INFLUENCE OF PERSONAL, FAMILIAL AND INSTITUTIONAL FACTORS ON ACHIEVEMENT OF SECONDARY SCHOOL STUDENTS IN MATHEMATICS

ABSTRACT

THESIS

SUBMITTED FOR THE AWARD OF THE DEGREE OF

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BY

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Under the Supervision of

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Introduction:

The learning of mathematics is indispensable because of its wide ranging applications in our life. The present society requires the use of the skills such as estimating, problem solving, interpreting data, measuring, predicting and applying mathematics in every day life situations. The National Policy on Education (NPE) 1986 has rightly visualised mathematics as the vehicle to train a child to think, reason, analyse and articulate logically. Moreover, the National Curriculum Framework for School Education (NCFSE) 2000 has reiterated that the study of mathematics contributes to the development of precision, rational and analytical thinking, reasoning and positive attitude and aesthetic sense. Researchers have suggested that achievement in mathematics in secondary schools is a function of many interrelated variables like students abilities, gender, attitudes, perceptions, socio economic values, parental education & occupation, family size, parental assistance, peer groups, size of the school, size of the class, types of management, resources, salaries of the teachers and tuition fees and so forth. Many of these variables are home and families related and thus are difficult to change and also out of control of the educators. However, the school related variables such as attitude, perceptions and knowledge of the role of mathematics achievement in future career opportunities that be influencing and is easy to change by educational interventions. Thus understanding the role of personal (attitude towards mathematics, gender; amount of time spent on television watching and sport activities, familial (parental education, occupation, family size and parental assistance in solving mathematics problems) and institutional (size of the class, types management and resources) factors on achievement in mathematics attracts serious attention in present study.
Review of related literature:

Over several decades, the identification and examination of the factor that explain achievement such as attitude (Ma, 1997), beliefs (Garofalo, 1989; Kloosterman; 1995; Schoenfeld, 1985; Schommer, 1990), gender (Benbow and Stanley, 1980; Fennema and Carpenter, 1981) parent education (Ethington and Wolfe 1984; Ma, 1997; Tsai and Walberg, 1983) employment (Greenberger and Steinberg, 1986), homework (Keith and Cool, 1992), and school size (Lee and Smith, 1997) have been researched. Although, the investigation of individual factors is important, a multifactor model possesses a distinct advantage over individual characteristics and constructs because it allows for the examination of not only each individual characteristic's or construct's association with achievement but also for the exploration and examination of the relationships among those characteristics. Shavelson, McDonnell, and Oakes (1989) and Shevelson, McDonnell, Oakes and Carey (1987) argued that a model is required because a single indicator is not able to provide information about a "Phenomenon as complex as education."

Recent researches have supported the influence of attitudinal variables in learning. According to Reynolds and Walberg (1992), Thorndike Christ attitudes towards mathematics were shown to be predictive of academic performance in mathematics. Friedman (1989) noted that until age 10 either no differences between genders or differences favouring girls are observed. Finally, with regard to standardized tests, boys tend to score higher than do girls. (Halperen and La May 2000). Keith, Reimers, Fehrman, Pottebaum and Aubey (1986) observed a small but negative relationship between the amount of television watched and achievement in mathematics. The finding of
Schereiber (2002) indicates that formal parental educational level is strongly associated with achievement in advance mathematics. Students from all ethnic groups who have parents with high education levels (high SES) perform better academically (Alwin and Thorton, 1984). Greenwald, Hedges and Laine (1996) concluded that resources of the school do have influences on students achievement in mathematics. Summers and Wolfe (1977) found that attending a small class is more beneficial for low achieving students than high achieving students.

**Statement of the problem:**

The problem selected for study reads as follows:

"Influence of personal, familial and institutional factors on achievement of secondary school students in mathematics."

**Objectives of the study:**

The present study is aimed at achieving the following objectives.

1- To compare the mathematics achievement of secondary school students on gender basis.

2- To study the attitude of students and math achievements.

3- To study the impact of television watching on achievement in math of students.

4- To study the impact of sport activities on math achievement of students.

5- To study the influence of parental education on math achievement of students.

6- To study the impact of parental occupation on math achievement of students.
7- To study the influence of parental assistance and math achievement of students.
8- To study the relationship between size of the family and math achievement of children.
9- To study the influence of school types on math achievement of students.
10- To study the impact of school resources on achievement of students in math.
11- To study the impact of class size and math achievement of students.

**Hypotheses of the Study:**

The following hypotheses were established:

1- Male and female students do not differ significantly on achievement in math.

2- There is no significant difference between attitude towards math of students and achievement in math.

3- T.V. watching of the students is not significantly related to achievement in math.

4- Sports activities of the students do not influence the achievement in math.

5- Parental education of the children is not significantly related to achievement in math.

6- Parental occupation of the children is not significantly related to achievement in math.

7- Family size of the children is not significantly related to achievement in math.
8- Parental assistance in problem solving does not influence the math achievement of their children.

9- Type of schools do not significantly related to achievement in math of students.

10- School resources do not significantly related to achievement in math of students.

11- Class size does not influence the achievement in math of students.

Sample used:

The selection of the sample for the present study was made from students of secondary schools of central districts of U.P., (India). The schools and students were selected in random manner keeping in view the needs and objectives of the study. The representative sample is approximately consists of 1127 9th grade students (boys (993) and girls (334) students.)

All students who participated in the investigation were studying math as one of their academic subjects at standard 9th level, their ages ranged between 15 and 17 years.

It should be mentioned that these students have been selected from 14 different secondary schools located in different districts of central U.P. Out of these, three are girls’ schools, five co-education and the rest are boys’ schools.

Again, these schools constitute different categories of management, some of them are privately managed and some by minority and some managed by government or semi-government agencies.

Also, the sample schools range from very good to poor in their performance. For instance, some English medium schools are running on the lines of public schools and has a very high reputation and is
considered to be prestigious. Pupils in these schools pay high tuition fee and belong to well to do families with a high socio-cultural background. Some schools are, generally poor in quality, the pupils in these schools come from lower socio-economic strata of the society.

Tools used:

The tools employed for collection of the data mentioned above included the following -

1. Math Attitude scale (MAS).
2. Math Achievement test (MAT).
3. A Personal and Familial Background Assessment Questionnaire.
4. School Information Questionnaire.

Statistical techniques employed:

Following statistical measures were used for analyzing the data- 

1. Determinations of reliability and validity of attitude scale and achievement test scale in math using known techniques.
2. Computation of means and standard deviation
3. Use of linear measure of correlation (Pearson Product moment coefficient correlation)
4. Use of the Newman - Keuls test on differences between treatment means.
5. Use of F-test (to see the significant difference between many means.
6. Use of the t-test for measuring the significance of the differences between means.
It may be relevant here to mention assumptions underlying the use of the product moment correlation and the test and how they satisfied before the use of these techniques.

Before $r$ is computed the data is tested to see if two conditions exist. The first of these conditions is that we have linear regression. This means that our points on the scatter gram tend to fall along a straight line. The second condition that we should look for is homoscedasticity. By this we mean that the standard deviations of the arrays tend to be equal.

In the present study it was assumed that the data is linear. Consequently, product moment correlations were found out between total distributions of scores of the variables put into correlation.

When the analysis of $t$ test is used, the following assumptions should be met:

1. The individuals in the various sub-groups should be selected on the basis of random sampling from normally distributed population.
2. The variance of the subgroups should be homogeneous.
3. The sample comprising the groups should be independent.

**Findings and conclusions of the study:**

1. There exists no significant difference between male and female students so far as their achievement in math is concerned. Both the groups are equally good or bad in the same measure.
2. The attitude towards math of students and achievement in it are positively correlated in this study. The higher the attitude of students towards math, the higher is the achievement in math.
3. The result presented support the idea that TV watching brings same benefits for students. The result shows that watching TV for 1 to 2 hours per day have increasingly positive effects on achievement in math of students. The results further show that, students have no TV in their homes and not watching TV and also students who have TV in their homes and viewing more than 2 hours per day have increasingly negative affects on math achievement.

4. Knowledge of how students spend their non-school hours can help in predicting their performance in school. This result presented support the idea that participating in sports activities brings some benefits for students. The result indicated that the school related activities (sports, drama and others) are related positively to math achievement.

5. In this study parental education is found to be an important factor of children achievement in math. Children from highly educated parents are likely to have significantly higher math achievement scores as compared to the children of less educated parents.

6. It has been found that father’s occupation is related to their children achievement in math. The nature of father’s occupation is important for their children’s math achievement. Children of professional group have got highest math score than all other groups. Children of businessman group have got more math achievement than other two groups but less than the professional group. The children of others group have got more achievement than the children of agriculturist group and on the other hand children of agriculturist group have got lowest math
achievement scores. It has been found in this study that mother’s occupation was not related to academic achievement in math. Children of housewife and working mothers have been found equally good or bad in math achievement.

7. The present study of parental assistance in solving math problems at home of their children and their achievement in math revealed that parental assistance is related to performance of their children in math.

8. This study also explained the relationships between students achievement and their family size. Children of smaller family size have got significantly higher achievement in math than the children of larger family size.

9. In this study the school type has emerged as a significant contributor in the determination of math achievement. The students of CBSE schools have got highest score than the students of other types of school. The students of KVS also achieved significantly higher achievement math score than students of other types of schools but lesser than CBSE students. Students of minority managed schools achieved significantly higher math score than the students of the government schools. In this way students of CBSE schools are highest achiever and students of government schools are lowest achiever in math.

10. The school resources and math achievement was positively correlated with each other. The better school resources lead towards higher scores in math achievement. In other
words the level of math achievement was very high where school resources were superior.

11. Students of smaller class size have got significantly higher achievement in math than the students of larger class size. There is negative correlation between size of the class and achievement in math. As the class size increases, accordingly the performance of the students decreases. In other words the low teacher-pupil ratio was positively associated with math achievement of students. The CBSE and KVS schools operated with comparatively low teacher-pupil ration than government and minority managed schools.

Implications:

This study and its finding highlighted some significant concerns in education. Several studies on Correlates of achievements come with conclusion that students personal, familial, institutional factors are determinants of math achievement. There are other studies also that give contrary results. But this study as many other studies gave mixed type of results. For example, on the whole it was found that school resources was positively correlated with math achievement. There are several major implications of this study. The implications can be classified in two broad categories. These are:

Research Implications

On the serious considerations of the findings of this study and its implication, it logically generates certain hypothesis and research questions. It would be important and necessary to conduct a number of studies in order to come to conclusive decision about whether or not personal, familial and Institutional factors have impact on learning. Some
of the major issues and research questions are recommended for further research.

1. This study was conducted in selected few districts of Central U.P. only. Sample was necessarily purposive this was warranted because of the nature of this study. Although one can be confident that finding would be generalizable to the all districts of central U.P. and to the other districts of the country, it would be necessary to carry out more studies in this format in several other districts in the state or other parts of the country. Such lateral replications would provide a stronger base for generalization.

2. It is also necessary to conduct studies at other class levels particularly at 10th and 12th classes where pressure for performance is significantly high. Together with the lateral replications this vertical replication would provide for larger base for testing the hypothesis on personal familial and Institutional factors.

3. In this study the expenditure were centered round only on institutional expenditures. It has not taken into consideration the household expenditure on the education. So, there is need to conduct a study that will extend the dimension of expenditure to include the household expenditures too.

4. In this study though major portion of syllabus was made the base for the construction of achievement testes but a limited portion was dropped on the grounds, peculiar to turbulent situations in central U.P.. There is a cope for
further studies taking the whole course content into consideration.

5. Research is needed to examine the dimensions of school resources too. School resources as operationally defined in this study can be limited or expanded to new dimensions in the ever changing social setup taking into consideration the latest technologies and the use of electronic media in education. Everybody is concerned about the quality in education, so there is ample scope on this area of research.

6. Economic (Parent education and occupation as an indicator of financial resources) disparities exist among secondary school students obviously, more work still needs to be completed to eradicate the disparity.

7. An important observation is that attitudes toward mathematics did not have a strong association with achievement in some school, which indicates that there may be school or teacher factors that reduce the impact of a poor attitude.

8. An important result for future inquiry for researchers is that factors were observed to vary from school to school.

9. One area that needs research is the amount of time and the type of programme watched. In previous research and in this study, the type of programmes the students are watching was not known and differential viewing preference may expose different associations with achievement.

10. Finally in this study, I simultaneously examined achievement as a composite of several factors—both school
and student levels. Schools are complex systems, and achievement should be examined as a system.

**Management implications**

The actual observations and responses of teachers, Headmasters and students and the responses to the questionnaires indicated that in all the sectors education there is need of gradation and minimum management inputs into the system are imperative like.

1. The manpower facilities are inadequate in terms of requirement, though the number may be more or sufficient but the dearth of math and science teachers is a common phenomena in public schools which needs a special intervention. There is no permanent teaching staff available in private schools and teachers in this sector are comparatively less qualified and less paid. The credit of comparatively better achievement levels of students in private sector goes to parents who take the education of their children very serious.

2. The lacks of infrastructural facilities are great hurdle in running the school smoothly. This largely affects the capacity of school to retain a child fairly for a good period of time in public schools. The lack of furniture and furnishing was a common problem in public schools.

3. The monitoring on the services a school offers to children is negligible at secondary stage of education. The classroom activities are not monitored by those who are responsible for the job especially in public sector schools. The lack of accountability on part of teachers was also
noticed by the investigator. All these short communing need to be taken seriously.

4. The lack of parental seriously and support for the education of their children was observed by the investigator especially in case of public school students.

Limitations:

It is not possible in a single research study to cover every aspect of variables associated with the problem under investigation. Although, the problem is very natural and is prevalent every where yet due to shortage of time and resources all the aspects variables could not be covered and the study is limited in several ways. It had to be determined in terms of population covered, sample selected, scope of variables studied, and the scope of generalizability of finding and so on.

1. The study was conducted on the students of few districts of central U.P. only. One can not generalize the findings of this study to all the institutions of India due to number of differences in their conditions and circumstances.

2. The number of students included in the sample was limited to 1127.

3. The study was limited to class 9th only due to limitation of time and resources.

4. The study can be conducted taking different variables which may contribute math achievement but only selected personal, familial and institutional variables have been taken into consideration.

5. The results that have been reported reflect merely what students are like have and now. The finding may be quite different at another time or in other cultural setting.
6. It is desirable that the researcher reaches first hand or original sources for the study, but as access to some material was not possible materials taken from available secondary sources has been used.

7. Collecting of data in two sitting may be one more delimitation as a number of students are present only in one of the two sessions. Through a third visit is made to cover such students, some drop outs still remain beyond reach of the investigator and have been dropped from the study.
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2008
Dedicated
to my beloved
Parents
Certificate

It is hereby certified that the present thesis entitled, "Influence of Personal, Familial and Institutional Factors on Achievement of Secondary School Students in Mathematics" incorporates the results of the independent research work of Md. Ali Imam, carried out under my supervision. The contents of his thesis are original and his interpretations have substantially added to the existing knowledge on the subject.

To the best of my knowledge this thesis or part of it has not previously formed the basis for the award of any degree, diploma, associateship, fellowship etc. or Associate of the Aligarh Muslim University or any other university or institute.

