' and 'will to achieve' are the twin factors which have been identified by the social scientists as bases for achievement (Cartnell, 1983).

Various factors, both intellectual and non-intellectual, may affect in the positive or negative way, the achievement of an individual. The prediction of academic achievement has assumed enormous importance in view of its practical view. It forms the main basis for admission and promotion in a class. It is also important for attaining a degree or getting a job. So, it has drawn the attention of investigators and one of the recurrent themes to be found in educational research involves the attempt to unravel the complex determinants of academic achievement.

1.5.1. Factors Influencing Academic Achievement

Academic achievement is of paramount importance particularly in the socio-educational context. Education has always been concerned with the prediction of academic achievement. It has probably received more public attention than any other single problem in education. Now-a-days academic achievement of students has been the main focus of educa-
tionists. It is assuming greater importance day by day, and is designed to identify the outstanding talents of the students.

Many researches have been conducted to identify the various factors which influence the academic achievement of students. Available studies indicate that academic achievement is influenced by a host of factors. These studies have examined the relationships between academic achievement and a large number of factors. Although several researchers have worked in this area, not much has been done to establish the association of factors like attitude, aspirations, aptitude, and personality characteristics with the achievement in Mathematics in particular. Since the present study intends to study this, the meaning of these variables and their relationship with academic achievement are discussed further.

1.6.0. Attitude: Its Meaning

Attitudes have been defined by various authors in different ways. Attitudes are basically expressed feelings of an individual towards certain objects which he/she is confronted with. What a person feels, thinks and believes is expressed in his/her attitudes towards that particular object.
According to Thurstone and Chave (1928), "Attitude denotes the sum total of man's inclinations and feelings, prejudices or biases, preconceived notions, ideas, fears, threats and conviction about any specific topic."

Thurstone (1936) states that "Attitude is a generalized reaction for or against a specific psychological object." The same author in 1946 defines an attitude "as the degree of positive or negative affect associated with some psychological object." By a psychological object, he means any symbol, phrase, slogan, person, institution, idea, or idea towards which people can differ with respect to positive or negative affect.

Murphy, Murphy & Newcomb (1937) views "Attitude as primarily a way of being 'set' towards or against certain things."

According to Kretch & Crutchfield (1948), an attitude can be defined as "an enduring organization of motivational, emotional, perceptual, and cognitive process with respect to some aspect of the individual's world." McKeachie & Doyle (1966) put it as "an organization of concepts, beliefs, habits, and motives associated with a particular object." Katz (1967) reiterates a similar meaning by defining "Attitude as a predisposition of the individual to evaluate some
symbol or object or aspect of his world in a favourable or unfavourable manner."

Newcomb (1952) states, "An attitude is not a response but a more or less persistent set to respond in a given way to an object or situation. The concept of attitude relates the individual to any aspect of his environment which has positive or negative value for him." This view has been supported by MacDonald (1965) who points out that "An attitude is a predisposition to act in a positive or negative way towards persons, objects, ideas, and events."

Attitude has been defined by Cronbach (1954) as, "a readiness to react toward or against some situation, person, or thing, in a particular manner, for example, with love or hate, or fear or resentment, to a particular degree of intensity." In his work in (1963), he explains that "An attitude consists of the meanings that one associates with a certain object (or abstraction) and that influences his acceptance of it."

Rosenberg (1960) considers an attitude "as a relatively stable affective response to an object."

While Allen (1960) states, "Attitude is an arrangement of mental processes, a mental set, an internal disposi-
tion or the way certain mental processes are organised in a person to make him act in a particular way."

Allport (1967) views attitude as a "mental and neural state of readiness, organised through experience and exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related."

According to the International Encyclopedia of the Social Sciences (Volume I, 1968), "An attitude is a relatively enduring organization of beliefs around an object or situation predisposing one to respond in some preferential manner."

In the words of Whittaker (1970), "An attitude is a predisposition or readiness to respond in a predetermined manner to relevant stimuli", while Travers (1973) considers an attitude "as a readiness to respond in such a way that behaviour is given a certain direction."

Encyclopedia of Psychology (Volume I, 1972) has given "Attitude is a perceptual orientation and response readiness in relation to a particular object or class of objects."

