CHAPTER – 3

METHODOLOGY

The need of the present research work and survey of literature related to the field, having been discussed in earlier sections, the urge is being felt towards unfolding the significance of certain definite psychosocial factors contributing to Scholastic Achievement in Mathematics along with a deeper probe into their interactions in terms of a definite methodological plan.

In the present chapter, the specific research hypotheses have been detailed in line with the broad objectives. The research design, the tools for assessing the variables, the methodology adopted in the study to reach research objectives have been elaborated. The selection of the sample, description of sample, the procedure of data collection and the statistical tools employed have also been narrated.

3.1 AIMS OF THE PRESENT STUDY

Though lots of studies have been done to investigate the association between Intelligence, Stress, Coping Styles/Strategies, meaning in life, and some personality variables with Scholastic Achievement in Mathematics, but the dynamics of Intelligence, Socio-Economic Background as the contributory factors in Scholastic Achievement in Mathematics is relatively unexplored. Moreover no studies have been done in this dimension taking the secondary level student population of Tripura state into consideration, which is indeed an indispensable area of research investigation. A comparison between the groups of different levels of Intelligence and SES would be much more advantageous for the counselors and for the social scientists who are trying to eradicate mathematics anxiety, and different scholastic achievement related problems of the students of the whole North East (especially Tripura).

The present study thus attempts to synthesize and evaluate the factors present in different aspects of Socio-Economic Factors and Intelligence which might play an effective role in the scholastic achievement in Mathematics on one hand, and on the other hand, might also cause in deteriorating the same of the secondary level student population of Tripura.

3.2 SELECTION OF VARIABLES

While probing into the research scenario of Education and Achievement it was seen that certain psychosocial variables are found to influence the behaviour of the students. The present research study has purposefully kept aside those variables which are very often associated with achievement of the students since they seem to be the most common and popular. Keeping in mind such commonly studied variables, the probe has been made to reveal those psychosocial variables which are very much pertinent, yet not sufficiently studied. Particularly in Indian context, there seem to be no significant work embracing the presently selected variables. Hence to usher in uniqueness certain variables have been selected for studying and others have been eliminated.

3.2.1 Operational definitions of selected variables

In continuation of the pursuing discussion, a stage has been reached where defining the variables selected for the present study becomes a necessity. A clear concept of the variables is important because it presents before the researcher a picturesque view of the variables. This helps to modify the research design, if necessary and also to defend the suitability of these variables as well as justify the exclusion of some other variables (mental illness, personal qualities, and achievement motivation).

A brief operational definition of each of the selected variables will be presented in the following sections:-

3.2.1.1 Achievement & Achievement in Mathematics:

Academic achievement is an important factor in national education because it acts as an indicator of successful education in a country. Dambudzo (2009) state that over the past couple of decades society has infinitely placed more emphasis on the academic achievement of its citizens. In our society, academic achievement is considered as a key criterion to judge one's total potentialities and capabilities. Therefore, it is becoming more and more pressing for individuals to have good academic achievement. Academic achievement has become an index of student's future particularly in the highly competitive world.

Research studies have proved that a supportive environment in home and school could enhance child's academic achievement (Bansal & Thind, 2006). Academic achievement is very important in any educational setting as it indicates the level of the student's competence with respect of the academic content. Indeed, academic achievement does create competition between the students. The academic achievement of a student determines whether he or she is successful or not and as a result academic achievement is very important (Coetzee, 2011). The academic achievement of students is important indicator of academic success at all levels, whether it is elementary, secondary or higher. Higher level of achievement helps students to obtain good employment and handsome salary. Test scores predict success in job market in terms of higher wages (Joppke & Morawaska 2003). In short, academic achievement is important because it promotes success in current life and also later in life (Arrepattaman & Freeman, 2008).

Educators have long recognized that students' beliefs about their academic capabilities play an essential role in their motivation to achieve (Zimmerman, 2000). Academic drives involve measuring items such as work-habits, scholastic expectations, attitude towards school and learning involves student's opinion about classroom environment and self-efficacy in learning (Entwistle, 1968). Students in higher educational institutions are viewed as leaders of tomorrow. They have academic success as the major goal in their life. Achieving this goal requires dedication, sacrifice, self-discipline, motivation and cordial relationship between students and teachers. Students at this level are saddled with a lot of responsibilities and challenges (Imonikebe,2009).

Thus, academic achievement is the ultimate goal of our schools today. Most researchers would argue that whatever takes place in the school needs to contribute achievement of this goal. According to Baadjies (2008), the main aim of every teacher is to obtain maximum achievement from every student. It has long been a theme in education indicating that a students' needs a good academic self-concept in order to be successful (Olatunde, 2010). Students' level of achievement may be related to their perceptions they have of themselves as learners. (Hamchek, 1995).