Dr. Tahira Khatoon
Reader
Dept. of Education
Aligarh Muslim University,
Aligarh
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Md. Ali Imam
Investigator

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Chapter - 1

Introductory Orientation
INTRODUCTORY ORIENTATION

1.1 Introduction:

Education is universally recognized as the most effective tool of bringing desirable change towards the social and economic betterment and cultural transformation of a society in the status of human being and the country as a whole. It broadens the mental horizon of the human being. In one hand, education develops the total personality of the individual and on the other hand education contributes to the growth and development of society. It is only through education that the moral ideas, spiritual values, the aspiration of the nation and its cultural heritage are transformed from one generation to another for preservation, purification and sublimation into higher culture. Humphrys, Traxler and North (1960) have very correctly remarked "our future material and cultural welfare and progress, even our survival as a nation depends upon the wise use of abilities and energies of our people."

The nation that fails to make a genuine assessment of his human energy available in it, is bound to lag behind others in the era of great competition in the national and international fields. An ideal system of education should enable individuals to know and develop to the fullest their physical and intellectual potentialities and promote their awareness of societal and human values so that they can develop a strong character and live better lives and function as responsible members of society.

Education is the key to all processes of development especially-human development. Catalytic action of education in this complex and dynamic growth process needs to be planned meticulously and executed with great sensibility.
Education is fundamental to all round development of human potential - material and spiritual. It refines sensibility and perceptions that contribute to national cohesion, a scientific temperament and independence of mind and spirit. Thus, furthering goal of socialism, secularism and democracy enshrined in our constitution. Education develops manpower for different levels of economy and empowers the poor masses to become self-reliant enough to participate in the process of national development. Education is thus an instrument for developing an economically prosperous society and for ensuring equity and social justice through enriching the knowledge.

An attempt to take a holistic view was made in 1986. The NPE-1986 is a landmark in the history of Indian education. The NPE-1986, visualized education as a dynamic, cumulative, life long process providing diversity of learning opportunities to all segments of the society. It envisaged improvement and expansion of education in all sectors, elimination of disparities in access and stresses on improvement in the quality and relevance of education at all levels. The NPE-1986 also emphasized that education must play a positive and interventionist role in correcting social and regional imbalances in empowering women.

Subjects like science and mathematics have found a significant place in the curricula of primary and secondary school education. Mathematics has become a substantial and integral part of an organized society. In today's world no one can live without mathematics for a single day.

Mathematics has played a decisive role in building up our civilization. But in doing so, it has also made itself essential for the
existence and progress of modern world. In modern world we have to be more and more exact, we make larger use of quantitative terms. We have to be accurate to a split of second. All this requires large calculations and minute mathematical understanding.

Mathematical thinking is important for all members of a modern society as a habit of mind for its use in the work place, business and finance; and for personal decisions making. Math is fundamental to national prosperity in providing tools for understanding science, engineering technology and economics. It is essential in public decision making and for participation in the knowledge economy. Math equips pupils with uniquely powerful ways to describe, analyze and change the world. It can stimulate moments of pleasure and wonder for all pupils when they solve a problem for the first time, discover a more elegant solution or notice hidden connections. Pupils who are functional in math and financially capable are able to think independently in applied and abstract ways and can reason, solve problem and assess risk.

Math is a creative discipline, the language of math is international. The subject transcends cultural boundaries and its importance is universally recognized. Math has developed over time as a means of solving problems and also for its own sake. In the present social set-up, mathematics is more important for the common man. In this age of taxes, insurance premium savings and interests, rents and propaganda a person only with good mathematical background can be reasonably sure that he is getting his due.

A little reflection will show what predominant role mathematics plays in our everyday life and how it has become an indispensable factor for the progress of our present day world. It is the
pivot of all civilization. Each individual is required to compute his or her income and balance, his family budget irrespective of having any formal education of mathematics. This is the subject which undisputed forms the very basis of entire world's commercial system. It is a contributory factor in the prosperity of human race. There is no science, no art and no profession, where mathematics does not hold a key position. The accuracy and exactness of a science is determined to a major extent by the amount of mathematics utilised in it. Even social sciences like economics, psychology, geography etc. make abundant use of mathematics. The gigantic work of construction of dams, bridges, building of ships, aeroplanes, bombs etc. are possible only because of the quantitative science. Even in medical sciences mathematics is used to measure the doses, the blood pressure, the rate of the pulse, the body temperature etc. Most of the natural sciences and philosophy are to be studied on mathematical lines and without the study of mathematics there would be no improvement in them.

Even nature also embraces mathematics completely. The sun rises and sets at specified moment. The stars appear at fixed time. Mathematics runs in the veins of natural sciences like Physics and Astronomy. This subject is inextricably incorporated with world and the natural phenomena.

Arithmetic is the language of commercial activity, algebra gives the idea of functional dependence and generalization, geometry teaches logical thinking and natural design. All these combine to produce a very valuable literature of interpretation, control and progress. We understand the world better. Graphical representation of numbers is becoming very common. Mathematics in home decoration
designs, measurement and construction in banking and business, in protection of life and property in painting and art is playing a vital role.

A well grounded understanding of math is an essential for everyday life as for higher study in the fields of science and technology. Math holds a unique place in every society today. People accept the fact that math is vital to the continued growth of the nation, both for expanding internal advancement and maintenance of leading role in the world community. Math aids man in his understanding of the world, he lives and in turn, modifies the worlds and his needs as he continues to develop. It has played a decisive role in building civilization of a nation.

Math is an important component of school education in the modern world. It is used in almost every phases of human life. A strong background in math is crucial for many career and job opportunities in today's increasingly technological society. There can be no true schooling without math.

One of the aims of teaching mathematics in schools is to inculcate the skills of quantification of experiences around the learners. Towards this, carrying out experiments with numbers and forms of geometry, framing hypotheses, verifying these with further observations from inherent part of mathematics learning. Mathematics helps in the process of decision making through its application to real life situations in familiar as well as non familiar situations. It contributes in the development of precision, rational and analytical thinking, reasoning, positive attitudes and aesthetic sense. Apart from being a distinct area of learning, it helps enormously in the development of other disciplines which involves analysis, reasoning, and quantification of ideas. Study of mathematics also provides ample
opportunities for making conjectures, testing and building arguments about their validity and also in asking new questions, understanding of the basic structure of mathematics leads to a much better appreciation of the scope and power of mathematics. NPE (1986) 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.

Let us find out the position of mathematics in our school curriculum in the last two or three decades. Most of the boards of secondary education in India prescribed two types of mathematics syllabuses for the students of 10-years schools, one being elementary or general mathematics which was an additional mathematics course for the student having special aptitude and interest in mathematics. The Central Board of Secondary Education had of course two different syllabuses in mathematics one at A level and another at B level. The student should choose any one of the two syllabuses. The Central Board has dispensed with the dual syllabi from the examination year 1986 and has prescribed only one syllabus irrespective of attitude, ability and aptitude of the students.

So far as the new contents were concerned, the syllabuses were to an extent new but in almost all the cases same methods of teaching were followed and same old evaluation process was resorted to. The National Commission of Education recommended some sort of general education for all children upto the age of 16+ with mathematics as a compulsory subject. The recommendations which were put forward in 1966 were accepted by many of the state Governments in 1974. The
Central Board of Secondary Education introduced the new pattern from the examination year 1977.

The Government of India accepted the main recommendations of the Education Commission (1964-66) in 1968. Subsequently, the Ministry of Education and Social Welfare constituted an Experts Group in 1973 to develop the curriculum for the 10+2 pattern of education which after circulating an approach paper to teachers, educational administrators and educationists produced a framework of the curriculum for the ten year school in August 1975.

Achievement is the end product of all educational endeavours. The main concern of all education efforts is to see that the learner achieves. Quality control, quality assurance and total quality management of achievement have increasingly gained the attention of research in education. After exploring the concept of achievement in the cognitive, affective and psychomotor aspects of human behaviour, researchers have probed further and have attempted to understand the 'blackbox' of achievement.

Academic achievement is a paramount importance particularly in the present social, economic and cultural context. Obviously, in the school great emphasis is placed on achievement right from the beginning of formal education. The school has its own systematic hierarchy which is largely based on achievement and performance rather than quality. Thus, the school tends to emphasize achievement which facilitates among other things, the process of role allocation for the social system.

The school performs the function of selection and differentiation amongst students on the basis of their scholastic and other attainments and open out avenues for advancement again, primarily in terms of achievement. The student at school is trained to accept the hierarchy based on
achievement. This helps him to be released from the family status in certain ways his personal status is a direct function of the position he achieves mainly in the formal classroom settings. Acceptance of the system of hierarchy in terms of achievement helps also to integrate the school system.

Achievement in math is the stage of attainment in math by the students, generally expressed in terms of grade or scores. It is defined as performance of students in math tests based on scores. Achievement test is used to measure the degree of mastery of skills, fundamental concepts, process and general knowledge of subject. All educational tests are actually are generally achievement test used for certain purposes. According to Tenaja (1989), achievement refers to performance in a particular subject or in the whole curricular that is measured by school examination or test. In this study, achievement in math has been studied as knowledge, skill, comprehension and application attained in the math.

The world is becoming more and more competitive and quality of performance has become the key factor for personal progress. Parents desire that their children climb the ladder of performance to as high level as possible. This desire of a high level of achievement put a lot of pressure on students, teachers, institutions and the educational system itself in general. In fact it appears as if the whole system of education revolves around the academic achievement of the students, through various other outcomes are also expected from the system. Thus, a lot of time and efforts of the schools are helping students to achieve better in their scholastic endeavours. The importance of scholastic achievement has raised several important questions for educational researchers. What factors promote achievement in students? How far do the different factors contribute
towards academic performance? Therefore, many factors have been hypothesized and researched upon and researchers have come out with different results, at time, complementing each other but at times contradicting each other.

A complete and comprehensive picture of academic achievement still seems to eluding the researchers. The search therefore continues and educational researchers all over the world are still seeking a break through in elucidating this phenomenon. Therefore, research has come to our aid by looking into what variables like personal, familial, institutional factors etc. promote academic achievement and what are the determinants to it.

It has been thus, indicated that a good number of variables such as personality characteristics of the learner, the socio-economic status, the institutional resources, climate, curriculum planning etc. mention a few exert influence on math achievement in different degrees. These variables are generally referred to as correlates of achievement. Head of the institutions, curriculum planners, teachers and others are involved in the task of helping students to achieve better would like to have knowledge of the extent of influence of these correlates on academic performance in math.

Over several decades, the identification and examination of the factor that explain achievement such as attitude (Ma, 1997), beliefs (Garofalo, 1989; Kloosterman; 1995; Schoenfeld, 1985; Schommer, 1990), gender (Benbow and Stanley, 1980; Fennema and Carpenter, 1981) parent education (Ethington and Wolfe 1984; Ma, 1997; Tsai and Walberg, 1983) employment (Greenberger and Steinberg, 1986), homework (Keith and Cool, 1992), and school size (Lee and Smith, 1997) have been researched. Although, the investigation of individual factors is important, a multifactor
model possesses a distinct advantage over individual characteristics and constructs because it allows for the examination of not only each individual characteristic's or construct's association with achievement but also for the exploration and examination of the relationships among those characteristics. Shavelson, McDonnell, and Oakes (1989) and Shevelson, McDonnell, Oakes and Carey (1987) argued that a model is required because a single indicator is not able to provide information about a "Phenomenon as complex as education."

By comparison, gender differences in achievement, specially mathematics, have not been consistent and continue to be a much debated topic (Leder, 1992). In an examination of 98 mathematics achievement studies, Frideman (1989) noted that until age 10 either no differences between genders or differences favoring girls are observed (e.g. Callahan and Clements, 1984; Dossey et al., 1988, Hawn, Elliot, and Des Jardines 1981). For the middle school years, some research favored girls (Tsai and Walberg, 1983), and some favored boys (Hilton and Berglund, 1974); other research showed no difference (Circicelli, 1967; Fennema and Sherman, 1978). In her meta-analysis, Feridman (1989) observed that in five of seven studies 12th-grade boys outperformed 12th-grade girls, with the remaining two studies showing no difference. Finally, with regards to standardized tests, boys tend to score higher than do girls (Halperen and LaMay, 2000); the difference is more prevalent in the extremes of ability distribution (Willingham and Cole, 1997). The research has consistently shown that at the end of high school boys perform better than girls on mathematics achievement tests whereas girls typically perform as well as boys in elementary school and perhaps, in middle school (Ewers and Wood, 1992; Marsh, 1989; Skaalvik 1990). Also, there is same evidence that girls achieve
better than boys on verbal tests (Maccoby and Jacklin, 1974, Halpern, 1992; Reuterberg, Emanuelsson and Svensson, 1993).

The increasing gender differences in math achievement in the high school years are most frequently explained in terms of sex stereotypes and differential sex role socialisation patterns (e.g. Eccles, 1987; Fennema and Peterson, 1985; Meece, Parsons, Kaczala, Goff and Futterman 1982). When it is sex typed math is viewed as a male domain (Eccles, Adler, Futterman, Goff, Kaczala, Meece and Midgley, 1983; Fennema and sherman, 1978), Where as reading and language are stereotyped as female domains (Kaczala, 1981 Stein and Smithells, 1969). Sex stereotypes also suggest that boys have better math abilities than girls and that math is more important for boys (Jacobs and Eccles 1985). According to Jacobs and Eccles sex stereotypes also suggest that girls have better verbal abilities than boys.

Affective background factors, such as attitudes and beliefs, play a central role in mathematics achievement (McLeod, 1992). The general relationship between attitude and achievement is based on the concept that the better the attitude a student has toward a subject or task, the higher the achievement or performance level tends to be. Ma (1997) observed that for trigonometry students, the attitudes that mathematics was important and enjoyable were significantly associated with achievement in mathematics. Students who experienced more enjoyment while learning achieved higher scores.

Current reforms efforts in mathematics education call for student to be active participants in the learning process and for solving nonroutine problems. While research has been pointed out that this type of environment support student construction of knowledge and organization of their thoughts (Wealthy and Abshire, 2002) these changes may conflict with students
attitudes towards mathematics. According to Mc Leod (1994), this type of reform should improve student interest and enjoyment of studying mathematics. Therefore, to improve the learning of mathematics, it is important to study students attitude towards mathematics (Fennema and Sherman, 1976; Reyes, 1984).

Children begin to develop an attitude towards mathematics as soon as they are exposed to mathematics; these attitudes can have an affect on students learning in mathematics. For example, research has shown that some student are prohibited from learning mathematics to their full potential due to negative attitude towards mathematics (Reyes, 1980). Ma and Kishore (1997) conducted a meta-analysis of 113 studies that investigated the relationship between attitude towards mathematics and achievement in mathematics and found this relationship to both reliable and positive but not strong. While overall measures of attitude towards mathematics have only small positive relationship with achievement, a measure of a student’s confidence with mathematics has relatively strong positive correlation with achievement in mathematics (Dowling, 1978). Research has shown that, when students are more sure of themselves, teacher seem to pay more attention to them (Reyes, 1980).

It refers in general, to inclination presumed to be enduring to react in a certain ways in response to certain kind of situations, to see and interpret events according to some predisposition, and to organise opinions into coherent interrelated cluster. Pal (1989) observed that better attitude towards math ensures better achievement of students in math at secondary level. Jayanraman (1989) found significant relation between attitude towards learning math and achievement in math. Hadfield, Martin and Wooders (1992) found a strong correlation between the variable of persistence and
degree of math anxiety, thus concluding that a student attitude may be a more important factor than previously thought. It has similarly been noted that more positive attitudes accompany lower levels of anxiety and are conducive to increased gains in the future (Genshaft 1982).