Garrett (1975) states, "Attitude is primarily an inner state rather than an outer expression. It is an impli-
cit response toward or away from an individual value or social value. An attitude is always a stand or position which an individual takes towards a person or an issue."

According to Anastasi (1976), "Attitude is a tendency to react favourably or unfavourably towards a designated class of stimuli, such as, a national or racial group, a custom, or an institution."

Sorenson (1977) views that,

"An Attitude is a particular feeling about something. It therefore involves a tendency to behave in a certain way in situations which involve that something, whether it be a person, idea or object. It is partially rational and partially emotional and is acquired, not inherent, in an individual."

A look into the various ways an attitude is defined brings out that attitudes have both cognitive as well as emotional components towards the psychological object. They are, to a great extent, responsible for the behaviour of a person towards the psychological object under question. The degree of a person's attitude may vary from extremely negative through a gradation to extremely positive position. Positive or favourable attitudes are developed towards those psychological objects which satisfy individual needs, whereas negative or unfavourable attitudes are developed towards
those psychological objects which obstruct or thwart the satisfaction of the individual needs. Attitudes develop through various sources, such as, specific experiences, communication from others, imitation of models and institutional factors.

A positive attitude towards a subject of study will strengthen a student's learning and will promote greater efforts on his part to strive towards mastery in that subject. This is expected to result in a higher achievement by the student. Attitudes are, to a great extent, responsible for the particular behaviour of a person about an object, idea or person. It makes the individual respond in a particular way to the particular stimuli. Therefore, we may understand attitude as a determining acquired feeling which prepares a person to behave in a certain way toward a specific psychological object.

1.6.1. Attitude and Academic Achievement

Attitude and academic achievement are both identified as important areas for student growth in the school curriculum. Attitudes determine the directions in which one strives and makes use of what he/she knows and can do. It also determines the character of one's motive power. If the students find Mathematics useful in their daily lives, then
the students are more likely to consider it to be a creative subject. It is plausible to consider that the more confident a person is, the better is his/her performance, especially in academic subjects like Mathematics.

It may be argued that attitude of an individual plays a critical role in enhancing one's academic achievement. Learning which is accompanied by specific attitude is meaningful, pleasant and impells one to continue the learning and thereby achieve higher. A person having a positive attitude towards Mathematics will try to achieve his/her goals and overcome all obstacles; but one who has a negative attitude towards it will try to avoid it. Negative attitude will surely hinder the effectiveness of the study. Thus, it may be expected that a relationship between attitude towards Mathematics and achievement in Mathematics exists.

1.7.0. Aspiration: Its Meaning

Aspiration refers to one's desire or ambition, specially to aim at high things, to mount up. It involves striving to achieve success in difficult tasks and circumstances. A brief compilation of the definition for the term 'aspiration' as given by different persons is provided below.

According to Encyclopedia of Psychology (Volume I, 1972), "The level of aspiration is the possible goal
(score) an individual sets for himself in his performance", while Webster's New Collegiate Dictionary (1983) gives the meaning of the term as "a strong desire to achieve something high or great."

Good (1959) says that "Aspiration is the level of performance or the goal that a person (or group) desires or hopes to reach in a specified activity."

Hurlock (1973) describes aspirations "as the goal the individual sets for himself/herself in a task which has intense personal significance for him/her or in which he/she is ego-involved". Further, she says that because aspirations are ego-involved, success leads to increased self-esteem, while failure brings embarrassment, remorse and feelings of personal inadequacy and inferiority.

Many researchers and psychologists have explained the term 'level of aspiration'.

Hope (1930) and Eysenck (1972) consider "Level of aspiration as the possible goal which an individual sets for himself."

Frank (1935) views "Level of aspiration as the level of future performance in a familiar task which an individual knowing his level of past performance in that task explicitly
Going further, Stacy & DeMartino (1958) describe "Level of aspiration as to the goal which the individual selects for himself and attempts to achieve."

The terms 'aspiration' and 'level of aspiration' have been extended to specific areas of human endeavours.

Level of occupational aspiration has been defined by Haller & Miller (1963) "as an orientation towards occupational goal". Grewal (1984) while constructing the Occupational Aspiration Scale (OAS) has accepted the same definition.

Sharma & Gupta (1980) explain level of educational aspiration, "as a concept, referring orientation towards educational goal, spaced in continuum of difficulty and social prestige, and arranged in educational hierarchy."