One of the significant concerns of the education is to ensure that each student is able to make most of his abilities. The problem why students achieve or fail to achieve higher grades in school has always attracted interest of the psychologists and the educationists (Naylor,1972). Academic achievement is a complex performance. However, the determinants of level of achievement in school courses are not definitely known. Academic achievement has been considered to be one of the most important factors in individual's life for the future planning of higher studies and vocational choices. It depends upon the outcome of scholastic achievement obtained by the students in annual examination.

Academic achievement of a pupil refers to the knowledge attained and skills developed in the school subjects. Academic achievement is the core of the wider term, "Educational Growth" which implies growth in all school subjects. Achievement of the learners refers to the performance in the series of tests for a given skill or knowledge, usually academic. It is the outcome of general and specific learning experiences which are assessed by the school authorities with the help of standardized or teacher made tests. It also involves self-appraisal by the students and the teachers' assessment of their success and failure from time to time with a view of continuous improvement so that education becomes dynamic and self-developing. Academic achievement is considered to be the primary goal of our education.

Traw (1950) defines academic or scholastic achievement as the attained ability or degree of competency In the school tasks usually as measured by the standardized tests and expressed in grades of units based on the norms derived from a wide range of sampling or pupil's performance.

According to **Monore & Engelhort (1952)**, achievement is the accomplishment or proficiency of performance in a given skill or body of knowledge. Achievement is generally used in the sense of "ability to do, capacity to do or tendency to do."

Crow & Crow (1956) states that "achievement means the extent to which a learner is profiting from instruction in a given area of learning."

According to Atkinson (1957), "Achievement is defined as a strive for success or the capacity to experience pleasure contingent upon success." It involves a concern from competition with some standard of excellence. It can also be pointed out in brief that the term academic achievement refers to the "quality and quantity of learning in the subjects as assessed by examination" (Pandey, R.P,1973).

Carter. V. Good (1959) in his 'Dictionary of Education' has defined the achievement as "knowledge attained or skills developed in school subjects usually designated by test scores or by the marks assigned by teacher or by both."

Freeman (1965) has pointed out that educational attainment is the one which is designed to measure knowledge, understanding or skills in a specified subject or a group of subjects. That is to say that whatever the knowledge or skills students acquire during the school period is called academic achievement.

It is said that learning is not limited to mere acquisition of knowledge; it includes various other aspects such as attitude, interests, values etc. **Rao (1964)** said that academic achievement includes life goals, aspirations, study habits, emotional factors, personnel and social adjustment etc.

Harrock (1969) defined academic achievement as “The state or level of person’s skill, the range and depth of his knowledge and his proficiency in a designed area of learning and behavior.”

Academic achievement in the present socioeconomic and cultural context is of paramount importance. Dictionary of Behavioral Sciences (Wolfman, 1973) defined academic achievement as the level of proficiency attained in some specific area concerning scholastic domain such as reading, mathematics, science and social studies or some other subject.

To optimize academic achievement parents and teachers and educational planners has a great role to play. Modern age is an age of science and technology, every student must need to outperform in science and mathematics.

3.2.1.2 Intelligence:

Intelligence has been defined in many different ways including as one's capacity for logic understanding, self-awareness, learning, emotional knowledge, planning, creativity and problem solving. It can be more generally described as the ability to take in information and to retain it as knowledge to be applied towards adaptive behaviors within an environment or context.

Some groups of psychologists have suggested the following definition:

"A very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience. It is not merely book learning, a narrow academic skill, or test taking smarts. Rather, it reflects a broader and deeper capability for comprehending our surroundings – catching on, making sense of things or figuring out what to do.

David Wechsler defined intelligence as “The aggregate or global capacity of the individuals to act purposefully, to think rationally and to deal effectively with his environment.”

Lloyd Humphreys defined intelligence as “the resultant of the process of acquiring-storing in memory, retrieving, combining, comparing and using in new contexts information and conceptual skills.”

3.2.1.3 Socio-Economic Status (SES) :

The word, socio comes from the word 'social' and refers to people and the ways (level) they fit into the community in which they live. It reflects how well they are educated, have job etc. Economic refers to the financial position of the people within society and include, how much they regularly earn, whether own a house and the assets owned etc. In other words, it is an economic and sociological combined total measure of a person's work experience and of an individual's or family's economic and social position in relation to others, based on income, education, and occupation.

Socio-economic Status (SES) is an economic and sociological combined total measure of a person’s work experience and of an individual’s or family’s economic and social position in relation to others, based on income, education and occupation.

When analyzing a family's SES, the household income, earners' education, and occupation are examined, as well as combined income versus , when their own attributes are assessed. Socioeconomic status is typically broken into three categories, High SES, middle SES, and low SES to describe the three areas a family or an individual may fall into. When placing a family or individual into one of these categories any or all of the three variables (income, education, and occupation) can be assessed. Moreover a 4th variable, wealth is also an important component of determining socioeconomic status.