Misconceptions about the nature of math have also been investigated. Gourgey (1992) states that many learners hold misconceptions about what math is, which results in their performing procedures without understanding, often incorrectly distrusting their own intuitions and feeling powerless when they make mistakes. These misconceptions erode a learners confidence and contribute to their learning difficult (Gourgey 1992).

Watching television is another after school activity widely believed to be associated with academic achievement. Traditionally T.V. watching has been assumed to lessen achievement (Comstock, 1991; Keith, Reimers, Fehrman, Pttebaum, and Aubey, 1986). Simply television viewing displaces academic activities and reduces the amount of time available for completing homework and other academic activities, thereby reducing achievement. Keith et al. observed a small but negative relationship between the amount of television watched and achievement. In a recent study, Cooper et al. (1999) observed a significant negative association between achievement and television viewing (mean viewing was 1-2 hr per night). Television viewing is presumed to lower academic achievement by displacing more academically oriented activities such as home work or leisure reading (Gaddy 1986). Other researchers have suggested that television viewing inhibits achievement by interfering with cognitive development (Anderson and Collins, 1988) as cited in Comstock, (1991), some empirical support exists for these assertions, for e.g. using a national sample from the high school and beyond longitudinal survey. Keitch, Reimers, Fehrman,
Pottebaum and Aubey (1986), found a small negative relationship between achievement and amount of television watching, however the negative effect of television viewing is not found consistently (Gortmaker, Satter, Walker and Dictz 1990); Suggesting the relationship may be weak and therefore sensitive to methodology variations, indeed Comstok (1991) concluded that the evidence indicates a modest casual contribution by television to lesser achievement.

Positive association between after school pursuits and achievement has been observed. Students involved in extracurricular activities such as sports also tend to have good attitudes, positive self-concept, and higher achievement than do student not involved in these activities (Holland and Andre, 1987). Gerber's (1996) results indicated that school related extra-curricular activities (e.g. sports, band honor society) and outside school activities (e.g., hobby groups, scouting and 4-H) were related positively to mathematics achievement. Marsh (1992) had similar finding with small but statistically significant positive correlations between activities (e.g., sports, drama, chorus, clubs by subject meter, church student government, and service clubs) and achievement.

In a review of research, Holland and Andre (1987) further focused on the examination of the relationship between athletic participation and achievement and reported that male high school athletes received some what higher GPAs than did non athletes. When one considers standardized achievement or aptitude tests, boys whose only after school activity was sports scored lower than national averages on the standardized achievement test. No significant difference in either GPA or standardized test score was observed between female athletes and female non athletes.
Socioeconomic status is generally defined as person's relative standing in society and is measured by such indicators as income, occupation, education, access to health coverage and community resources and political power and prestige (Secada, 1992) but in this study SES is taken as the parental education, occupation, family size and parental assistance to guide their children in math. SES consistently has been shown to have a direct positive association with achievement (e.g. Keith and Cool 1992; Mc Coneghy 1987) and students from all ethnic groups have parents with high education levels (high SES) perform better academically (Alwin and Thornton, 1984; Dossey, Mullis, Lindquist and Chambers, 1988; Green, Dugoni, Ingels and Cambrun, 1995, and Schreiber, 2002).

Dave and Dave (1971) investigated the relationship of parental education on caste with the academic achievement. They found that higher percentages of rank holder belong to homes with higher parental education whereas a higher percentages of failed students belong to those who have lower parental education. Bridge et al (1979), and Glasman and Biniaminov (1981) concluded that the achievement level of a student in math is directly proportional to the level of his parent's education. There is more direct evidence of a relationship between SES and mathematics skills, although the relationship itself may actually be some what weaker. The most commonly used measures of SES sample were family income, father's educational level, mother's educational level, and father's occupational status or type. Multivariate analyses that have used two or more of these indices have found that each one has sizable independent effects on mathematics scores. (Coleman et al, 1966, Hauser, 1971, Hess, Holloway, Dickson, and Price, 1984, White, 1982).
Parental occupation may influence student's performance in various ways. For example, occupation related income may determine access to learning opportunities and resources and so play role in learning outcomes. Parental occupation may also influence how students perceive the value of math learning, their beliefs about the usefulness of math and learning environment at home (Education matter, 2004). Ojha (1979) found that for both rural and urban students parental occupation and income were related to their educational achievement. Quadh (1996) found statistically significant negative relationship between students' GPA and their father's and mother's income and occupation. Verghese (1994), Singh and Saxena (1995) they found that parental occupation is an important factor associated with learner achievement in math.

Number of family members has been found to be important predictor of academic achievement. Family structure (parents and number of siblings) is also set to influence students' academic achievement (Manning, 1998, Ponj, 1997, 1998). Smaller family size has been linked with higher academic achievement (Eaman, 2005, Marjoribanks, 1996). Students with fewer siblings are likely to receive more parental attention and more access to resources than children from larger families.

A variable that may have important effects on achievement is parental involvement (Bloom 1984, Seginer, 1983, WalBerg 1984,) Parental involvement variables often include components such as actual or perceived expectations for school performance (Seginer), verbal encourage or interactions regarding (Marjoribanks, 1983), direct reinforcement of improved academic performance (Karraker, 1972) or general academic guidance and support (Bloom) In a recent longitudinal study of the effects of parental involvement (e.g. encouraging school work, listening to children
read, or participating in learning activities at home) on elementary students' achievement, Epstein (1984) found significant increases over time, with the greatest gains shown in reading skills. Similarly, research has shown positive effects on achievement when parents provide rewards for improvement on daily class assignments (Witt, Hannafin and Martens, 1983) and for direct parental involvement in compensatory education programs (Gnrad and Eash, 1983).

Parental involvement has long been believed to be associated with a range of enhanced school outcomes for elementary, middle, and high school students, including varied indicators of achievement and the development of student attributes that support achievement, such as self-efficacy for learning, perceptions of personal control over school outcomes, and self-regulatory skills and knowledge (Bandura, Barbaranelli, Caprara, and Pastorelli, 1996; Brody, Flor, and Gibson, 1999; Epstein and Van Voorhis, 2001; Fan and Chen, 2001; Frome and Eccles, 1998; Grobick, Kurowski, Dunlap, and Hevey, 2000; Grobick and Slowiaczek, 1994; Henderson and Mapp, 2002; Hill and Craft, 2003; Jeynes, 2003; Xu and Como. 2003). Although parental involvement is an important contributor to children's positive school outcomes, much less is known about the factors that motivate parents' involvement practices.

Institutional factors (e.g., size, resources, culture,) also have been shown to have an impact on achievement (Greenwald, Hedges, and Laine, 1996; Lee and Bryk, 1989). The size of school has been shown to be negatively associated with achievement (e.g. Edington and Marttellaro, 1989). Lee and Bryk (1989) found that larger schools enhanced the effect of social class differentiation on achievement (i.e., large- high, SES School were less equitable in mathematics achievement). Using the national
educational longitudinal study: 1988 (NELS: 88) data set, Lee, Smith and Croninger (1997) that larger school has negative influences on academic achievement in high school mathematics and science. The authors argued that small school size acts as a "facilitating or inhibiting factor." The small school may facilitate social interactions and inhibit differentiated curriculum and teachers' specialization, which they stated, are features of bureaucratic high school. The authors concluded that school should have fewer students (number of students). Lee and Smith (1997), using all three waves of the NELS: 88 data set, concluded that the optimal size for a school was between 600-900 students.


Resources are another institutional factor that has received a good deal of attention in the literature (e.g. Greenwald, Hedges and Laine, 1996, Hanushkek, 1989). In a review of 377 studied, Hanushek (1989) observed no consistant pattern between the amount of money spent (e.g. teacher-student ratio or per pupil expenditure and achievement). Numerous studies in
Hnushek's review had either significantly positive or negative results, or non significant positive or negative results. He concluded that no "strong or consistent relationship" exits between school resources and student performance and that more resources would not yield performance gains for the students. Greenwald, Hedges, and Laine (1996) performed a meta analytic review of the studies from Hnushek's review and more recent article and concluded that resources do have influence on student achievement. Neither study focused on the impact of resources on student variables that could affect performance.

When asked about their views on class size in surveys, parents and teachers generally report that they prefer smaller classes. This may be because those involved with teaching believe that smaller classes promote students learning or simply smaller classes offer more pleasant environment for the pupils and teachers who are in them (Mueller, Chase and Walden, 1988). Social scientists and school administrators also have a long standing interest in class size question. Class size is often thought to be easier to manipulate than other school inputs, and it is a variable at the heart of policy debates on school quality (e.g. Robinson, 1990, OFSTED, 1995 and Moshel Ravid, 1995). In widely cited meta analyses of class size research, Glass and Smith, 1979 and Glass et al, 1952 conclude that smaller classes raise children test scores. Card and Krueger (1992 a, 1992 b) also found that lower pupil-teacher ration in school are associated with higher adult learning, while randomized trials in Tennessee and Ontario provide evidence for beneficiais effects randomly assigned reductions in class size (Finn and Achilles, 1990, Shapson, Easone and Fitzerald 1997).

The investigator is more convinced that students personal, familial and institutional factors need no longer be neglected in research efforts
directed towards a study of correlates of math achievement. The reason is obvious, conceptually, they appear to influence the math achievement but their influence has not yet been empirically studied adequately. This being the reason, the investigator undertook the present study which attempts to investigate relationship of their personal, familial and institutional factors of secondary school students with their math achievement.

1.2 Statement of the problem:

The problem selected for study reads as follows:

"Influence of personal, familial and institutional factors on achievement of secondary school students in mathematics."

1.3 Independent and dependent variables:

The independent variables are students personal and familial factors and types of schools that the students attained. The schools are either single sex or co-educational. The dependent variables are the score they achieved for mathematics. This score was determined through the administration of self constructed math achievement test.

1.4 Objectives of the study:

Every research study deals with the solution of some problems of human interest. That is why the researcher has a definite purpose he/she has certain specific aims and goals to achieve through his/her research work. Such specific goals or purposes of research are technically termed as objectives. Every research work must have some objectives to achieve without which no research can be conducted. The entire research process is guided by objectives, which have been explicitly and presently spelled out
by the investigator in advance. The present study is aimed at achieving the following objectives.

1- To compare the mathematics achievement of secondary school students on gender basis.
2- To study the attitude of students and math achievements.
3- To study the impact of television watching on achievement in math of students.
4- To study the impact of sports activities on math achievement of students.
5- To study the influence of parental education on math achievement of students.
6- To study the impact of parental occupation on math achievement of students.
7- To study the influence of parental assistance and math achievement of students.
8- To study the relationship between size of the family and math achievement of children.
9- To study the influence of school types on math achievement of students.
10- To study the impact of school resources on achievement of students in Math.
11- To study the impact of class size and math achievement of students.

1.5 Hypotheses of the study:

In order to give proper directions to investigation, it was thought necessary to formulate certain hypotheses which may be tested in this study. The investigator was guided by the results of previous researches in their
areas, theoretical view points available in related literature and investigator's intuitive understanding and insight. For the present study, the hypotheses have desirably to be stated in the null-form. The reason is obvious when they are conceived as research hypotheses they are generally stated in the form of statements but when they are conceived as statistical hypotheses usually they take on the form of null-hypothesis.

The following null-hypotheses have been constructed for testing through the study. The confidence interval set-up for the purpose of accepting or rejecting the hypotheses in the study is 0.05 to 0.01 levels. The reason for fixing the rigorous limit is discussed elsewhere. Common practice in this regard, is to set-up a range of 0.05 to 0.01 levels. The following hypotheses were established:

1- Male and female students do not differ significantly on achievement in math.
2- There is no significant difference between attitude towards math of students and achievement in math.
3- T.V. watching of the students is not significantly related to achievement in math.
4- Sports activities of the students do not influence the achievement in math.
5- Parental education of the children is not significantly related to achievement in math.
6- Parental occupation of the children is not significantly related to achievement in math.
7- Family size of the children is not significantly related to achievement in math.
8- Parental assistance in problem solving does not influence the math achievement of their children.
9- Type of schools do not significantly related to achievement in math of students.
10- School resources do not significantly related to achievement in math of students.
11- Class size does not influence the achievement in math of students.

1.6 Definition of the key terms:

Some terms and concepts have been repeatedly used in this study. In view of the unfortunate situation that terminology in behavioural sciences unlike that in physical references has not yet attained a standardised form, it appears necessary that their definitions as accepted for this study are given so that any term may not means different things to different readers of the dissertations. It is obvious that the investigator has not coined his non definitions, but has for each term selected the one from those given in standard text books which was found to have best served the purposes of the present study. In case of each term or concept the accepted definition is preceded by a brief discussion of how it is viewed by different authors.

1.6.1 Education

This fundamental question has been answered differently by a number of philosophers and thinkers right from Socrates and Plato down to Gandhi and Dewey. But the word 'education' has a very wide connotation and it is very difficult to give its precise definition. In its narrow sense, school instruction is called education. In this process, the teacher is the most important factor. He is expected to instill in
the child's mind ready made pieces of knowledge. As a result, the
child can acquire knowledge but he can not attain the wholesome
development of his personality.

"In narrow sense, education may be taken to mean any
consciously directed effort to develop and cultivate powers". (Mackenzi)
In its wider sense, education means the total development of personality
and consists of all those experiences which affect the individual from
birth till death. Thus, education is a life-long process of growth and
development. Gandhi Ji however defines as "By education, I mean the
allround drawing out of the best in child and man-body, mind and soul".
Education in its widest sense includes all the influences which act upon
an individual during his passage from cradle to the grave (Dumvile).

1.6.2 Academic Achievement

Achievement may be defined as 'the measure of what and how
much an individual has learnt. It may be the quality or quantity of
learning attained by an individual in a subject of study after a period of
instruction'

Marshner (1972) in Encyclopedia of Educational Psychology
has interpreted the term achievement as:

(a) It is the general term for the successful attainments of
some goal requiring a certain effort.

(b) The degree of success attained in a task.

"Successful accomplishment or performance in particular
subjects, areas, or courses usually by reasons of skill, hard work and
interest; typically summarized in various types of grades, marks, scores
or descriptive commentary" (Hawes, 1982). Good (1973) has defined
academic achievement as, "knowledge attained or skills developed in the school subjects, usually designated by test score or by marks assigned by teachers or by both". "Academic achievement is often defined in relation to the concept of aptitude, by simple contrast measuring the learning that takes place during definable course of instruction in achievement testing" (Mitzel, 1984).

There are so many terms such as academic attainment, achievement, academic aspiration etc. which are used to represent the phenomena of academic achievement. By academic achievement, I mean the performance of a learner after a course of instruction and measure it in terms of marks or grades obtained in a given area of knowledge, or the level of knowledge or skills acquired after undergoing a program of instructions, may also be assessed with the help of the standardized achievement test available in the market. In this study scores obtained by a student in the mathematics achievement test is taken as his/her academic achievement in mathematics.

1.6.3 **Achievement in mathematics**

The term achievement here refers to the ability of the students to solve mathematical problems as measured by specially designed test. The score of a student on a particular test will stand for a measure of his/her achievement on the test. Mathematics achievement for the present study shall mean the total score obtained by the sample groups on the Mathematics achievement test constructed by the investigator for class IX.

1.6.4 **Secondary education**

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Secondary Education which serves as a bridge between primary and higher education serves a step towards preparation for higher and professional education. It is the stage where a proper understanding of work ethos and values of a humane and composite culture is provided to future citizens of the country. "Secondary school is the division following the elementary school, comprising most often grades from 9 to 10 or grades 7 to 12". (Good, 1973) "A school more advanced in grade than an elementary schools and, offering general, technical, vocational or college-preparatory courses". (Webster's Third New International Dictionary).