Therefore, aspirations are goal statements concerning future level of achievement. Aspiration refers to a person's orientation towards a goal, mostly idealistic ones, while a person's expectations may be termed as his realistic goals. People adjust their level of aspiration in such a way that they are not totally out of line with the prospects of attaining those goals. The goal setting behaviour as well as the process of attaining the goal are consequences of their
past experiences, whether failure oriented or success oriented, level of efforts made by them in that direction, and their capacity to pursue the goal.

1.7.1. Aspiration and Academic Achievement

Aspiration and academic achievement are closely related. Aspiration refers to a student's aims, goals, hopes, targets that he/she sets for himself/herself. Naturally this would differ from person to person. One may aspire to secure an A-1 class in his/her examination results or abilities and capacities in one or more or all the subjects of the curriculum or other academic pursuits, while another may be satisfied simply with pass grades. Achievement depends on the opportunity to learn and attainment of skill or knowledge is a result of learning.

It can be assumed that high aspirations motivate people to make efforts towards the realization of their ambitions. In advanced societies high aspiration in terms of success is a dominant cultural value as well as a major theme which influences the total life pattern of an individual. Aspirations play an important role in the field of education. It leads to activities to make the maximum possible use of the resources and facilities provided by the school in academic matters for one's personal growth and
development so as to score high in academic achievement. High aspiration would result in careful study and preparation for examinations, maintaining oneself in a state of readiness to compete with others, to face and undertake challenging tasks, extensive reading, intensive concentration and assimilation, and, above all, gathering material from any source (lectures, debates, newspapers, broadcasts, etc.) with a view to transfer that knowledge and understanding to one's own practical purpose in solving problems or in excelling others.

1.8.0. Aptitude: Its Meaning

Aptitude is an ability to acquire skills or gain proficiency in a specific field.

Bingham (1937), whose contribution to research in aptitude is pioneering, defines "Aptitude as a condition symptomatic of a person's fitness, of which one essential aspect is his readiness to acquire proficiency in his potential ability, and another is his readiness to develop an interest in exercising his ability".

Traxler (1957) considers,

"Aptitude as a condition, a quality or a set of qualities in an individual which is indicative of the probable extent to which he will be able to acquire under suitable training, some knowledge, skill or
composite of knowledge, understanding and skill, such as ability to contribute to art or music, mechanical ability, mathematical ability or ability to read and speak a foreign language.

In the words of Freeman (1971),

"An aptitude is a combination of characteristics indicative of an individual's capacity to acquire (with training) some specific knowledge, skill, or set of organised responses, such as the ability to speak a language, to become a musician, to do mechanical work".

Mangal (1983) states, "An aptitude is a special ability or specific capacity besides the general intellectual ability, which helps an individual to acquire a required degree of proficiency or achievement in a specific field."

According to Chauhan (1984),

"An individual's aptitude for a given type of activity indicates his capacity to acquire proficiency in it under appropriate conditions. Further, his potentialities at present as revealed by his performance on selected tests have predictive value. It reveals an individual's promise or essential teachability in a given area."

Hence, aptitude is a combination of characteristics indicative of an individual's capacity to acquire some specific knowledge, skill or set of organized responses such as the ability to become an artist or to be a mechanic.
The knowledge of one's aptitude helps us in predicting the future success of the individual, when given suitable training or experiences, in a particular area or activity.

1.8.1. Aptitude and Academic Achievement

Aptitude is an important determinant of academic achievement. It tries to make an estimate of one's future success or failure. Aptitude has future reference and it tries to predict the degree of attainment or success of an individual in an area or activity after adequate training.

Aptitude tests, in all their forms, measure only the present ability or capacity of an individual which can be exploited for making prediction about the future attainments. Aptitudes are concerned with specific abilities. The knowledge of aptitudes acquaints us with those specific abilities and capacities of an individual which give an indication of his ability or capacity to succeed in a special field or activity. Therefore, in predicting achievement in some particular job, training, courses or specialized instruction, one needs to know more about a person's aptitudes.

To get a desirable success in a given activity, a person must have an aptitude for that activity. Various aptitude tests have been devised to measure aptitudes of
the individual in various specific fields. The results of these tests enable us to locate, with a reasonable degree of certainty, the fields of activity in which an individual is most likely or least likely to be successful.