3.2.1.4 Secondary Level:

Secondary education is in most countries the phase in the education continuum responsible for the development of the young during their adolescence, the most rapid phase of their physical, mental and emotional growth. It is at this very education level, particularly in its first cycle, where values and attitudes formed at primary school are more firmly ingrained alongside the acquisition of knowledge and skills. Secondary level means Class IX and Class X of our academic system.

3.3 RATIONAL OF THE STUDY

Mathematics has a great importance in our everyday life. In the era of science and technology, we cannot proceeds a single step without mathematics. The development of a country depend mathematical knowledge of the people.

In our education system, mathematics has a great importance. It is considered as a basic and compulsory subject up-to the secondary level. Kothari commission has given opinion to introduce mathematics as a compulsory subject up-to secondary level. But it is found that student's achievement in mathematics at secondary level under Tripura Board of secondary Education is very poor. Students' performances in mathematics at secondary level also influence the boards results negatively.

Whether intelligence and socio-economic status are responsible for poor performance in mathematics? No work in this area has done earlier for the achievements of mathematics at secondary level students in relation to intelligence and socio-economic status. It will give an idea about students' problem and solution for achievement in mathematics if intelligence is more and poor performance in relation to socio-economic status.

3.4 HYPOTHESES

After selecting the variables and framing the objectives of the present research, some hypotheses have been formulated to carry on with the research project for statistical analyses and verification of them to come to the conclusion of possible generalizations.

***Hypothesis 1*:** There will be no significant difference in the Achievement of Mathematics between the students of High and Low Socio-Economic Status.

***Hypothesis 2*:** There will be no significant difference in the Achievement of Mathematics between the students belonging to the relatively large family and students of relatively small family.

Hypothesis 3: There will be no significant difference in the Achievement of Mathematics between the students whose parents are graduate or more in academic qualification and students whose parents are non-graduates.

Hypothesis 4: There will be no significant difference in the Achievement of Mathematics between the students whose parents are in stable & secure profession and students whose parents are not in stable profession.

Hypothesis 5: There will be no significant difference in the Achievement of Mathematics between the students whose parents have adequate and fixed source of income and students whose parents do not have a fixed and secure source of income.

Hypothesis 6: There will be no significant difference in the Achievement of Mathematics between the students whose family monthly income is relatively higher and the students whose family income is relatively low.

Hypothesis 7: There will be no significant difference in the Achievement of Mathematics between the students residing in different categories of house (i.e. between the students residing in Kuchha and Pucca Houses).

Hypothesis 8: There will be no significant difference in the Achievement of Mathematics between Secondary Level Students of High and Low Levels of Intelligence.

Hypothesis 9: The interaction effect of Individuals' intelligence and their respective Socio – Economic Status on the Achievement of Mathematics do not differ significantly.

Hypothesis 10: There will be no significant relationship between Achievement in Mathematics and Intelligence.

Hypothesis 11: There will be no significant relationship between Achievement in Mathematics and Socio-Economic Status.

Hypothesis 12: Intelligence and different dimensions of Socio-Economic Status will have significant effect in predicting Mathematics Achievement of the Students.

3.5 RESEARCH DESIGN

The research design has been schematically presented in the following **figure 3.1**. Its details have been presented in the following sections.