1.6.5 Gender Difference

Any significant difference in mental, physical, social and emotional traits that depends only on the sex of individuals is called the gender difference.

1.6.6 Attitude

The concept of attitude was first introduced by Thocna Znanicchi (1918) in their monumental study of people in transition between two cultures. They regard attitude as internalised counterpart of an extent object representing the individual's subjective tendencies to act towards that object.

The term attitude has extensively been used in psychological investigations during the last few decades mainly through the impetus given to such researches by L.L. Thurstone. At present time the word attitude includes the wider meaning than it was before when it was used to denote the muscular- neural set of an organism.
John Dewey (1922) defined attitude as "a special case of predisposition, the disposition waiting as it were to spring through an open room". Chave (1928) defined that "an attitude is a complex of feelings, desires, tears, convictions, prejudices or other tendencies that have given a set or readiness to act to a person because of varied experiences". Kohler (1929) according to Gestalt Psychologists "a change of attitude involves a definite psychological stress exerted upon a sensory field by processes originating in other parts of the nervous system". Bogordus, 1931 explained "an attitude is a tendency to act toward or against something in the environment which becomes thereby a positive and negative value".

Droba (1933) said "an attitude is a mental deposition of the human individual to act for or against a definite object". Morgan (1934) defined attitudes are literally mental postures guides for conduct to which each new experience is referred before a response is made. Allport (1935) took attitude as a mental or neural state of reasons to response, organised through experience exerting a direct and dynamic influence on behaviour. Krech and Crutchfield (1948) said "attitude is an enduring organization of motivational emotional, perceptual and cognitive process with respect to some aspect of the individual in the world". Thurstone (1929) says that "the degree of positive or negative effects associated with some psychological objects". Here psychological object Thurstone means any symbol, phrase slogan, person, institution, ideal and idea towards which people can differ with respect to positive or negative effect. Guilford defined attitude "as a personal disposition common individual but possessed to different degrees, which implies them to react to objects, situations or disposition in a way that can be called favourable or unfavourable".
Katz and Scotland (1959) defined attitude as "an individual's tendency or predisposition to evaluate an object or the symbol of that object in a certain way". Traverse (1973): "an attitude is a readiness to respond in such a way that behaviour is given in a certain direction". Sorenson (1977) defined attitude as a particular feeling about something. It, therefore, involves a tendency to behave in a certain way in situations which involve that something, whether person, idea, or object. It is particularly rationale and partially emotionally and is acquired, not inherent in an individual".

In all these above given definitions one can mark the common element with a little difference in one way or the other hand and that is readiness for response. Attitudes are, to a great extent responsible for the particular behaviour of a person about an object, idea, or person. But it should not be taken that one's behaviour is an absolute function of one's attitude. Behaviour by all means is a function of both characteristics of a behaving person and the situations in which he behaves. Attitude involves what people think about, feel about and they would like to behave towards an attitude object. Behaviour is not only determined by what people would like to do but also by what they think should do, i.e., social norms, by what they have usually done, that is, habits and by the expected consequences of the behavior.
1.6.7 Attitude Towards Mathematics (ATM)

Researchers often assume different definitions of ATM (McLeod, 1992). For example Leder (1987) and Reyes (1984) used ATM as a general concept that includes beliefs about self and about math. The multiplicity of meaning given to the concept of ATM is the primary culprit of the inconsistencies in the ATM (Anderson, 1981). A reasonable solution is to measure attitude towards specific mathematical activities rather than a generalized attitude toward mathematics (Aken, 1970b). Hence, I defined ATM as either positive or negative responses, in terms of importance, difficulty and enjoyment when learning arithmetic, algebra, Geometry and trigonometry. This definition of ATM allowed an examination of whether feelings about math as important, difficult and enjoyable causally linked with one another, and with ATM, in similar way across the four mathematical areas. The mathematics attitude has therefore been operationally define as a generalized attitude towards the universe of mathematics content and being measured in terms of its favourableness or unfavourableness estimated from the score obtained by the subject.

1.6.8 TV Watching

Amount of time spent daily by students watching TV has been considered as TV Watching. TV watching of students has been categorized into four groups, i.e., Zero hour, Less than one hour, 1 to 2 hours and More than 2 hours.

1.6.9 Parent's education

Father's and mother's educational qualification of the students were considered as parents education. Parent’s education has been categorized into three groups, i.e., Illiterate, Upto Class XII and Degree level and above.
1.6.10 **Parent's Occupation**

Father's and mother's occupation were considered as parent's occupation of the student. The father's occupation has been categorized into four groups, i.e., Professional, Businessman, Agriculturist and Others. The mother's occupation has been categorized into two groups, i.e., Housewife and Working Mother.

1.6.11 **Family size**

The total numbers of children and parents have been considered as family size of the family.

1.6.12 **Parental involvement**

Parental involvement has been defined in a variety of ways in the literature (Epstein, 1986; Fan and Chen, 2001). Although involvement is a complex process that often transcends geographic boundaries. Researchers have often characterized involvement into two subtypes: home-based and school-based (e.g., Christenson and Sheridan, 2001).

This study offers an examination of a targeted range of involvement activities commonly used by parents of children. Home-based involvement is generally defined in the literature as interactions that take place between the child and parent outside of school (Hoover-Dempsey and Sandler, 2005). These parental behaviors generally focus, on the individual child's learning-related behaviors, attitude, or strategies and include parental activities such as helping, with homework, reviewing for a test, and monitoring the child's progress. In this study parental assistance in solving math homework of their children is considered as parental involvement.
1.6.13 **Types of schools**

Four types of schools have been considered for this study (1) CBSE Schools (2) KVS Schools (3) Government schools and (4) Minority managed schools.

1.6.14 **Central Board of Secondary Education (CBSE) private school**

CBSE private school means any govt. recognised private secondary school without any financial support and administrative control of local, state or central govt.

1.6.15 **Kendriya Vidalaya Sangathan (KVS) School**

KVS school means secondary school fully controlled, financed, supported and administered by central govt.

1.6.16 **Government School**

Govt. school means any secondary school fully controlled, financed, supported and administered by local and state govt.

1.6.17 **Minority Managed Schools**

Minority managed school means any secondary school financed by state govt. but controlled and administered by minority management committee.

1.6.18 **School resources**

Greenwald et al (1996) defined educational inputs or resources as including (a) school characteristics and facilities and (b) student
characteristics such as SES or ability. According to Hartwan (1999), the school inputs studied most frequently include student/teacher ratio or class size, teacher education level, experience of teacher, teacher's salary, and expenditure per student.

In the present study, teachers qualification, number of math teachers, training of teacher's, teacher's experience, and physical facilities in the schools considered as school resources.

1.6.19 Class Size

In the present study the number of students present in the class room is considered as class size.

1.7 Significance of the Study:

One of the old and still persisting questions is why some students perform well in school, while others perform poorly?" Earlier studies showed positive relationship between academic achievement and math test scores. In most of the studies the relationship of just one or two variables with academic achievement in math has been worked out. To have an idea about the relative importance of the different variables in determining academic achievement in math there is need to have more comprehensive studies in which a larger number of independent variables may be included and by working out their relationship with math achievement, the ones having positive relationship with achievement may be identified and then through appropriate statistical techniques their relative importance in determining math achievement may be found out. Most of the work in this area has been done in the more developed countries. Because of the popularity of the social set-up and economic conditions in India, the findings
of these studies may be fully applicable here. There is thus, need to have the Indian data to see how the different factors are at work in various school situations in this country. Achievement is different for different subject of study. Mostly, it is found that level of achievement of the students differs from subject to subject and factors influencing this achievement vary in their importance as contributing factors. Achievement in math like other subject has certain contributing factors. Therefore, it is worth while to take up a detailed study of achievement in math alongwith various factors influencing the achievement.

The present study was, therefore, designed to fulfill these needs and it aimed at identifying variables, having relationship with math achievement. Through appropriate statistical techniques an attempt was made to work out the relative importance of the different variables in determining achievement in math. If the education system is to provide equal access to school for all, it requires reliable information about the cause of low achievement in math among secondary school students. Several studies have been made to investigate the relationship between academic achievement in math and personal, familiar and institutional factors and conflicting results were obtained. The present study therefore, is conducted to determine achievement in math of secondary schools students in relation to their personal, familial and institutional factors.
Chapter - 2

Review of Related Literature
REVIEW OF RELATED LITERATURE

Introduction:

The review of the literature helps an investigator to get into the frontiers of knowledge that are related to his area of interest. According to Millar (1965) research workers must be aware of what is known with some degree of certainty what is accepted as truth by some and not by others, must have some link of the nature of unexposed areas where additional research should be conducted. The review involves locating, realizing and evaluating research reports as well as reports of observation and opinion that are related to the individuals planned research project. As such the investigator can not have an insight into the problem to be investigated, unless and until he learnt what other have done and what remains to be done in a particular area of interest. Thus, the related literature, besides forming one of the early chapters in the research report for orienting the readers, also serves some other purposes which are given by Good, Barr and Scates as follows.

i) To know whether the evidence already available solves the problem adequately without further investigation and thus to avoid the risk of duplication.

ii) To provide idea, theories explanations or hypotheses valuable in formulating the problem.

iii) To suggest methods of research appropriate to the problem.

iv) To locate comparative data useful in the interpretation of results and.

v) To contribute to the general scholarship of the investigator.
Justification of Literature

The researcher has tried to find out the needed studies in the area of math achievement, gender, attitude, T.V. and Sports, socio economic status and School factors and during his hunt for related literature. It was found that there was no study available which was parallel to the present study. All studies had other different combination of variables or were taken at different levels and on different sample.

In the light of the importance attached of related literature, the investigator high lights briefly the significance of research in secondary education and summarises the relevant studies that have been conducted in this area.

Secondary education has received a global attention in the recent and the past. However, the research in this priority sector of education has mostly remained confined within the developed countries and especially in USA and U.K. till the nineteen sixteen. As regards to developing countries and particularly In India, research in secondary education is not providing a healthy sign.

The present chapter attempts at reviewing the related literature in the domain of mathematical achievement, with special reference to secondary schools students and variables under study. Prediction of mathematical achievement has been occupying a central position in the educational sphere. Prediction of math achievement of secondary schools students through some biographical characteristics (personal and familial) and schools factors has been studied. In this chapter, an attempt has been made to review the related literature under the following headings -
A- Studies related to math achievement and personal factors of students.
B- Studies related to math achievement and familial factors of students.

C- Studies related to math achievement and institutional factors of students.

2.1 Relationship between math achievement and personal factors of students

2.1.1 Gender and math achievement

Thakur (1972). A sample of 780 science studying students of class XI during the academic session of 1965-1966 were selected from different schools of Bihar.

The Major Findings

1. The group performance in all the branches of scholastics achievement did not differ significantly.

2. The group performance of boys was superior to the girls in all the branches.

3. The best group performance of upper-middle class was found to be followed by middle class, upper class, lower-middle class and lower-lower class.

Collins and Lynn (1986). The purpose of this study was to assert differences in ability, academic achievement, and aspiration of mathematically gifted males and females and to analyse factors that contribute to high levels of performance among these individuals. The 67 subjects in this study (60% males 40% females) were identified as mathematically gifted in their sixth grade at age 10 or 11. Significant differences in the number of advanced course were found in favour of males. The difference in the means (Mm = 8.73 and Mf = 7.15) indicates a higher change of acceleration for the males rather than a failure for the females to
pursue advanced elective courses the math and science. The male exhibited a significantly higher correlation between the SAP math and the number of courses in math and science than the females. When the variables of course taking was controlled, significant difference between the mean scores on SAT math did not occur. Influences emerging as positive factors in high achievement were; early identification of mathematical ability placement with peers of similar intellectual talent, opportunities to accelerate learning, knowledgeable and supportive teachers and parental encouragement.

**Friedman (1989).** This paper is a meta-analysis of studies that have taken place between 1974 and mid-1987 on sex differences in mathematical tasks. The methods used are estimations of (a) parameters for a random effects model and (b) coefficients for a linear regression equation, all based on effect sizes calculated from each study. These results were compared with meta-analyses or the studies on quantitative skill collected by Maccoby and Jacklin (1974). These comparisons, together with adhoc comparisons of Scholastic Aptitude Test effect sizes over the years, yield two conclusions. First, the average sex difference is very small: a confidence interval for it covers zero, though the interval lies mainly on the side of male advantage. Second sex differences in performance are decreasing over the years.

**Hyde, Fennema and Lamon, (1990)** conducted study to make a refined assessment of the magnitude of gender differences in mathematics performance. Homogeneity analyses were used to analyse the gender differences in math performance. Results indicate that there were no gender differences in problem solving in elementary or middle school, differences favoring men emerged in high school (d=0.29) and in college (d=0.32). Gender differences were smallest and actually favoured females in samples
of the general population, grew larger with increasing selective samples, and were largest for highly selected samples and samples of highly precocious persons. The magnitude of the gender difference has declined over the years, for studies published in 1973 or earlier $d$ was 0.31, whereas it was 0.14 for studies published in 1974 or later.

**Kimball, (1989).** This article presents an examination of the little noted sex related difference in classroom grades. In both third and fifth grades, regression results showed that math and reading achievement test scores, together with student effort, were significant predictors of teacher rating of student mathematics achievement. Gender was not a significant contributor in either grade. Similar results were found when students were split by general and special education. The finding suggests that the teachers did not consider student gender when rating the mathematics skill level of their students.

**Cherian, et.al., (1993).** This study investigated gender and socioeconomic status differences in mathematics achievement of 1021 Xhosa children (369 boys and 652 girls) whose ages ranged from 13 to 17 years (15.6 yr.). They were chosen at random from the Standard 7 population of Transkei, South Africa. Their marks on the Standard 7 External Examination in mathematics were the criterion measure. A two-way analysis of variance indicated that mathematical achievement of girls was significantly higher than that of boys of low socioeconomic status whereas at middle and high socioeconomic status mathematics achievement of boys was significantly higher than that of the girls.

**Jain and Arora (1995).** The central focus of the study is to explore the achievement gap between boys and girls on mathematics and language and school level factors that are associated with this gap. A sample
of 1,746 schools, comprising 4,879 teachers and 23,700 students was covered in this study. Mathematics achievement test and the test of language were used in this study. The findings revealed that girls score approximately 12% and 11% standard deviation lower and than boys in mathematics and language respectively. The continuous stay of teachers of not more than five years in the same schools, proper qualification of teachers, appropriate number of teachers and higher percentage of female teachers are likely to improve the performance of girls and thus the primary education.

Kumar, (1995). The present study was conducted to study the attitude of male and female students towards mathematics on its utilitarian value dimension, social value dimension, intellectual value dimension, and the overall attitude towards the subjects. The sample of this study consists of 100 male and 100 female students of secondary school level of Bharatpur city. "Attitude towards mathematics inventory" developed by Lalit Kumar (1993) was used in the study. To test the hypotheses mean, standard deviation and t-value were calculated. Attitude of male and female towards math was expressed to the same extent on utilitarian value dimension of attitude towards math. Female group expressed more favourable attitude towards math than male groups on social value dimension of attitude towards math. Attitude of male and female students towards math was expressed to the same extent on aesthetic value dimension of attitude towards math. Attitude of male and female students towards math was expressed to the same extent on intellectual value dimension of attitude towards math. Attitude of males and females towards math was expressed to the same extent.