1.9.0. Personality: Its Meaning

The term 'personality' has been defined in various ways by psychologists who worked on the problem of personality and the variables influencing its development.

While accepting the role of both heredity and environment, Prince (1929) states, "Personality is the sum total of all the biological innate dispositions, impulses, tendencies, appetites and distincts of the individual and the dispositions and tendencies acquired by experience."

According to Watson (1930), "Personality is the sum of activities that can be discovered by actual observations over a long enough period of time to give reliable information."

Allport (1950), who devoted most of his time for research on personality defined it, "as a dynamic organisation within the individual of those psycho-physical systems that determine his unique adjustment to his environment." A similar idea is conveyed by Hartman who says, "Personality
is integrated organization of all the pervasive characteristics of an individual as it manifests itself in focal distinctiveness to others" (Chauhan, 1984).

Guilford (1959) considers one's "Personality as his unique pattern of traits, where a trait is any distinguishable, relatively enduring way in which one individual differs from another."

McDougal views "Personality as a synthetic unity of all mental features and functions in their innate interplay" (Kundu, 1976).

In the words of Cattell (1970), "Personality is that which permits a prediction of what a person will do in a given situation."

The term 'Personality' as given by Eysenck (1971), "is the more or less stable and enduring organisation of a person's character, temperament, intellect, and physique, which determine his unique adjustment to the environment."

Sherman (1979) states, "Personality as the characteristic pattern of behaviours, cognitions, and emotions which may be experienced by the individual and/or manifest to others."
Fredenburgh (1971) tries to summarize the various definitions in a single definition which runs as, "Personality is a stable system of complex characteristics by which the life pattern of the individual may be identified."

Bhatia (1984) says that psychologically speaking, "Personality is the sum total of all that an individual is, of everything that constitutes a person's physical, mental, emotional and temperamental make-up."

Personality is defined by Rao (1985), "as the characteristic patterns of behaviour and models of the thinking that determine a person's adjustment to the environment". The term characteristic in the definition implies some consistency in behaviour that people have tendencies to act or think in certain ways regardless of the situation.

Thus, it can be concluded that one's personality manifests itself in all aspects of one's life. Our personal appearance, dress, manners, physical constitution, speech, gait, taste, understanding, enthusiasms, ambitions, principles of life and conduct and the like colour our personality. It is those characteristics or traits which distinguish one individual from the other.
1.9.1. Personality and Academic Achievement

Personality is a forceful determinant of human activities and hence also of achievement. The amount and quality of achievement in the different walks of life are certainly the output of distinct organization of different traits of personality. Our unique composite of the temperament traits, needs, interests, values, problems, adjustment, attitude, aptitude, tests and talents decide our achievement, not only in the academic field but in every area.

The personality factors have an important bearing on academic achievement. The individual self esteem may depend greatly on academic progress in school as it is a substantial indication of his potential for later years. Psychologists and educators have shown their interest around the study of person in relation to academic achievement which is considered as a function of one's personality. Paul Centi (1962) agreed with this view and remarks,

"Recently more and more attention has been directed to the effect on achievement of selected personality variables. This new emphasis has stemmed from the new generally accepted belief that the academic performance of the students is another aspect of his total behaviour and as such is determined and influenced by the dynamic process of personality."
1.10.0. Need for the Study

The modern world is accredited with explosion of knowledge. As civilization becomes more complicated, Mathematics is a must to man's existence. Every citizen needs to know sufficient quantum of Mathematics to cope with the practical problems one encounters in day-to-day life. To meet the challenge, students must be trained thoroughly to understand the mathematical concepts and principles, to reason clearly and communicate effectively to recognize mathematical applications in the world around them, to approach mathematical problems with confidence, to develop proficiency in problem solving and higher order thinking, to develop the fundamental skills, that will enable them to apply their knowledge to new situations and to take control of their own lifelong learning. As Mathematics has pervaded into every dimension of human life, its importance is realised greater than ever before.