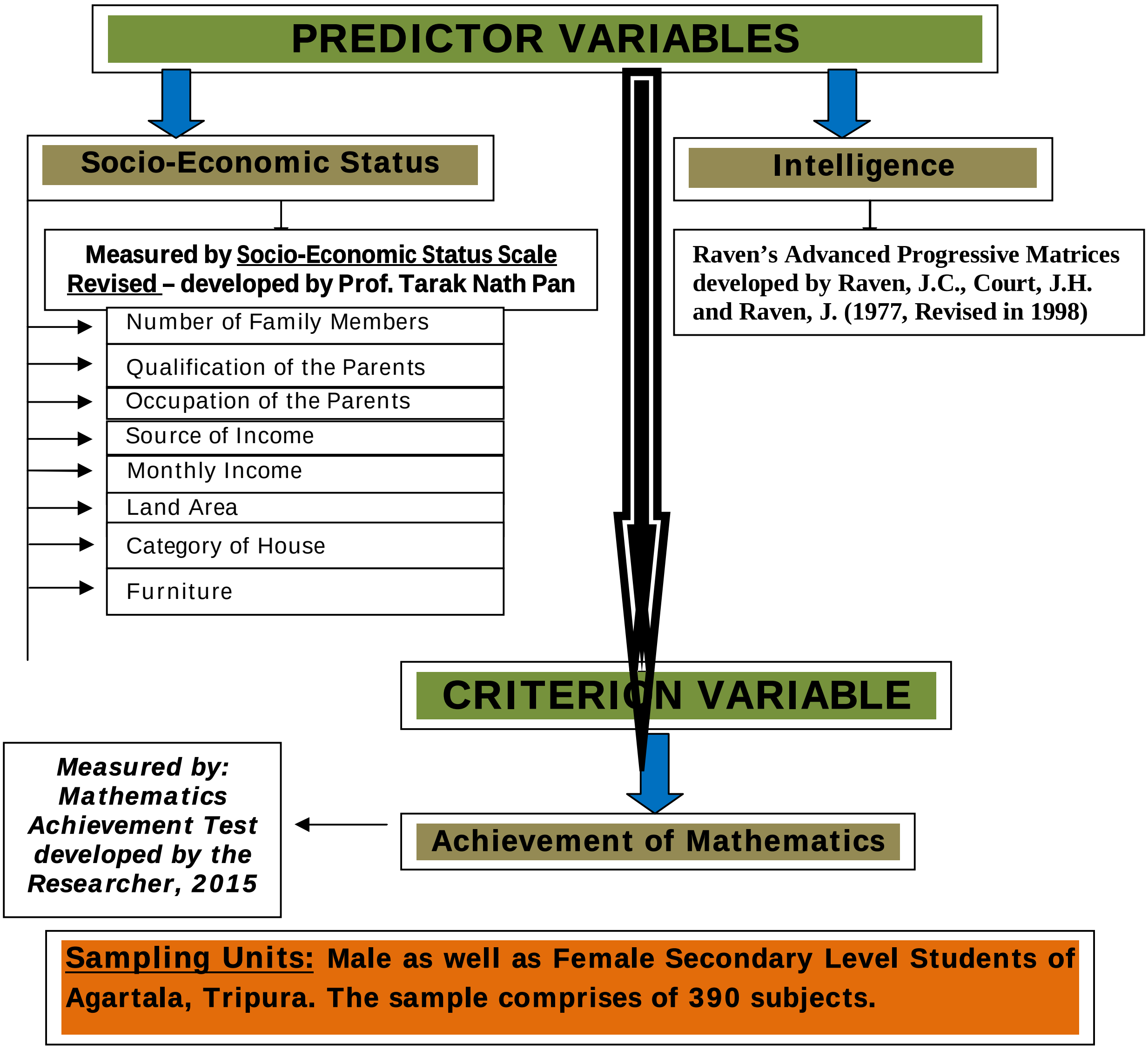

Figure 3.1.: Schematic diagram of research design.

3.6 TYPES OF RESEARCH EMPLOYED IN THE STUDY

The study is *ex post facto* in nature. Here attempts have been made to find out whether there exists any significant difference between the students of High and Low Socio-Economic Status in terms of Achievement in Mathematics.

Here the researcher also tried to find out whether any significant difference exists in the Achievement of Mathematics between the students of High and Low levels of Intelligence.

The researcher also attempts to find out the relative contribution (stepwise contribution) of Intelligence and Socio – Economic Status *(Number of Family Members, Qualification of the Parents, Occupation of the Parents, Source of Income, Monthly Income, Land Area, Category of House and Furniture)* in the development of the power of Achievement in Mathematics among the Secondary Level Students of Agartala, Tripura.

Here Intelligence, and Socio-Economic Status are treated as predictor variables and Achievement in Mathematics as criterion variable. The researcher does not have direct control on the predictor variables because their manifestations have already been occurred or because they are inherent not manipulable.

Inferences about relation among variables have been made, without direct interventions, from concomitant variation of predictor variables (Intelligence and Socio-Economic Status) and criterion variable (Achievement in Mathematics) by appropriate statistical analysis.

Correlational technique has also been used to find out the relationship between Achievement in Mathematics and Intelligence as well as the relationship between Achievement in Mathematics and Socio-Economic Status.

3.7 SAMPLE OF THE STUDY

Population: Generally, population refers to the group or collection of individual which have similar traits or characteristics. Population is the entire set of individuals or the other entities to which the study findings are to be generalized (Check & Schutt, 2012). In the present study, secondary school students from Agartala, West Tripura district, Tripura, India was selected as target population to generalize the results.

Sample: The Sample comprises of 390 (male and female) Secondary Level Students of Agartala, Tripura. These subjects have been taken from randomly chosen **10 different Schools of West Tripura** (List of the names of the schools given in ***Appendix No. VI)***. The subjects have been selected on the basis of the following criteria.

3.7.1 General Inclusion Criteria

- Age Group: 13 to 16 years
- All were of Indian nationality.
- Minimum Educational Qualification – Class VIII Pass.
- Those who are comfortable with English.