Melkonian, Michael. (1997). The sample was consisted of 400 students having 17+ years age from 14 government general secondary
schools. The research analyzed the performance in Greek-Language grade and mathematics grade. It was found that generally female students attained significantly higher grades than their male counterparts.

Barbara Signer, et.al., (1997). One hundred White and African American urban secondary students were interviewed for this study. After review and interpretation of the interview, tapes, responses to each question were coded, and three dependent variables were selected. Loglinear models, which analyze relationships among cross-classified variables, were used to investigate interactions among ethnicity, mathematics achievement level socioeconomic status, and gender. Although, this study verified previous findings that male students are more likely than female students to enroll in additional mathematics courses and to attribute their mathematics grades to intrinsic constructs (ability and effort), interesting findings not previously explored are reported.

Manning, M. Lee (1998). A review of literatures concerning the gender differences in mathematics and science achievement reveal certain stereotypes perpetuated by society, school and family. The 'Mathematics Report Card for the Nation and the States' by the National Assessment of Educational Progress and 'Everybody Counts: A Report to the Nation on the Future of Mathematics Education' report on the results of gender differences surveys conducted on male and female elementary students. Males were found to show higher motivation levels than females who were stereotyped as not having mathematical skills.

Joseph and William (1998). In this study the effects of student's gender and cultural experience, (region) on the ratings of previously identified causal attribution factor, were investigated. The participants were 341 high school students from the urban (N = 144) and the rural (N = 197)
regions of Kenya. There were 205 male and 136 female students. Causal comparative research design was used and data collected using the Causal Attribution Scale (CAS) The Hierarchical linear model (HLM) technique was used to test the hypotheses. There were significant gender and cultural experience variations in the mean ratings of the attribution factors. Instructional Strategy was highly rated for perceived success, and lack of Ability for perceived failure. Effort was of least importance in making attribution to either per perceived success or failure.

Alkhateeb (2001). This study explored gender differences in mathematics achievement of students in the last grade of high school and changes in these differences over a 10 year period in United Arab Emirates. A random sample of 2000 students, 1000 males and 1000 females for each of the 10 academic years, was taken from Ministry of Education records, and achievement results for males and females were compared findings indicated no significant overall differences. In the last 6 years, females scored higher, although effect sizes were small. Results are discussed in the light of cultural differences.

Nagaraju, Sumalatha, and Reddy, (2002). They made a study of academic achievement of senior secondary students in relation to certain factors. The sample was consisted of 240 senior secondary students of Tirupati and Chandragiri Mandals of Chittoor distt. in Andhra Pradesh. The students marks in Junior intermediate class were considered as their academic achievement. The study indicated that the performance of girls was better than that of the boys in academic achievement and the performance of urban students was significantly higher than rural students in academic achievement.
Review of Related Literature

**Orhun (2007).** This study aimed to investigate whether there is a relationship between gender and learning style, mathematical achievement and attitude towards mathematics. The subjects of this study were 5th semester students (42 females, 31 males) from the mathematics department at Anadolu University. The results of this study suggest that there were differences among learning modes preferred by female and male students, their mathematical achievements, and their attitudes towards mathematics. Mathematics achievement and attitude towards mathematics were not themselves dependent on gender.

**Mine and Erdinc (2008).** The Purpose of this study was to explore gender differences in mathematics achievement as demonstrated by performance on the mathematics subsection of a nationwide high school entrance examination in Turkey. In this study, the cities in Turkey were separated into five groups according to their level of economic development. The analysis was based on 2647 students that were randomly selected from these five different groups of cities. Although results indicated a statistically significant difference in mathematics achievement in favor of cities with the highest economic status, the effect size was quite small, which indicates the difference was not practically significant.

2.1.2 **Attitude and math achievement**

**Jha (1992)** investigated the relationship between attitude towards mathematics and achievement in mathematics of primary schools students. He found that - (i) There is a positive and significant correlation between proper attitude towards math and achievement in the subject (ii) High and positive correlation exists between attitude and achievement in case of high achievers and low achievers.
Walberg and Reynol (1992) conducted a study on structural model of high school mathematics outcomes. The model was further tested with a national probability sample of about 2,500 high school sophomore mathematics students. Corroborating previous findings, home environment and previous achievement had the largest effects on achievement, perhaps because they cumulate during the preschool and elementary school. Nonetheless, the other hypothesized factors-motivation, mathematics attitude, peer environment also had significant effect on mathematics achievement.

Rech and Stevens (1996). The mathematics achievement and attitude of black 4th and 8th grade students were the focus of a present study. The effects of gender, economic status, self-concept, and learning style on achievement were examined, along with differences between the grade levels on each variable. The sample consisted of 251 black students - 133 fourth graders and 118 eight graders. Results obtained from testing the 251 Black students in the sample indicated that they were from economically stressed families and generally possessed negative attitudes towards mathematics. Predictive equations were developed for the mathematics achievement of both fourth and eight grade black students. Among fourth graders mathematics attitude and economic status contributed significantly to the prediction of achievement.

Ma (1997) investigated the reciprocal relationship between attitude towards mathematics and achievement in math. Subjects were administered one student questionnaire and two mathematics achievement tests. Major findings from the model included

(a) A reciprocal relationship existed between every attitudinal measure and math achievement.
(b) The feeling of enjoyment, not the feeling of difficulty, directly effected math achievement.

(c) The feeling of difficulty functional via the feeling of enjoyment to effect math achievement.

(d) The perception of math as important was independent of other attitudinal measure.

Meheer (2004) conducted a study on the achievement at the secondary level and some of its determinants. He found that - (i) Achievement in mathematics was significantly related to major learning environment, attitude towards mathematics. (ii) Urban students show significantly higher achievement in mathematics, better learning environment and better attitude toward mathematics than their rural counterparts. (iii) No sex difference was found in account of students in math's regarding the enjoyment of learning environment of students and attitude of students towards mathematics. (iv) No stratawise and sex wise difference was found in the scientific attitude of students. (v) The high scoring group of students in major learning environment showed significantly higher score in math than their low scoring counterparts. (vi) The high scoring group of students in scientific attitude showed significantly higher achievement than their counter parts. (vii) The high scoring groups of students in SAT showed significantly higher achievement in math than their low scoring counterparts.

Saha, (2007) conducted a study of academic achievement in relation to cognitive style and attitude towards mathematics of primary school students. Results indicate that boys and girls differed significantly on attitude and math achievement. The component attitude in favourble
direction of learning mathematics is a significant contributor to the success in the mathematical achievements of both boys and girls.

2.1.3 Television and math achievement

Keith, et. al., (1986). In the present study, the direct and indirect effects of TV time, homework, and parental involvement on high school seniors achievement were investigated by using the massive High School and beyond data set. As expected, homework had an important, positive effect on student achievement and TV time had a smaller, negative effect. Parental involvement had no direct effect on seniors achievement scores but did positively influence the amount of time that seniors spent on homework. Further analysis suggested the possibilities of low homework demands and of excessive weekday TV viewing. Given the time spent on TV and homework and their influence on achievement, we suggest that these variables be considered in the current push for educational improvement.

Clarke and Costes (1997). The relationship among school readiness, children's television viewing, parental employment, and the educational quality of the home environment were examined. Thirty five school children from low income families and their primary care givers were interviewed. Co-relational analyses indicated that television viewing time was negatively related to parental instruction and number of children's books in the home. Viewing time was also negatively related to children's school readiness skills.

James Lendsay (1999) studied the relationship between five after school activities and academic achievement. Generally more time in extra curricular activities and other structured groups and less time in jobs and television viewing were associated with higher test scores and class grades,
more time on home work was associated with better grades. The joint effects of all five after school activities nearly doubled the predictive ability of any single activity.

Amita and Agarwal (2000). The present study explores television viewing patterns of higher secondary level students and its impact upon their study habits. A purposive sample of 95 students stratified across sex and educational stream was selected. Tools used were self-made television viewing pattern inventory and Palsane and Sharma’s study habit inventory. Major results indicate that most of the students spent less than four hours per day in television viewing. Duration of televiewing was found to effect negatively the math achievement of students. Watching the television for more than four hours in a day adversely affect the math achievement. Variations in the patterns of televiewing influence the study habits of students.

Rezel (2001) examined the relationship between amount of television viewing and educational achievement. Small amounts of TV watching increased math achievement but as viewing increased beyond a certain point, achievement decreased.

Wright, et al., (2001). The relations of early television viewing to school readiness and vocabulary of children from low income families was the focus of this study. For both cohorts, frequent viewers of general-audience programs performed more poorly on subsequent tests than did infrequent viewers of such programs. Children's skills also predicted later viewing, supporting a bi-directional model. Children with good skills at age 5 selected more child audience informative programs and fewer cartoons in their early elementary years. Children with lower skills at age 3 shifted to viewing more general audience programs by ages 4 and 5. The results affirm
the conclusion that the relations of television viewed to early academic skills depend primarily on the content of the programs viewed.

**Ennemoser and Schneider (2007).** The longitudinal study explored the long term effects of television viewing on the development of children's reading competencies. They found that educational program viewing was positively correlated with reading achievement. Relations between entertainment program viewing and reading performance were generally negative. Children's who were classified as heavy viewers (average viewing time per day = 117 minutes) show lower progress in reading overtime as compared to medium and light viewer average viewing times per day 69 and 35 minutes, respectively. Partial support was found only for 1 of the 3 tested casual mechanisms, namely television induced reduction in leisure time book reading.

### 2.1.4 Sport and math achievement

**Lipscomb (2007)** investigated the relationship between secondary school extra curricular involvement and academic achievement. Independent of individual ability it is found that athletic participation is associated with a 2% increase in math and science test scores. Club participation is associated with a 1% increase in math test score. Finally, involvement in either type of activity is associated with a 5% increase in bachelor's degree attainment expectation.

**Gerber (1996)** found that school related extra-curricular activities (e.g. sports, band honor society) and outside school activities (e.g., hobby groups, scouting and 4-H) were related positively to mathematics achievement.
Holland and Andre (1987). In this study positive association between after school pursuits and achievement has been observed. Students involved in extracurricular activities such as sports also tend to have good attitudes, positive self-concept, and higher achievement than do student not involved in these activities.

Marsh (1992) had similar finding with small but statistically significant positive correlations between activities (e.g., sports, drama, chorus, clubs by subject meter, church student government, and service clubs) and achievement.

2.2 Relationship between math achievement and familial factors:

2.2.1 Parental education, occupation and family size of children and math achievement

Satyanandam, (1969) found that (1) The children of graduate parents performed better than matriculate parents. (2) The children belonging to upper and lower strata differ significantly in their academic achievement. (3) These were no great difference between middle and lower economic groups. (4) Sex had no bearing upon the achievement level.

Ojha, (1979). This study was conducted in all 1050 male students of class XI belonging to both rural and urban intermediate college of Jaunpur Distt. (U.P.). They filled the personal information, which was devised to collect information about the determinants of socio economic status. The marks obtained in the high school exam served as the criterion for achievement. The analysis of data revealed a significant positive correlation of 0.34 between achievement and socio-economic status for rural
Review of Related Literature

boys and 0.69 for urban boys. The achievement of rural boys was found to be better than urban students. For both rural and urban students the t-test analysis led the investigator to conclude that the higher the SES better would be the academic achievement of students at high school level, parental education occupation and income were also related with educational achievement of both rural and urban boy of class XI.

Khanna, (1980). The sample comprised 1000 students of class VI, VII and VIII (among 30 schools of urban and rural areas). The academic achievement scores of half yearly and annual examination of students were used as the criteria of achievement. The Chi-square and contingency of correlation were used for analyzing the data. Major findings are - (1) Socio-economic status was positively and significantly related with academic achievement. (2) The correlation was more consistent in urban areas than rural areas. (3) The academic achievement of rural and urban students was closely related with their guardian’s income. (4) The academic achievement of children of various schools was significantly related with the socio-economic conditions of their family. (5) The academic achievement of children of educated parents, illiterate persons and educated mothers significantly correlated with the socio-economic status of the family.

White, (1982) studied the relationship between socio-economic status and academic achievement. Results indicated that as SES is typically defined (income, education, and occupation of household heads) and typically used (individuals as the unit of analysis), SES is only weakly correlated (r = .22) with academic achievement with aggregated units of analysis, typically obtained correlations between SES and academic achievement jump to .73. Finally characteristics, such as home atmosphere, sometimes incorrectly referred to as SES, are substantially correlated with
academic achievement when individuals are the unit of analysis ($r = .55$). Factors such as grade level at which the measurement was taken, type of academic achievement measure, type of SES measure, and the year in which the data were collected are significantly correlated statically with the magnitude of the correlation between academic achievement and SES. Variables considered in the meta analysis accounted for 75% of the variance in observed correlation coefficient in the studies examined.

Alwin and Thorton (1984). This paper explores the potential role of socio-economic factors in school achievement outcomes at two separate periods in the life course early in childhood and during late adolescence. Our analytic results point to a potentially stronger role of early socioeconomic factors in cognitive development and school learning. In a single instance the case of family size - we find independent effects on school achievement from both early and late socioeconomic experiences.

Krishnan and Namboodiri (1994). The purpose of the present study is to find out the effect of familial variables on the educational status of the Adhivasis of Wyand. The major hypotheses of the study are stated as: the educational status of the Adhivasis of Wyand is dependent upon their family type, size and system. A stratified representative sample of 405 Adhivasis in Wyand District is included in the present study. A schedule structured by the investigators was used in the interview personally conducted by one of them. Chi-square test of hypothesis of independence was employed. Joint family facilitated educational status in a better way. Smaller family size has led to higher educational status. They may be due to the possible possession of optimum resources by small families.

Shukla (1994) conducted another study to find out the level of attainment of primary school in various states in India. For the entire country
the SC/ST pupils performed lower than the non-SC/ST ones. Further, the pupil's achievement was found to be positively related with father's education, facility for learning and educational environment at home. The variables related to schools and teachers indicated somewhat weak relationship with achievement.

**Harolds (1996).** Study includes measures of family norms in multivariate model of academic achievement applied to new nationally representative dataset the National Educational Longitudinal study of 1988. The study finds that when measures of family norms omitted from the models, student socio-economic status, all strongly influence academic achievement but when measures of family norms are introduced. The private school control is markedly reduced in achievement for mathematics and proves spurious for reading, history and science.

**Ibrahim (1996)** studied the relationship between the academic achievement of student in Jordan State Universities and the Socio-economic Status (SES) of their families. In this study statistically significant negative relationship were found between students GPA and their fathers and mothers income, occupation and education. However, the relationship between parents SES and students GPA were weak and without practical significance.

**Crane (1996).** Determinants of young children's mathematics skill home environment, socioeconomic status (SES) and maternal cognitive test scores were statistically analysed in a simple model. The effect of home environment on children's math test scores was large, even when SES and maternal test scores were controlled. The effects of SES and maternal test scores were smaller but by the means trivial.
Pong (1997). Result shows the schools that are predominated by students from single-parent families and stepfamilies negatively affect their students' achievement, even after individual demographic characteristics and family background are controlled. This negative effect of single-parent families and stepfamilies is partly explained by the relatively low socioeconomics status of children in these schools. However, the negative effect of single-parent families and stepfamilies on school achievement can be countervailed when social relations among parents are strong.

Caldas and Bankstone (1997). The relationship between the socioeconomic status (SES) of peers and individual academic achievement was examined in this study. Regression techniques were used to analyses the data. Peer family social status in particular does have a significant and substantive independent effect in individual academic achievement, only slightly less than an individual's own family social status.