It is often said that of all the subjects included in the school curriculum, Mathematics is the one most disliked by a good number of pupils. Many students view mathematical problems as insurmountable obstacles. It is often argued that Mathematics is an exceptionally difficult subject i.e., its study requires special ability and intelligence and therefore everybody should not be burdened with the
study of this subject. References are made to low pass percentage in the subject. But it is felt that man's knowledge in this world is incomplete without Mathematics. If students continue to fail in Mathematics in large numbers, it will be difficult to have qualified economists, scientists, doctors, engineers, and statisticians since these categories of students cannot gain admission into any of the universities in the country, without being qualified in the subject. Failure to produce skilled personnel in these areas will slow down the technological advancement of the country. Thus, ignorance of Mathematics at this stage will be a great handicap to the progress of the nation. Realising this need, educationists have made Mathematics as a compulsory subject till the completion of the school level of education.

The scientific and technological development of our country has placed a new demand on Mathematics. The subject offers plenty of scope for the development of logical reasoning and is a very useful subject for most vocations and higher specialised courses of learning. The duty of the school is to give students a broad view of what he/she is capable of achieving in future and enable him/her to choose a suitable line out of that. At the university stage, most of the physical and social sciences require the application of Mathematics. Discoveries in the subjects including
industries rely heavily on mathematical techniques. Therefore, a student will find his future choice of specialisation narrowed indeed if he is unable to tackle Mathematics.

To function effectively in the 21st century, students irrespective of sex will need proficiency in an enriched body of Mathematics. It is important to provide preparation of the highest quality for those who are to be nation's discoverers, innovators and interpreters in every field of competence, in science and technology, in arts, trade, business, industry, professions and in public service and statesmanship. India cannot hope to become a leading power in the world unless it has a regular supply of talented young men and women to various positions that lie vacant in our institutions of learning and work. Therefore, promotion of Mathematics is an important factor in the progress, welfare, and security of our nation.

Though numerous studies have been conducted with regard to the academic achievement of students, very few are carried out with regard to the students' achievement in Mathematics in particular. To mention some such studies are Balasubramanian & Feroze (1966), Sathiyagirirajan & Rao (1967), Elamaran & Kandaraj (1967), Kulkarni, Naidu & Arya (1970), Khenglawt (1982), Kumar (1986), Jain (1986), Singh (1986) and Caroline Ngailiankim (1988).
Balasubramanian & Feroze (1966) made a comparative study of achievement in Mathematics of rural and urban students of standard X in some of the high schools in Coimbatore. The study showed no real difference between the achievement of urban boys and girls in Mathematics. In the study of Sathiyagirirajan and Rao (1967), it was found that boys were superior to girls in achievement in composite Mathematics. Pupil's attitude towards the subject was suggested as a factor in the achievement of mathematical concepts by Elamaran & Kandaraj (1967). The All India Survey of Achievement in Mathematics for primary, middle, and high school students conducted by Kulkarni, Naidu & Arya (1970) reported the relationship of aspirations and attitude towards Mathematics to be significant variables related with achievement in Mathematics. Khenglawt (1982) indicated that some of the personality characteristics as measured on the Cattell's Jr-Sr 14 HSPQ differentiated the low, normal, and high achievers in Mathematics. Kumar (1986) assessed the amount of contribution made by ego-involvement, level of aspiration, intelligence and socio-economic status to the academic attainment of the students. The study revealed that correlation between the examination scores and the four correlates to be positive. Jain (1986) noted sex as a variable in achievement in Mathematics. The study of Singh
(1986) demonstrated intelligence, study attitudes and socio-economic status to contribute in this order of importance to discriminate between high and low achieving groups with respect to Mathematics. Caroline Ngailiankim (1988) studied the existence of any difference in the two variables, namely, student's attitude towards Mathematics and study habits, among high achievers, average achievers and low achievers in Mathematics. There were some indications in the results of the study that attitude towards Mathematics could contribute to some extent towards the achievement of boys in Mathematics, but study habits were not found to have any relationship with Mathematics.

A perusal of the studies conducted highlights the need for a deeper research to understand the variables that are associated with achievement in Mathematics. It is in this thinking that the present study is envisaged.

1.11.0. Statement of the Problem

The title of the problem under study is, "A Study of Selected Variables Associated with Achievement in Mathematics".

The study considers under its purview the following variables which may be associated with the achievement in Mathematics.
i) Attitude towards Mathematics.

ii) Aspirations (Educational and Occupational).

iii) Specific Abilities for Mathematics — These abilities are selected from those drafted for the Differential Aptitude Tests, on the consideration that they would be associated with achievement in Mathematics. These are:
   a) Numerical Ability.
   b) Abstract Reasoning, and
   c) Space Relations.