- All are settled in an urban and semi-urban environment.
- The sample considered in this study consists of only those who are by birth a permanent resident of Tripura.
- Those who do not have any past or present history of any psychiatric or chronic physical illness or any disabilities.

3.7.2 General Exclusion Criteria

- Individuals with history of any serious physical and / or organic ailment or who are not willing to answer all the questions.
- Individuals having history of any psychiatric illness.

3.7.3 Selection of Sample

Purposive Sampling was followed in this study. Subjects were approached individually and were asked to volunteer for the study and those who agreed and met the criteria defined for the study were included as prospective subjects.

The Final Sample

On the whole 472 data were collected. Data of 82 individuals were eliminated due to incomplete data submission. And in total **390** data were retained of which **198** were Male Secondary Level Students and **192** were Female Secondary Level Students.

3.7.4 Sample Profile

The demographic profiles of the two Gender:

Table 3.1: Shows the Mean (M) values, Standard Deviations (SD) & t value of the Age as a demographic variable of the Boy and Girl samples considered.

Variables	Gender	Mean	SD	No.	t - value	Level of Sig
AGE	Male Students	14.5	1.73	198	1.08	Not Sig
	Female Students	14.26	2.56	192		

Graph 3.2 represents the Mean Age of the Male Students (14.5) and Female Students (14.26) samples considered.

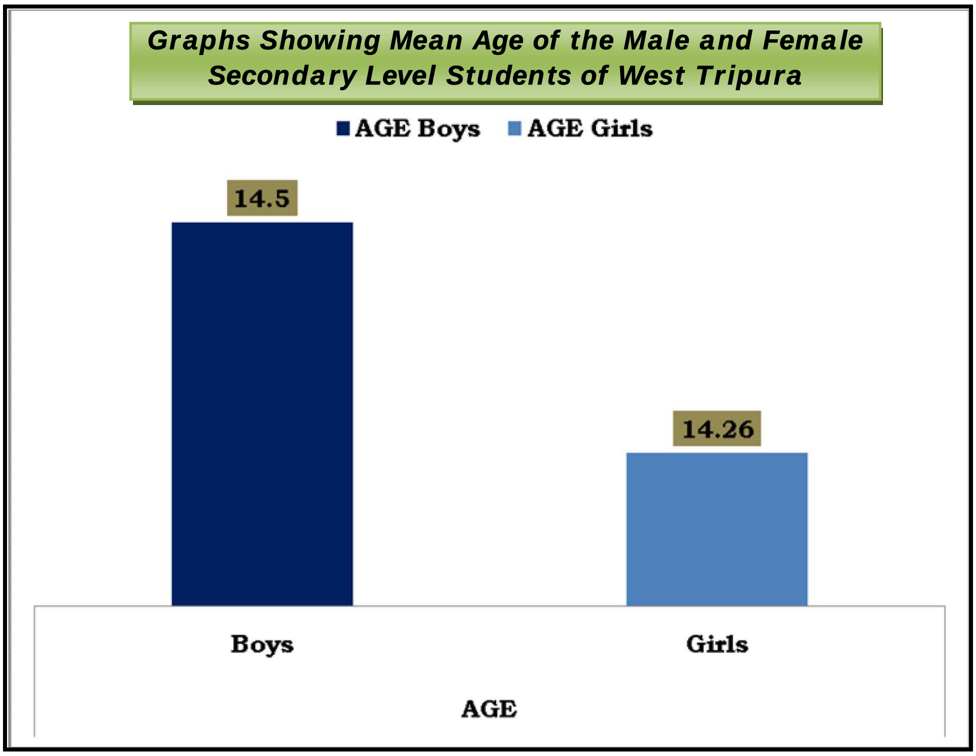

Table 3.1 narrates the descriptive statistics and t – test value for age of the Male and Female subjects. And the result suggests that the Male Students and Female Students do not differ as far as age is concerned.

3.8 SELECTION OF TOOLS

After designing the hypotheses, tools were selected for the present study.

- Personal Information Schedule
- Raven's Advanced Progressive Matrices developed by J.C. Raven, J.H. Court, and J. Raven **[**1977, Revised in 1998**]**
- Socio-Economic Status Scale Revised (SES Scale) **[**T.N.Pan, (2012)**]**
- Mathematics Achievement Test **[**Developed by the Researcher, (2015)**]**

3.8.1 Description of the tools

The selected tools for the present study need to be discussed in details.

3.8.1.1: Personal Information Schedule (Appendix I)

A specially designed information schedule was prepared for collecting necessary background information about the subjects and their family. Moreover, certain basic information like Age, Education, Occupation, Locality / Area of Residence, Community, Marital Status, Family Monthly Income and Presence of any (past/present) mental or physical illness or any kind of disability, Information regarding parents and the like were attempted to elicit through the schedule. The items of the information schedule were prepared earlier and were approved by experts of this field. The personal information schedule has been attached in Appendix I.