Campbell and Beaudry (1998). The study includes 11th grade mathematics students (330 boys and 213 girls) by using Campbell's differential socialization paradigm as a theoretical framework. The path model for both the sexes showed that educated mothers had strong indirect effects on their children's mathematics achievement.

Senechal and Lefevere (2002). This article presents the findings of the final phase of a 5 year longitudinal study with 168 middle and upper middle class children in which the complex relations among early home literacy experience, subsequent receptive language and emergent literacy skills, and reading achievement were examined. Parent involvement in teaching children about reading and writing words was related to the development of early literary skills. Early literacy skills directly predicted
word reading at the end of grade 1 and indirectly predicted reading in grade 3. Word reading at the end of grade 1 predicted reading comprehension in grade 3. Thus the various pathways that lead to fluent reading have their roots in different aspects of children early experiences.

Wilkins and Ma (2002). Authors found that parent education had a positive relationship with students initial status in all three content areas however, influence from peers and parents had a consistent relationship to growth in middle school for all three content areas. In high school, parent push was related to student growth only to algebra and geometry peer influence on growth was not evident in high school.

Ercikan, et.al., (2005). This paper reports an exploratory study examining factors that might be associated with achievement in mathematics and participation in advanced mathematics courses in Canada, Norway, and the United States of America (USA). These factors, which were not directly related to schooling accounted for large degrees of variability, 24% to 39%, in mathematics achievement scores. Confidence in mathematics was the strongest predictor of achievement for students from Canada and Norway, whereas for the students from the USA, parents' highest education level was the highest predictor of achievement. Student home environment related variables were stranger predictors of.

Byrnes and Miller (2007). In the present study, the authors propose a new framework that integrates literature on achievement, supports the testing of novel hypotheses, and stresses the importance of examining a large number of factors in the same study. This framework assumes that high achievement is a function of three categories of factors: (a) opportunity factors (e.g. coursework). (b) propensity factors, (e.g., prerequisite skills, motivation), and (c) distal factors (e.g., SES). A secondary analysis of the
National Longitudinal Educational Study (NELS:88) using hierarchical regression and structural equation modeling revealed that 58-81% of the variance in achievement was explained by family variables and specific opportunity and propensity factors.

2.2.2 Parental assistance in mathematical problem solving and math achievement

Fields and Herring (1975). This study was directed towards identifying parents and teachers who demonstrated interest in the achievement of their child and students and then evaluating whether their interest had a relationship to the student's achievement. Samples were 240 ninth grade algebra students in four Junior high Schools in an urban school system. The statistical analysis yielded the following major conclusions (1) students whose parents were more interested in their children's algebra achievement were more likely to achieve better in algebra than students whose parents were less interested. (2) Students whose teacher's were more interested in their students' achievement were not likely to achieve better in algebra than students whose teachers were less interested. (3) Student who had more interested teachers and less interest parents were not likely to achieve as well as in algebra as students with more parents. Parents interest was thus determined to be posterity related to students achievement.

Wilson and Hunter (1976). The major objective of the study was to determine if there exists significant relationship between parental involvement and academic achievement. It was found that differences in parental involvement are related in high or low achievement among children. Analysis of data shows a relationship between parental involvement and student achievement.
Green and Walker (1989). The result shows that stepwise multiple regression analyses revealed various combinations of the predictors accounted for significant portions of the variance in all parent involvement outcomes. Parent conferences (52%), parent volunteers (27%), parent home tutoring (24%), parent involvement in home instruction programs (22%), and teacher perception of parent support (41%). Variables most consistently involved in outcomes were teacher efficacy and school socioeconomic status.

Trusty (1998). The author examined the influence of family and parenting variables on expectations regarding education. Zero order correlation coefficient, New computer analysis program and Chisquare Automatic Interactions Detector (CHAID); magidson, 1993) were applied to analyses the data. Socio economic status (SES) was most strongly related to educational expectations. Adolescents perceptions of parents personal involvement and parents reports of this own behaviour were both related to educational expectations.

Agarwal and Kapoor, (1998). They made a study of parent's participation in children academic activities in relation to their academic achievement at the primary level. Main finding of the study indicated that the parent's participation in children's academic activities also play an important role in enhancing their academic achievement.

Sarita and Mayuri, (2003). They conducted a study to see the influence of family and school factors on the academic achievement of residential school children. The sample consisted of 120 children 60 from IX and 60 from X and 40 teachers from IS residential schools of Hyderabad city. An interview schedule was developed by the investigator to study the family conditions and the questionnaire was developed by investigator to
study school factors. I-IV ranks holding children were the criteria of sample selection from the previous final year examinations.

1. The results indicated that girls were superior to boys.
2. Family factors like parental aspiration and SES significantly contributed to academic achievement.

Anderson, et.al. (2006). This study explored the relationship between student achievement and student, school and variables from the pan-canadian assessment program administered by the council of Ministry Education Canada (CMEC). The school achievement Indicators Program (SAIP) Mathematics study also evaluated the datasets used in relationship to their utility to mathematics achieve both age groups and for both domains of mathematics. As students make use of instructional supply (parental assistance with mathematics homework, computers in the mathematics classroom) there is an associated decrease in mathematics scores.

2.3 **Relationship between math achievement and institutional factors:**

2.3.1 **School type and math achievement**

Kulkarni and others (1970). conducted the first major study on achievement survey in mathematics covering the three levels of education, viz, end of primary (Class V), end middle (Class VIII) and end of secondary stage (class X) in 15 states. The number of students in the sample varied from more than 28,000 at primary level to nearly 20,000 at the secondary level. The major findings of the study for the primary level were. Boys achieved higher than girls, the socio economic conditions of the parents of school type (e.g. govt. or private management) provided better teaching
learning situations, and no relation was found between school achievement and teacher qualifications.

Coleman, Hoffer and Kollgore (1982). Three types of analysis are carried out in this study and provide strong evidence that there is, in vocabulary and mathematics, higher achievement for comparable students in catholic and other - private schools than in public, the results are less consistent increasing.

Noell (1982). In this study he reanalyzed the impact of catholic school attendance on the reading and mathematics achievement of senior and sophomore pupils. The standardized tests in reading and mathematics were used to measure the achievement in both subjects. Findings - except for a statically significance but small advantage on sophomore reading tests, catholic school pupils were found to do no better or worse than public school pupils.

Reeta (1986) conducted a study to compare private and government schools on matriculation result of 1985. A correlation statistics was also worked out to find out the mean scores on mathematics and sciences (in both private and government settings). The results show that the pass percentage government students were 45.8 as compared to the 87.5 percent of the boys belonging to private institutions.

1. The pass percentage of government girls was 44.8 and that of 81.8 in case of private girls.
2. The highest marks percentage was 81 in case of private schools and only 76 in case of government school.
3. The private institution got 7 positions with an average of 80 percent marks as compared to position from government schools with an average of 78 percent marks.

4. The number of first divisioners from private sector was more than govt. sector. It was 263 in private schools and only 48 in govt. schools.

5. The number of students failed in math and science was more in case of govt. schools than private schools.

On the whole of was found that: The boys have done significantly better than girls (the level of significance .01)

1. Private schools boys have performed significantly better than government school boys (the level of significance .01)

2. Similarly private school girls have done significantly better than government school girls.

Murthy and Kulshreshtha (1991) tried to study whether academic anxiety facilitates or impedes academic achievement in two management system viz. private and public school. A sample of 199 class IX students comprising boys and girls (100 boys and 99 girls) were taken from Government and public school of South Delhi. The academic anxiety scale of Sinha was used as a tool to collect the data. The collected data were analysed statistically using mean, standard deviation, correlation coefficient, one way ANOVA and for post hoc comparison, Duncan's Multiple range Tests. Major findings of the study are as under: Academic anxiety and academic achievement are inversely and significantly related. It means, as the academic anxiety increases, the achievement level decreases.
1. That the mean difference of boys and girls of government and private schools differed significantly on their academic achievement. The private boys have achieved far better followed by private girls. Govt. boys and govt. girls while as, on the whole boys and girls do not differ significantly in academic achievement.

2. It has been found that government and private school students differ significantly (level of significance .01) in academic achievement and this difference is in favour of private school students.

White (1992) conducted a study to examine the effect of type of schools on achievement in vocabulary and mathematics. The Major results of the study are as under: Once public and private schools are statistically equated they appear be produce similar gain in achievement. (i) On average catholic school students, slightly scored higher in vocabulary and mathematics test then public school students. (ii) Student background characteristics like SES largely influence the educational gains. (iii) That the difference in achievement in public and private school are trivial in size and highly uncertain.

Sajitha (1994) investigated as whether the greater managerial discretion associated with the private sector leads to high academic performance in Tamil Nadu. A multi grade sampling design was used, yielding on analytic sample of 2667 pupils in 113 schools (65 public school, 20 private aided schools and 20 unaided private schools.) located in five districts of state. Major findings of the study are - (i) Neither the father's education nor mother's education seems to affect student performance. (ii) Aided schools exert a strongly positive effect on mathematics achievement.
but the effects for reading comprehension are mixed. (iii) The class-teacher ratio has a positive effect on mathematics achievement. (iv) Pupils in school with better physical facilities score higher. (v) Private unaided schools performed worse than public school. (vi) Other important results included the fact that longer teacher experience seems to produce a negative effect.

**Geeta (1994).** In her study found that in Uttar Pradesh, private unaided junior school were significantly more cost-effective than either government or private aided junior schools. Surveying grade 8th students in 30 Secondary Schools in Lucknow in 1991 and controlling for student background characteristics and selection effects, it was found that students in private unaided junior schools performed significantly better on tests of reading and mathematics then students in government and private aided schools.

**Rath and Saxena (1995).** The study focuses on the difference between SC/ST and non-SC/ST students on mathematics and language achievement and identifies the pupil and school level factors attributable to those differences. The sample comprised 5, 292 SC/ST and 17,771 non-SC/ST students of IV and V grade. To estimate achievement of students on language and mathematics standardized achievement tests (Shukla, et al 1994) were used. Hierarchical linear regression model and meta analysis were used for the analysis of data. The results reveal that SC/ST students score lower than non-SC/ST students in both the subjects. Father's education contributes for better achievement of SC/ST students. In mathematics, the achievement gap does not vary significantly across the schools whereas in language, it varies in Karnataka and Kerala. Test and feedback provided by the teacher tends to reduce the gap between SC/ST and non-SC/ST students in language.
Estalle, et.al. (1997) investigated the impact of public versus private finance of education and public versus private management of school on school cost and efficiency, using school level data on revenues, expenditure, enrollments, examination scores and student characteristics from Indonesian Primary Schools. The data for analysis was taken from National Survey of Public and Private Schools in Indonesia conducted by the Ministry of Education and Culture (MOEC) 1992. The survey collected data on a wide range of school level variables including number and salaries of teachers, conditions and availability of classrooms and libraries, level and source of funding, type of expenditure and average score on sixth grade national examination in Mathematics and Bahasa Indonesia. The major findings are: (i) Private management is more efficient than public management in achieving academic quality. (ii) Private funding also improves efficiency whether schools are publicly or privately managed, and (iii) Private managed school behave differently from public managed school because they have different objective functions, greater autonomy and have to face greater pressure from market place to operate efficiently.

Singh Satvir (1996) studied the determinants of learner achievement in mathematics and language at primary stage using the data of Karnataka State Baseline Assessment Study covering 177 schools, 442 teachers and 2568 pupils. Major Findings of the study include the following: There were large and significant differences between schools in their math mean performance. (i) Govt. Schools performed lower than privately managed schools. (ii) On average boys were performing better than girls. (iii) There was a positive association between mean SES (Intake composition) and school mean performance.
Mc Ewan and Patrick (2001) presents the results of a study comparing Spanish and mathematics scores of children of 8 grades in types of public and private schools. Controlling for students and peer attributes, the initial results suggest that the average students scored higher on Spanish and mathematics test in private Non-Voucher schools than in other types of schools.

Aswal (2001). He conducted a survey on the achievement in mathematic across different level of socio-economic status (SES). 200 students were randomly selected from 5 college of Tehri district SES Scale by Pareek and Trivedi, Pearson product-moment correlation and Critical Ratio were applied to analyze the data. The important objectives were to study the relationship between SES and academic achievement. Result showed the significant relationship between them as three colleges reflected significant difference among different levels of SES out of 5 colleges.

Young et al, (2006) explored the relative importance of school and individual factors in the determination of science learning. Hierarchical linear analyses showed that individual measures accounted for most of the variance. Previous achievement was the preponderant influence on subsequent achievement. Nonetheless, initial science attitude, instructional time home environment and exposure to mass media were also significant individual level influence on science achievement.

2.3.2 School Resources and math achievement

Das (1974). Conducted a study to ascertain weather there was any impact of the physical conditions (facilities) of primary schools on the retentively and regular educational program of its children. The study
revealed that there was significant relationship between efficiency in education and physical facilities in schools. The school conditions definitely seemed to have a favorable impact on school education. Better physical facilities increased the attractive and retentive power of the school as well as provided situations conducive for effective education and hence contributed to towards better education of children in the school.

Sutton and Soderstrom (1990). Relationships between school and social factors reported on the Illinois school report card were examined, along with student achievement, as measured by the Illinois goal assessment program (IGAP). The participants in this study included all of the 3,856 schools in Illinois that reported information for the 1994 Illinois school report card. Statistical analyses included the generation of frequency distribution and descriptive statistics for all variables. Correlational analyses included bivariate correlation multiple linear regression and stepwise multiple regression. Results revealed that all of the independent variables (except high school per-pupil expenditure) were significantly related to achievement scores. A school's IGAP achievement score is more a function of the school demographic status and SES than its effectiveness education legislators, and the public should consider this when comparing achievement among and rank them accordingly.

Caldas (1993). This study examined the direct effects on, and contribution of, several input and process factors on public school achievement in Louisiana. Descriptive statistics were used to analyse the data. Socioeconomic status and minority status were the strongest predictors of school achievement in every model. The discrepancy between the achievement of white students and black students increased with grade level of school. School size did not have any meaningful effect on school
achievement, nor was the effect of class size significant for every sub-population. However, students attendance had a more substantial (P<0.001) effect in every model on school achievement.

Varghese (1994) conducted a study under DPEP programme on learner achievement in mathematics and school quality. He found that - (1) Schools managed by private sector show marginally better performance than government schools. (2) Parental education and occupation are also important factors associated with learner achievement. (3) There exist no direct association between school facilities and performance of children in grade IV test. (4) Boys have very marginal advantage in mathematics and girls in Malayalam. (5) Sex of learner does not seem to be important in predicting learner achievement. (6) The level of school infra structure and variation in the availability of teaching material seem not be closely related with levels of learning.

Singh and Saxena (1995). This paper attempts to study the effects of school variables on pupil's achievement using the data of Baseline Assessment Studies (BAS) recently conducted in the eight states of India. Students of Class IV and V were administered tests on mathematics and reading. It is found that there exist gender gaps in achievement. Mother's and father's education and father's occupation are positively associated with the pupil's math achievement. The schools level factors of academic climate (test and feedback, homework, etc) and teacher quality (teacher study) teaching experience, etc. are the prominent contributors as compared to those of school resources (educational and physical facilities).