   Hence, they are nomenclatured as Specific Abilities for Mathematics instead of Aptitude in Mathematics.

iv) Personality Characteristics.

1.11.1. Conceptual Definitions of the Terms Used

   Conceptual definitions of the variables considered in the study are as follows:

A. Achievement

   It is the extent to which proficiency is obtained in Mathematics as a school subject.

B. (i) Attitude

   It is the degree of positive or negative affect associated with some psychological object.
ii) Aspirations

It is the goal the individual sets for himself/herself in a task which has intense personal significance for him/her or in which he/she is ego-involved.

iii) Specific Abilities for Mathematics

They refer to some Specific Abilities which are expected to promote Achievement in Mathematics.

iv) Personality Characteristics

They may be stated as those which permit a prediction of what a person will do in a given situation.

1.11.2. Operational Definitions of the Terms Used

Operational definitions of the variables considered in the study are as follows:

A. Achievement

It is the Achievement in Mathematics as indicated by the score obtained on the Achievement Test in Mathematics developed by the investigator for the purpose of the study.

B.(i) Attitude

It refers to the score obtained on the Attitude Scale developed by the investigator (Caroline Ngailiankim, 1988) to measure the Attitude of students towards Mathematics.
(ii) Aspirations

(a) Educational Aspiration - It is represented by the scores obtained on the Educational Aspiration Scale (EAS) Form V, developed by Sharma and Gupta (1980).

(b) Occupational Aspiration - It is represented by the scores obtained on the Occupational Aspiration Scale (OAS), developed by Grewal (1975).

(iii) Specific Abilities for Mathematics

(a) Numerical Ability - It refers to the score obtained on the Numerical Ability Test of Differential Aptitude Tests (DAT) Form A, adapted to the Indian conditions by J.M. Ojha.

(b) Abstract Reasoning - It refers to the score obtained on the Abstract Reasoning Test of Differential Aptitude Tests (DAT) Form A, adapted to the Indian conditions by J.M. Ojha.

(c) Space Relations - It refers to the score obtained on the Space Relations Test of Differential Aptitude Tests (DAT) Form A, adapted to the Indian conditions by J.M. Ojha.

(iv) Personality Characteristics

They refer to the scores obtained on the Jr-Sr 14 High School Personality Questionnaire (14 HSPQ) developed by Cattell and Cattell (1968).
1.12.0. Objectives

The following were the objectives of the study:

(i) To find out whether any significant association exists between Attitude towards Mathematics and Achievement in Mathematics.

(ii) To find out whether any significant association exists between Educational Aspiration and Achievement in Mathematics.

(iii) To find out whether any significant association exists between Occupational Aspiration and Achievement in Mathematics.

(iv) To find out whether any significant association exists between Numerical Ability and Achievement in Mathematics.

(v) To find out whether any significant association exists between Abstract Reasoning and Achievement in Mathematics.

(vi) To find out whether any significant association exists between Space Relations and Achievement in Mathematics.

(vii) To find out whether any significant association exists between each of the 14 Personality Characteristics, namely, Factors A, B, C, D, E, F, G, H, I, J, O, Q₂, Q₃, and Q₄ (as given in the Cattell's HSPQ), and Achievement in Mathematics.
1.13.0. Hypotheses

The following were the hypotheses of the study:

(i) There is no significant association between Attitude towards Mathematics and Achievement in Mathematics.

(ii) There is no significant association between Educational Aspiration and Achievement in Mathematics.

(iii) There is no significant association between Occupational Aspiration and Achievement in Mathematics.

(iv) There is no significance association between Numerical Ability and Achievement in Mathematics.

(v) There is no significant association between Abstract Reasoning and Achievement in Mathematics.

(vi) There is no significant association between Space Relations and Achievement in Mathematics.

(vii) There is no significant association between each of the 14 Personality characteristics, namely, Factors A, B, C, D, E, F, G, H, I, J, O, Q₂, Q₃ and Q₄ (as given in the Cattell's HSPQ) and Achievement in Mathematics.

1.14.0. Delimitation of the Study

The study was confined to only the students of Class IX (following the CBSE pattern) in the three States of the North Eastern Region of India, namely, Nagaland, Meghalaya and Manipur.