3.8.1.2: **Raven's Advanced Progressive Matrices developed by Raven, J.C., Court, J.H. and Raven, J. (1977, Revised in 1998)** ***(Appendix II)***

There are varieties of intelligence test which measure the intellectual ability of subjects. Ravens Advanced Progressive Matrices is a first non-verbal and culture free tool in order to get an index of the IQ of the subjects without consideration of language. The main purpose of construction of the Advanced Progressive Matrices (APM) was to find out the intellectual efficiency among the intellectually below average, average, above average and even superior ability students. The investigator wants to know the superior ability of the students and it should be free from any cultural effects.

3.8.1.2.1 Description of APM

This tool comprises of two sets of problems (Set I and Set II). In set I, there are 12 pictorial problems designed to induce a person to the method of working and cover all the intellectual processes needed for success. The first problem is as much as possible self-evident. The problems become more difficult progressively. In Set II, there are 36 pictorial problems in both their presentation and their argument. These problems are identical in concept with those in Set I. They increase in difficulty more steadily and become considerably more complex. To avoid fatigue and boredom, the figures are drawn boldly and accurately and these are pleasing for assessing a person's maximum capacity to form comparisons and reason without being unduly exhausted. The scale is self-administered or can be administered to an individual or to a group. A person's total score in set II provides an index of one's intellectual capacity. The scores in set I are not used as this set is solely used to prepare the subjects for set II. The test is being used throughout the world.

3.8.1.2.2 Administration of the test

The test was administered to the sample subjects in separated seating positions to avoid cheating and to facilitate the keeping of a firm vigil on them. The sample subjects were seated comfortably, mostly in the school ground, sufficient apart, facing the investigator. After distributing the answer sheet, they were asked to fill up the particulars themselves in the answer sheet and were instructed not to open the booklet (Set I) until everyone was ready. The investigator explained the problem list of set I and the ways of answering it correctly. After sound instruction, set I was administered. A break of five minutes before commencing set II was given in order to avoid monotony.

3.8.1.2.3 Scoring

The scoring of the answer sheet was done strictly in accordance with the scoring key of the manual (APM, 1998). Each correct answer is awarded one score and zero score is given to the wrong answer. A total single score for each subject is obtained on this test. The necessary percentile score for the individual are given in table 3.2.

Table 3.2. Percentile norms of Advanced Progressive Matrices according to age limit (APM 1977, Revised in 1998).

Percentile	Age in Years									
	12	12.5	13	13.5	14	14.5	15	15.5	16	16.5
95	17	18	19	21	22	23	24	25	26	27
90	15	16	17	18	19	20	21	22	24	25
75	12	13	14	15	16	16	17	18	19	20
50	8	9	9	10	11	11	12	13	14	15
25	5	6	6	7	7	8	8	9	9	10
10	2	3	3	4	5	5	6	6	7	7
5	1	2	2	3	3	3	4	4	4	5

The above table shows the lowest and highest raw scores of RAPM (1977) according to age group. For the present study, the age group of selected senior secondary schools students was 14 years. So that the raw scores of 22 and above were considered as high intellectual ability.

3.8.1.2.4 Reliability and Validity of APM

The retest reliabilities shows that the test was highly reliable for adults (r = .91), reliable for 121/2 year olds (r= .86), but only reasonably reliable for 101/2 year old (r=.76). These data suggests that APM is unsuitable for young children. Further, the APM set II has good interval consistency with split half reliability varying between .83 and .87 (APM, 1998).

Construct validity, the APM correlates fairly well with other tests of intellectual ability, especially given the restriction of range associated with high level tests. The correlations with nonverbal measures are slightly higher than those with verbal measures.

3.8.1.3: Socio-Economic Status Scale Revised (SES Scale) by T.N. Pan, (2012) (Appendix III)

The socio-economic status scale (SES) which was used by researcher was constructed by Prof T.N. Pan. The SES scale was also validated by the author of the scale. The reliability of the scale was estimated with reference to its validity. As per opinion of the author of the scale both content and construct validity was estimated during the construction of the scale based on the opinion of the experts in this field. It was initially constructed in two parts.

First part for general information and second part for socio-economic status of the person, which include educational status of the family, the living condition of the family, academic status of the family, house hold condition, properties belonging of the family etc. The scale was revised from time to time to maintain the parity with the social situation. The language of the scale is in Bengali and items are very cleared, precised and to the point. Therefore the scale is having necessary and sufficient characteristics. The scale is comprehensive in nature and does not discriminate between male/female subjects. Its reliability is checked by test-retest reliability method, which was found to be r= .82. Validity of the test described in the manual by the author, is also quite satisfactory.

The researcher used the scale with proper permission from the author and duly acknowledged the author for granting the scale to administer to the study area. Therefore the researcher is very thankful to the author of the scale.