Gupta and Gupta (1995). This paper attempts to study effects of operation Black board (OB) and incentive schemes on pupil's achievement in mathematics and language. The data collected from 1,746 schools for base
line assessment studies of DPEP formed the basis of this study. Detailed information about school and pupil characteristics were collected through school and pupil schedules respectively. To estimate achievement of pupils on mathematics and language, standardized achievement tests (Shukla, et al. 1994) were used. Hierarchical linear model and meta analysis are used to analyse the data. Supply of free text books and mid-day meals have indicated positive and significant impact on pupil’s achievement in Madhya Pradesh whereas scholarship for regular attendance as shown significant impact on language achievement in Kerala.

Singh and Sexena (1995) attempted to study the effects of school related variables on pupil achievement using the Baseline Assessment Studies (BAS) data in eight states. Main Results: The results show that there are large and statistically significant differences between boys and girls within school in their achievement in mathematics in states of Assam, Haryana, Karnataka, Madhya Pradesh and Orrisa. These differences are also found statistically significant in language achievement for all states except Haryana and Kerla.

i) At the school level the mean SES is positively associated with the achievement in mathematics and language after adjusting for pupil’s background.

ii) Mother and Father's education and father's occupation have positive association with pupil achievement and are mostly consistent across states.

iii) The factors of educational and physical facilities in school have positive association with school mean achievement in mathematics.
Okpala et al. (2001). He conducted a study to see the influence of parental involvements, SES of parents and instructional supplies expenditure on mathematics achievement scores of 4,256 of 4th grade students in North Carolina. An educational production function framework was used to see the influence of educational resources on the mathematic achievement score.

Results showed that percentage (%) of students in free/reduced price lunch programme was related negatively to the students’ academic performance in mathematics. This supports the notion that economic circumstances are correlated with academic achievement.

Gupta (2003) conducted an experimental study to see the impact of physical facilities of primary schools on scholastic achievement of the students. He has taken primary schools of two districts i.e. Calcutta and Cooch Bihar. Two random samples of schools were estimated. The three subjects (1) Bengali language (ii) Arithmetic and (iii) Environmental studies are taught in primary. Three achievement tests for three subjects were constructed and used to assess the academic achievement of the children at the end of the course. The results of the test indicate that differences between means of two districts in all three subjects are significant at .001 level as (ii) students of primary schools of Calcutta has significant higher mean achievement score in Arithmetic than the primary school students of Cooch Bihar. (iii) The primary school of Calcutta has good physical facilities than the primary school of Cooch Bihar.

2.3.3 Class size and math achievement

Joshua, et al. (1999). The twelfth century rabbinic scholar Maimonides proposed a maximum class size of 40. This same maximum induces a nonlinear und nonmonotonic relationship between grade
enrollment and class size in Israeli public schools today. Maimonides rule of 40 is used here to construct instrumental variables estimates of effects of class size on test scores. The resulting identification strategy can be viewed as an application of Donald Campbell's regression-discontinuity design to the class-size question. The estimates show that reducing class size induces a significant and substantial increase in test scores for fourth and fifth graders, although not for third graders.

Lee and Smith (1997). The study described in this article investigates the relationship between high school size and students' learning. They used three waves of data from NELS:88 and hierarchical linear modeling (HLM) methods to examine how students' achievement growth in two subjects (reading and mathematics) over the high school years is influenced by the size of the high school they attend. Three research questions guided the study: (a) which size high school is most effective for students' learning? (b) In which size high school is learning most equitably distributed?, and (c) Are size effects consistent across high school defined by their social compositions? Results suggest that the ideal high school, defined in terms of effectiveness; (i.e., learning), enrolls between 600 and 900 students. In schools smaller than this student learn less; those in large high schools (especially over 2,100) learn considerably less. Learning is more equitable in very small schools, with equity defined by the relationship between learning and student socioeconomic status (SES).

Monk (1987). If economies of scale are important in secondary education in ought to be possible to observe fewer problems with input indivisibility and greater degrees of resource specialization in larger compared to smaller secondary schools. Moreover, it ought to be possible to observe some evidence of greater curriculum comprehensiveness in larger
schools since this is one of the possible consequences of scale economies. The present study examines these phenomena using data collected in New York State schools. Results indicate that the sources of scale economies are largely exhausted by the time enrollments reach relatively small levels and that beyond these modest enrollment levels, gains in curricular comprehensiveness are trivial.

Lee and Smith, (1995). This study assessed the impact on 10th-grade students of attending high schools whose practices are consistent with the school-restructuring movement. Using data on a sample of 11,794 sophomores in 830 high schools from the first two waves of the National Educational Longitudinal Study of 1988, the authors evaluated restructuring effects on students' gains in engagement and achievement in four subjects and the social distribution of those gains. High schools with several practices consistent with restructuring and those with none of the 30 practices that were considered were contrasted with schools that engaged in only traditional reforms. School size was evaluated as an independent structural feature. The results revealed that students' gains in achievement and engagement were significantly higher in schools with restructuring practices and lower in schools without reforms. Higher and more socially equitable engagement and achievement were consistently associated with smaller high schools.

Brown and Jencks (1975). The authors find few, relationship between high-school characteristics and any measure of high-school effectiveness. From these findings, they argue that, at least for whites, changes in high-school characteristics like teacher experience, class size, and social composition are unlikely to change high-school effectiveness, and that
holding schools accountable for one outcome is unlikely to guarantee effectiveness on another.

**Krueger (1999).** This paper analyzes data on 11,600 students and their teachers who were randomly assigned to different size classes from kindergarten through third grade. Statistical methods are used to adjust for nonrandom attrition and transitions between classes. The main conclusions are (1) on average, performance on standardized tests increases by four percentile points the first year students attend small classes; (2) the test score advantage of students in small classes expands by about one percentile point per year in subsequent year; (3) teacher aides and measured teacher characteristics have little effect; (4) class size has a larger effect for minority students and those on free lunch; (5) Hawthorne effects were unlikely.

### 2.4 Review of the Studies:

A critical analysis of the above mentioned studies give rise to certain substantive inquiries which need to be highlighted and addressed to for the sake of further investigation. Most of the studies whether conducted in India or abroad support multiple results leading to phenomena where the need of further research becomes imperative. In the area of school resources it has come to light that research studies found contrary and mixed results. The studies conducted by Sajitha (1994), Das (1974), came to the conclusion that school resources (school infrastructure, condition and facilities) largely enhance academic achievement. As against this, studies conducted by Varghese (1994), Hanushek (1989) and hold that school resources are not related to academic achievement. Nearly, all the studies reported above except that of Ibrahim (1994) revealed that socio-economic status is the significant determinant of academic achievement. Similarly, except Sajitha
(1994) and White (1992), all the investigators referred in the literature have found that in the school quality and academic achievement private schools are performing significantly better than government schools and government aided private schools.

The contradictory findings of various studies mentioned above inspired the investigator to conduct a study of influence personal, familial and institutional factors on achievement of secondary school students in mathematics. There is already lack of research activity in the area of secondary education in the country. Although, a lot of research has been conducted outside the country on these variables, still all these variables in combination have not been studied extensively.

Besides getting an over all view of research at secondary stage of education, the review of literature helped the investigator in understanding the important variable like gender attitude, T.V., sport, parental education, occupation, family size and assistance in math problem, school resources, school types, and class size. They helped in understanding the relationship between achievement and other variables like students’ motivations, students’ engagement in extra curricular activities, family characteristics, school quality, school expenditure SES, teacher pupil ratio etc.

The review of studies highlighted the need for such a study in the light of inconclusive and conflicting findings. It also come to the notice of the researcher that the work so far done is this area in India is inadequate and the area needs further exploration especially at secondary stage of education. The review through some light on method of data collection, research design, method of tool construction, standardization and use of statistical tool for analyzing data, which helped the researcher in developing an
appropriate methodology for the present investigation which will be discussed in the next chapter.
Chapter - 3

Methodology and Design of the Study
METHODOLOGY AND DESIGN OF THE STUDY

Plan of a research study entails over view of the total layout including a consideration of how the work is to be executed. It is at this stage that decisions crucial for the accomplishment of the aims of the study such as what measures of gathering data are to be used, how population is to be defined and sampled, what controls are to be applied, what kind of data pertinent to the study are to be collected and finally how it is to be analyzed are made. Needless to say that without proper planning difficulties to be encountered during the progress of the work cannot be anticipated and resolved. In fact, successful completion of the study without preplanning becomes not only difficult, but impossible, Lastruecil defines as, "the function of a research design is to organize the procedures of study so that error is minimized, effort is economized and relevant evidence is gathered efficiently." A considered discussion of all those aspects in respect of the present study is embodied in this chapter.

3.1 Methodology:

The method adopted for the present study can be categorized as descriptive statistical in nature. Descriptive research describes and interprets what is, It is concerned with conditions or relationship that exist, practices, that prevail, beliefs, points of view or attitudes that are held, processes that are going on, effects that are being felt or trend that are developing. The process of description as employed in this research study goes beyond mere gathering and tabulation of data. It involves an element of interpretation of the meaning or significance of what is described. Thus, description is combined with comparison or contrast involving measurement, classification, interpretation and evaluation.
The use of inferential statistics has been made in deducing results from different statistical techniques employed for investigating the relationship between math achievement, personal, familial and institutional factor with the above mentioned goals to be achieved, this study was designed to be executed in different steps given below.

3.2 Sample:

The problem of actual selection of the sample of required type and size becomes indeed very crucial of any systematic and scientific method of enquiry. Adequate sampling design involves a number of considerations such as nature and characteristics of the populations from which the sample is to be drawn, accessibility of the subjects chosen, availability of time and resources at the disposal of the investigator and appropriateness of the statistical treatment of the data etc.

3.2.1 Size of the sample:

The worth of a study is judged by several criteria including the size of the sample. The number of units to be included in a population sample, by and large, depends upon the purpose of the study, the use of results in decisions making and the statistical techniques to be used. There is, however, little doubt that other factors being equal, larger the sample, the greater should be the accuracy of results but most investigations find this ideal to be really difficult to achieve and in selection of the sample some compromise is made such that neither the resultant data becomes unmanageable to handle nor do the generalisations and findings arrived at become questionable on account of adequacy of the sample.
Methodology

Since the study had to be confined to the willing and cooperating teachers & principals, it does not claim that the sample was selected strictly randomly. The principle of randomness was adapted to the extent it was practicable. Access to students and their cooperation were the main factors in selection of sample for the main study.

Further more, the sample size was different at different stages of investigations partly due to dropping out of a few students from investigation and partly due to non-inclusion of some students of the main sample in subsequent analysis on account of their failure to complete one test or the other.

Note withstanding these constraints, however, the main sample and the sub-sample were sufficiently large as also representative of the student of secondary schools in general as would be evident from table 3.1 and brief description that follows:

Table 3.1 Description of the sample

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Sample used for</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Development of Math attitude scale</td>
<td>150</td>
</tr>
<tr>
<td>2</td>
<td>Development of Math achievement test</td>
<td>200</td>
</tr>
<tr>
<td>3</td>
<td>Study of relationship between math achievement of students and their.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Personal Factors</td>
<td>1127</td>
</tr>
<tr>
<td></td>
<td>b. Familial Factors</td>
<td>1127</td>
</tr>
<tr>
<td></td>
<td>c. Institutional Factors</td>
<td>1127</td>
</tr>
</tbody>
</table>

3.2.2 Sample used in the trial run for the development of math attitude scale:

The initial form of Math attitude scale (MAS) was administered to 150 student (75 males & 75 females) randomly sampled from six-
secondary schools, out of which two were girls, one was co-educational and rest were boys schools located in rural and urban areas of Lucknow district. These schools belong to different categories of management and range from good to poor in regard to standard of performance of their pupil. Thus, the sample selected for try out of the MAS constituted a cross section of secondary school students.

3.2.3 Sample used for the development of Math achievement test:

Math achievement test was administered to 200 secondary school students (110 male and 90 female) randomly sampled from eight secondary schools, out of which two were girls schools, two were boys and the rest were co-educational schools, located in rural and urban areas of Lucknow district. These schools belong to different categories of management and range from good to poor in regard to standard of performance of their pupil. Thus, the sample selected for the math achievement test constituted a cross-section of secondary school students.

3.2.4 Sample used for the study of relationships between math achievement and personal, familial & institutional factors

The sample used for study of secondary schools students' achievement in math forms the main sample of the study in view of the objective of the investigation which sought to find its relationship with some other student characteristics such as their personal, familial & institutional factors. In all 1127 students were involved in the study of relationship between math achievement and their personal, familial and institutional factors. An examination of the particulars of students under study contained in table 3.2 reveals that the number of the male students are more than double of that female students, their numbers being 793 and
334 respectively. All students who participated in the investigation were studying math as one of their academic subjects at standard 9th level, their ages ranged between 15 and 17 years.

It should be mentioned that these students have been selected from 14 different secondary schools located in different districts of central U.P. Out of these, three are girls’ schools, five co-education and the rest are boys’ schools.

Again, these schools constitute different categories of management, some of them are privately managed and some by minority and some managed by government or semi-government agencies.

Also, the sample schools range from very good to poor in their performance. For instance, some English medium schools are running on the lines of public schools and has a very high reputation and is considered to be prestigious. Pupils in these schools pay high tuition fee and belong to well to do families with a high socio-cultural background. Some schools are, generally poor in quality, the pupils in these schools come from lower socio-economic strata of the society.
Table 3.2 Distribution of the main sample by school, gender, School type & medium of instruction

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Institution</th>
<th>No. of students</th>
<th>Male</th>
<th>Female</th>
<th>Type of school</th>
<th>Eng. Med.</th>
<th>Hindi Med.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Islamia Inter College</td>
<td>100</td>
<td>70</td>
<td>30</td>
<td>M.M.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Sunni Girls Inter College</td>
<td>65</td>
<td>65</td>
<td></td>
<td>M.M.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Karamat Girls Inter College</td>
<td>60</td>
<td>60</td>
<td></td>
<td>M.M.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Taleem Niswan Girls Inter College</td>
<td>70</td>
<td>70</td>
<td></td>
<td>M.M.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Jeevan Dhara Inter College</td>
<td>61</td>
<td>41</td>
<td>20</td>
<td>CBSE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>S.V.M. Inter College</td>
<td>60</td>
<td>50</td>
<td>10</td>
<td>CBSE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>GIC Barabanki</td>
<td>100</td>
<td>100</td>
<td></td>
<td>Govt.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>KVS Sitapur</td>
<td>37</td>
<td>14</td>
<td>23</td>
<td>KVS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>GHSS Sitapur</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>Govt.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Govt. Inter College Sitapur</td>
<td>100</td>
<td>100</td>
<td></td>
<td>Govt.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>KVS, Kanpur</td>
<td>108</td>
<td>78</td>
<td>30</td>
<td>KVS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Haleem Inter College, Kanpur</td>
<td>100</td>
<td>100</td>
<td></td>
<td>M.M.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Faizan Inter College, Kanpur</td>
<td>80</td>
<td>80</td>
<td></td>
<td>M.M.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>FPS, Faizabad</td>
<td>86</td>
<td>60</td>
<td>26</td>
<td>CBSE</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>1127</strong></td>
<td><strong>793</strong></td>
<td><strong>334</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.3 Data collected for the study:

The following base line data were collected for carrying out the present investigation:

1. Data used for development of math attitude scale.
2. Data used for development of achievement test.
3. Scores of the student related to personal factors.
4. Scores of the students related to familial factors.
5. Scores of the student related to institutional factors.
3.4 Tool used:

The tools employed for collection of the data mentioned above included the following -

1. Math Attitude scale (MAS). This attitude scale developed by investigator, was used to collect the data regarding attitude of the sample towards math.