The different subscales of the test are as follows:

- Number of Family Members
- Qualification of the Parents
- Occupation of the Parents
- Source of Income
- Monthly Income

- Land Area
- Category of House
- Furniture

3.8.1.3.1 Administration of the test

Socio economic status scale booklet is distributed to all the subjects selected for the study. The students are asked to fill his/her name, gender, locality, age, class, caste, category etc, on the space provided. Then the first item of the test is ready and explained by the investigator simultaneously item wise to help the students understand them properly. After finishing the SES, students are asked item to check back and make sure that no item has been missed. It is administered in group setting, with no time limit.

3.8.1.3.2 Scoring of the test

In this scale, scoring key is given to record the responses for each information. The obtained scores for each category are recorded in scoring table, before that the total weight age of each item is counted and recorded against each of the seven categories. The raw scores are compared with the norms to assign the category to the students accordingly.

3.8.1.4 Mathematics Achievement Test, developed by the researcher, (2015), (Appendix IV)

The present research was having the focus to find out the status of achievement in mathematics and its relation to intelligence and socio-economic status of the students. For assessing achievement level of the students, students of class IX were considered. The achievement test covers the content of class IX under Tripura Board of Secondary Education. Achievement test was constructed on 30 marks and it contains 15 questions. The researcher has taken the syllabus of Half-yearly Examination. It covers all the content of Half-yearly examination. Number of test items were restricted to 15 and maximum marks was kept 30 for time constraints because in normal school condition it was not possible to take full length question paper. The achievement test was prepared to assess the achievement level of the students. The test items were of multiple choice type question. For each question four answers were supplied and one of them were correct. The student had to choose the correct answer.

There were two major problems in constructing objective type items. Firstly, it is extremely difficult to place or to arrange the questions in order of difficulty and in framing the answer that only one correct answer can come out. Secondly, there is also the problem of spelling but none of the mentioned weakness applied to answers. So the use of multiple choice items for testing achievement was quite justified.

3.8.1.4.1 Editing the constructed items:

As the items were selected by the researcher himself a rigorous editing by some experts comprising of subject and measurement was necessary, so he took experts' advice of different teacher of mathematics in Tripura who are well experienced in the field and are having the teaching experience at secondary level schools or college/university level.

The test items were shown to them, who edited all items cancelling irrelevant and weak items and retaining those items which served the particular objective successfully. Items which were considered to be too easy or too difficult for the pupils of grade IX were also eliminated by those subject experts. (See appendix V)

3.8.1.4.2 Final selection of items:

The present researcher accepted only those test items which were passed by at least sixty percent of the Subject Experts. There were surplus items that have been eliminated. The elimination of surplus items was done largely by subjective judgment based upon inspection of the items. In making the final choice of items certain problems have been considered to be excluded like to remove monotony and (length of computation) to minimize time in the completion of the test.

3.9 PROCEDURE

The study was cross sectional in nature and carried out in two phases :

- **Pilot study**
- **Main study**

3.9.1 Preparation of the Information Schedule

An information Schedule has been prepared in order to elicit certain basic information regarding the respondents. The proposed criteria for preparation of this schedule is as follows –

- Personal Identity
- Educational level
- Information regarding Family members
- Family Background
- History of physical or mental illness.

Several items under each category have been written and the responses are free, open ended or multiple choice types.

3.9.2. Pilot Study

3.9.2.1 The *objectives of the pilot study* are as follows:

- To familiarize the researcher with the administration of the scales, scoring, and interpretation.

- To decide whether the subjects were able to comprehend the questionnaires and respond satisfactorily.

3.9.2.2 *Procedure of the Pilot study:*

The pilot study was conducted on 100 secondary level students, among which 50 males and 50 females were considered. They completed a Personal Information Schedule, then the Mathematics Achievement Test (developed by the researcher), followed by Raven's Standard Progressive Matrices **[**J.C. Raven, (1939)**]** and Socio-Economic Status Scale Revised (SES Scale) **[**T.N.Pan, (2012)**]** were applied.

The scales were administered to the subject one at a time. And afterwards the subjects were individually asked whether they had encountered any difficulty in understanding the instructions or the meaning of the test contents.

3.9.2.3 Result of the pilot study:

- The researcher did not find any difficulty in administering the scales.
- It was found that respondents were able to comprehend and respond the items of the scales.

3.9.3 Main Study

Finally, data were collected between August, 2015 and December, 2015. In this regard help was sought from different

School Authorities/Heads/Principals, some members of different teachers' associations. The subjects were selected on the basis of the above mentioned criteria. The subjects who have fulfilled inclusion criteria were considered for the study. At the outset, rapport was established with each of the subjects and confidentiality was ensured. When consent for administration of the selected tools was obtained, then those questionnaires were administered individually with each of them. The questionnaires were all filled in the presence of only the researcher so that any clarification could be done immediately. Sufficient amount of rest was provided in between each of the questionnaires whenever required, to prevent the creeping of fatigue, boredom and monotony on the part of the subjects. The time taken to administer all the questionnaires to each of the subjects was roughly two hours, all being administered during a single session upon prior appointment with each of the subjects. The sequence of administration of the questionnaires followed a pre-determined sequence as mentioned in the sub-section of "Selection of Tools." A strict order of presentation of the tests was followed for all the subjects. Each of the subjects was instructed that they would be provided with a few questionnaires one by one, which requires them to give certain important information. They were assured that their responses would be kept confidential and was counseled not to hesitate and to provide free and frank answers to those questions.

They were also instructed to intimate in case of any problem during the session. Finally the different school authorities and principals of the schools along with the teachers' organisations were thanked for their co-operation. With completion of analyses of data, the researcher informed about the level of Intelligence and the Mathematics Achievement Score as a whole to only those subjects who were interested to know about themselves.

3.10 PRECAUTIONS ADOPTED DURING COLLECTION OF DATA

i. It was made sure that the subjects (respondents) understood the instructions clearly of all the test or questionnaires used.

ii. It was assured to the respondents that the result of the tests would be treated in strict confidence.

iii. Care was taken to see that the respondents answered all questions freely, frankly and sincerely.

iv. All the questionnaires for each of the subjects were administered during a single session for avoiding contaminations of data owing to varying degrees of motivation, fatigue and other interfering variables.

v. To ensure maximum effective response from the respondents, they were made to sit comfortably in a well illuminated place. One respondent at a time was given the test.

vi. No time limit was given while answering the questionnaires. Hence, it was observed that most of the subjects finished the tests within two or two and half hours.

vii. Any difficulties felt about any test items were made clear by the researcher himself.

3.11 EXAMINATION, SCORING & TREATMENT OF DATA

Scoring, Tabulation and Statistical Analyses – After completion of data collection, the responses were scrutinized and scored. It has already been stated that out of 472 subjects, 82 individuals were eliminated due to reasons mentioned earlier. Hence finally 390 data (198 Males and 192 Females) were analyzed.

Scoring for all the scales were done by hand according to the manuals. The information schedule was coded and a profile of the sample was drawn from it. The scores were tabulated and statistical analysis (with the help of licensed SPSS version, SPSS - 12) was carried out that are presented in result section. Probability values to be accepted for the tests of significance were equal to or beyond 0.05 level.

The statistical tools – Mean, Standard Deviation, t test, Analysis of Variance, Correlation, and Step-wise Regression Analysis were selected in accordance with the objectives of the study.

1) **Test of Homogeneity of Variance:** Leven's Test of equality of error variance of the total scores obtained by the students of different levels of Intelligence as well as different levels of SES in terms of the Achievement in Mathematics as the dependent Variable were done.

2) **Descriptive Statistics**: Descriptive Statistics were done to show the nature of the data. Mean and Standard Deviations of all the variables were calculated for the total sample, as well as for the different groups considered in the present study separately.

3) **Two - Way Analysis of Variance:** Two – way analysis of variance was done to show the significance of Intelligence and Socio-Economic Status and their interaction on Achievement in Mathematics. This was done to check the hypothesis No. 9.

4) **Student's t Statistic:** t tests were done to find out whether the students of High and Low Socio-Economic Status as well as Students of High and Low Levels of Intelligence differ significantly between themselves with respect to the predictor variable and the criterion

variables. This was done to check the hypotheses No. 1 to 8.

5) **Correlation Statistics:** Pearson's Product Moment Correlation Coefficients were computed separately for the groups considered to determine the significant association between the criterion variable and the predictor variables. This will help to check Hypotheses No. 10 and 11.

6) **Stepwise Multiple Regression Analysis (SMRA):** For checking Hypothesis No. 12 Stepwise Multiple Regression Analysis (SMRA) was done for the subjects considered to determine the relative contribution of predictor variables (Intelligence and Socio – economic Status) in the Achievement of Mathematics. In SMRA, variables are entered into a specified order. The order specified should reflect some theoretical consideration or previous findings or specific research objectives. If there is reason for the researcher to believe that one predictor variable is likely to be more important than another, or one predictor variable contributes beyond the variance of criterion variable predicted by another predictor variable, then this method is to be used. In SMRA, the direction in which predictor variables are contributing (either positively or negatively) depends on the direction of the beta coefficient.

Earlier researchers used this model while approaching similar sort of problems (Mascaro & Rosen, 2005; Mascaro and Rosen, 2006; Scannell *et al.*, 2002) and in Indian context Dogra *et al.*, 2008 had successfully used this model.