2. Math Achievement test (MAT). This test was specially constructed and developed for the present study by the investigator.

3. A Personal and Familial Background Assessment Questionnaire. This questionnaire was prepared by investigator to collect the data regarding personal and familial factors.

4. School Information Questionnaire. This information sheet was also prepared by researcher to collect information about institutional factors.

Brief descriptions of these tools are given as:

3.4.1 Attitude towards math

This attitude scale consists of 22 statements of Likert type representing attitudes towards various aspects of math such as enjoyment of math, value of math, math anxiety, success in math, math as male domain, usefulness of math, confidence to learn & evaluation. The reliability of coefficient of the attitude scale is 0.90 as reported by the investigator and as calculated by split-half method. It is found to discriminate sufficiently between students of high attitude and those of low attitude. This scale appears to have high content validity and the method of selecting items supports this position. The range of scores on
this tool extends from 22 to 110 with the mean of 66. The summation of score earned by a student on all statements was taken as his attitude score. The total scores indicate favourableness or unfavourableness of the attitude of students towards math. The higher is the score the more favourable is the attitude towards math and lower is the score the more unfavourable is the attitude towards math of the students. A copy of the scale is given in appendix A-1.

3.4.2 Math achievement test

The achievement test in math for class IX students that is used in the present study was constructed by the investigator. This is a very comprehensive test based on 14 chapters of class VIII math text book (NCERT). The test consists of 60 items of multiple choice type representing achievement at various areas of math such as 21 items in arithmetic, 19 items in algebra and 06 items in geometry, 11 items in mensuration and 4 item in statistics. The total score on the test as a whole was used as a measure of achievement in math. All the items in the test were the easy items in the test were arranged in order of difficulty, the easy items being placed in the beginning and this was done to motivate the students. The difficulty values of items in the test between the range of .25 to .85 similarly, each item had a discriminating power greater than 0.30. The test was based on the latest syllabus prescribed by the directorate of education, U.P. & NCERT. This test had a fairly high content validity and its reliability is found to be 0.94. A copy of the scale is given in Appendix A-2.


3.4.3 A personal and familial background assessment questionnaire

The personal information sheet was prepared by the investigator. This sheet contains such questions requiring the subjects to give information on their parental educational and occupational background as well as on some economic facilities available at home, family size, parental involvement in tutoring their children, students' involvement in extra curricular activities and time spent on watching T.V. etc. A copy of the proforma is given in Appendix A-3.

3.4.4 School information questionnaire

In the school questionnaire, I sought information about number of students enrolled in schools and number of students present in the class room, medium of instruction, teachers' qualification, number of teachers, number of math teachers, teaching experience and physical facilities in the school. A copy of the questionnaire is given in Appendix A-4.

3.5 Methods of data collection:

In order to collect the systemic data, it was essential to approach subject personally and the investigator did the same. In this regard first of all, prior permission from the principals of the schools from which the data were collected was obtained and a schedule of administering the test was fixed with them. To seek cooperation of principals & teachers of these schools the investigator received introduction letter from his supervisor and chairman of the department of education; AMU, Aligarh. After contacting students, the investigator explained the objectives of the study to them. The respondents were assured that the information provided by them would be kept confidential. Then the investigator
distributed all the tests & information sheet among the students. They were also asked to go through the general instructions given on the top of the front page of the booklet form tests, before filling the given entries. Lastly, the students were asked to read the questions and statements carefully and requested to give their responses. Doubts and confusions were made clear by the researcher before moving to the next item. The investigator also gave full freedom to the student to ask the meaning of the words or sentences which are beyond their understanding, except in case of math achievement test. Moreover, there was not any kind of undue stress and control over the students at the time of completion of the tests. After completion, it was collected from the students before permitting them to leave the room, the booklets were carefully checked by the investigator whether all the items were answered or not. If any blanks were left the students were asked to complete the same before leaving the class.

3.5.1 Hurdles in data collection

Unfortunately, the data collection work was delayed due to many unforeseen difficulties. The main difficulties encountered were as follows:

   One of the space main hurdles that the investigator encountered during the data collection of students emanated from the lack of cooperation of teachers and principals. Many of the senior teachers did not allow the investigator to enter in the class room.

2. Holidays & Vacations.
Winter vacations, gazetted holidays, half-working days on
week ends in the local schools, short periods on Friday in
some schools, functions of the schools, inspection days etc
proved to be other obstacles in smooth collection of data.

3. Exams problems.
Moreover, various examinations such as terminal, monthly
and class tests also proved hurdles in the normal work of
data collection.

There was a great rush of B.Ed. trainers in almost every
school which, in turn, jeopardized the normal activities of
schools.

3.6 Statistical techniques Employed:
The analysis of the data was done by employing the following
statistical techniques which were chosen only after the investigator found
them to be most appropriate and compatible to the data. Each statistical
method is based upon its own specific assumptions regarding the nature
of the sample, its universe and research conditions. These factors are
considered in advance. Following statistical measures were used for
analysing the data-

1. Determinations of reliability and validity of attitude scale
   and achievement test scale in math using known
techniques.
2. Computation of means and standards deviations
3. Use of linear measure of correlation (Pearson Product
   moment coefficient correlation)
4. Use of the Newman - Keuls test on differences between treatment means.

5. Use of F-test (to see the significant difference between many means.

6. Use of the t-test for measuring the significance of the differences between means.

It may be relevant here to mention assumptions underlying the use of the product moment correlation and the test and how they satisfied before the use of these techniques.

Before \( r \) is computed the data is tested to see if two conditions exist. The first of these conditions is that we have linear regression. This means that our points on the scatter gram tend to fall along a straight line. The second condition that we should look for its homoscedasticity. By this we mean that the standard deviations of the arrays tend to be equal.

In the present study it was assumed that the data is linear. Consequently, product moment correlations were found out between total distributions of scores of the variables put into correlation.

When the analysis of t test is used, the following assumptions should be met:

1. The individuals in the various sub-groups should be selected on the basis of random sampling from normally distributed population.

2. The variance of the subgroups should be homogeneous.

3. The sample comprising the groups should be independent.
3.6.1 Formula used:

3.6.1.1 Pearson Coefficient Correlation (r):

Of the several mathematical methods of measuring correlation, the Karl Pearson's method, popularly known as Pearson's coefficient of correlation (r) is most widely used in practice. The formula for computing r is

\[ r = \frac{\sum xy}{\sqrt{\sum x^2 \cdot \sum y^2}} \]

where \( x \) and \( y \) stands for deviation of \( X \) and \( Y \) series of samples from their means \( \bar{X} \) and \( \bar{Y} \), i.e., \( x = (x - \bar{X}) \) and \( y = (y - \bar{Y}) \).

The value of the coefficient of correlation as obtained by the above formula shall always lie between \( \pm 1 \).

3.6.1.2 Calculation of t-value:

For testing difference between means of two samples, general definition of \( t \) is

\[ t = \frac{\bar{X}_1 - \bar{X}_2}{S_{DX}} \]

where \( \bar{X}_1 \) and \( \bar{X}_2 \) are two means of samples of size \( N_1 \) and \( N_2 \) and \( S_{DX} \) is the standard error of difference. The means \( \bar{X}_1 \) and \( \bar{X}_2 \) are given as

\[ \bar{X}_1 = \frac{\sum X_1}{N_1} \quad \text{and} \quad \bar{X}_2 = \frac{\sum X_2}{N_2}. \]

i) For homogeneous data

\[ S_{DX} = \sqrt{\frac{\sum x_1^2 + \sum x_2^2}{N_1 + N_2 - 2} \left( \frac{1}{N_1} + \frac{1}{N_2} \right)} \quad \text{(for pooled variance)} \]
Degree of freedom = \( N_1 + N_2 - 2 \)

ii) For non-homogeneous data

\[
S_{dx} = \sqrt{\frac{\sum x_i^2}{N_1(N_1-1)} + \frac{\sum x_i^2}{N_2(N_2-1)}}
\]

and Degree of freedom = \( \frac{S_{dx}^2}{\left( \frac{\sum x_i^2}{N_1(N_1-1)} \right)^\frac{1}{2}} + \frac{\sum x_i^2}{N_2(N_2-1)} - 2 \)

In the above relation

\[
\sum x_i^2 = \sum_{i=1}^{N_1} (x_i - \bar{x}_1)^2 \quad \text{and} \quad \sum x_i^2 = \sum_{i=1}^{N_2} (x_i - \bar{x}_2)^2
\]

3.6.1.3 F – Test:

When significance of the difference among several means is desired, F – Test is applied. Assume that we wish to study the effects of the \( r \) different experimental groups of size \( N \).

The F – Test is defined as

\[
F = \frac{\text{Variance between samples}}{\text{Variance within samples}}
\]

Following procedures (steps) are adopted to calculate the variance between and within samples. For simplicity we assume here \( r = 4 \) samples.
Step 1: Mean of each sample

<table>
<thead>
<tr>
<th>Sample I</th>
<th>Sample II</th>
<th>Sample III</th>
<th>Sample IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>A₁</td>
<td>B₁</td>
<td>C₁</td>
<td>D₁</td>
</tr>
<tr>
<td>A₂</td>
<td>B₂</td>
<td>C₂</td>
<td>D₂</td>
</tr>
<tr>
<td>A₃</td>
<td>B₃</td>
<td>C₃</td>
<td>D₃</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Aₙ</td>
<td>Bₙ</td>
<td>Cₙ</td>
<td>Dₙ</td>
</tr>
<tr>
<td>Total</td>
<td>ΣAᵣ</td>
<td>ΣBᵣ</td>
<td>ΣCᵣ</td>
</tr>
</tbody>
</table>

Mean of each sample

\[
\bar{A} = \frac{\sum Aᵣ}{N}, \quad \bar{B} = \frac{\sum Bᵣ}{N}, \quad \bar{C} = \frac{\sum Cᵣ}{N}, \quad \bar{D} = \frac{\sum Dᵣ}{N}
\]

Grand Mean

\[
\bar{X} = \frac{\left(\bar{A} + \bar{B} + \bar{C} + \bar{D}\right)}{r}
\]

Step 2: Sum of squares between the samples (SSBS)

<table>
<thead>
<tr>
<th>Sample I</th>
<th>Sample II</th>
<th>Sample III</th>
<th>Sample IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\bar{A} - \bar{X})²</td>
<td>(\bar{B} - \bar{X})²</td>
<td>(\bar{C} - \bar{X})²</td>
<td>(\bar{D} - \bar{X})²</td>
</tr>
<tr>
<td>a</td>
<td>b</td>
<td>c</td>
<td>d</td>
</tr>
<tr>
<td>a</td>
<td>b</td>
<td>c</td>
<td>d</td>
</tr>
<tr>
<td>a</td>
<td>b</td>
<td>c</td>
<td>d</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>aₙ</td>
<td>bₙ</td>
<td>cₙ</td>
<td>dₙ</td>
</tr>
<tr>
<td>Total</td>
<td>Na</td>
<td>Nb</td>
<td>Nc</td>
</tr>
</tbody>
</table>

Sum of squares between samples (SSBS) = N(a + b + c + d)

Mean sum of the squares of sample (Variance between samples)

\[
VBS = \frac{N(a + b + c + d)}{(r - 1)}
\]
Step 3: Total sum of squares within samples

<table>
<thead>
<tr>
<th>Sample I</th>
<th>Sample II</th>
<th>Sample III</th>
<th>Sample IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A - \overline{A})²</td>
<td>(B - \overline{B})²</td>
<td>(C - \overline{C})²</td>
<td>(D - \overline{D})²</td>
</tr>
<tr>
<td>a₁</td>
<td>b₁</td>
<td>c₁</td>
<td>d₁</td>
</tr>
<tr>
<td>a₂</td>
<td>b₂</td>
<td>c₂</td>
<td>d₂</td>
</tr>
<tr>
<td>a₃</td>
<td>b₃</td>
<td>c₃</td>
<td>d₃</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>aₙ</td>
<td>bₙ</td>
<td>cₙ</td>
<td>dₙ</td>
</tr>
</tbody>
</table>

\[
\text{Total} = \sum (A - \overline{A})^2 + \sum (B - \overline{B})^2 + \sum (C - \overline{C})^2 + \sum (D - \overline{D})^2
\]

Total sum of squares within the samples (SSWS)

\[
= \left[ \sum (A - \overline{A})^2 + \sum (B - \overline{B})^2 + \sum (C - \overline{C})^2 + \sum (D - \overline{D})^2 \right]
\]

Mean sum of squares within samples (Variance within samples)

\[
V_{\text{WS}} = \frac{SSWS}{(N-r)}
\]

All the results can be tabulated as follows:

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Sum of square</th>
<th>Degree of freedom</th>
<th>Variances</th>
</tr>
</thead>
</table>
| Between Samples     | Sum of squares between the samples (SSBS) | r - 1 | SSBS  
|                     |              |                  | r - 1     |
| Within Samples      | Total sum of squares within samples (SSWS) | N - r | SSWS  
|                     |              |                  | N - r     |
| Total               | SSBS + SSWS  | N - r - 1        |           |

\[
F = \left( \frac{SSBS}{r - 1} \right) \left( \frac{SSWS}{N - r} \right)
\]
3.7 Null hypotheses:

The starting point in all statistical tests is the statement of null hypothesis (Ho), which is a ‘no difference hypotheses’. In other words, null hypothesis states that there is no significant difference between the samples under study. It makes a judgment about whether the obtained differences between samples are due to some true differences or due to some chance errors. The null hypothesis is formulated for the express purpose of being rejected because it is rejected, the alternative hypothesis (H1), which is an operational statement of the investigators research hypothesis, is accepted. The tests of null hypothesis are generally called tests of significance, the outcome of which is stated in terms of probability figures or levels of significance.

If the difference between the experimental group and the control group is very small, the experimenter is likely to accept the null hypothesis, indicating the fact that the small difference between these two groups is due to sampling error or some other chance fluctuations. On the other hand, if the difference between the experimental group and the control group is too large, the experimenter is likely to refute or reject the null hypothesis, indicating the fact that the obtained differences are real differences between or among the samples under study.

3.7.1 Level of significance:

In statistical method, levels of significance is an unavoidable term and is used to know whether a difference is to be taken statistically significant or not and depends upon the probability that the given difference could have arisen “by chance” usually a difference is marked “significant” when the gap between the two sampled means points to or
signifies a real difference between the parameters of the population from which the samples were drawn. It must be kept in mind that the judgments concerning are never absolute, but on the contrary range over a scale of probability and our confidence increases as chances of wrong judgment decreases.

Investigators, experimenters and research workers have chosen several arbitrary standards for convenience that are called levels of significance of which 0.05 and 0.01 levels are most often used. The confidence with which an experimenter rejects or accepts a null hypothesis depends upon the level of significance adopted. When a t-value is 1.96 or more, we may reject the null hypothesis at 0.05 level of significance and when a t-value is 2.58 or more, we reject the null hypothesis at 0.01 level of significance. Further, the 0.01 level is more accurate than the 0.05 level.

If the null hypothesis is rejected at 0.05 level, it means that 5 times in 100 replications of the experiments, the null hypothesis is true and 95 times this hypothesis would be false. In other words, this suggests that a 95% probability exists that the obtained results are due to experimental treatment rather than due to some chance factors. The 0.01 level suggests that 99% probability exists that the obtained results are due to the experimental treatment and hence, once in 100 replications of the experiments, the null hypothesis would be true.

3.7.2 One-tailed and two-tailed test of significance:

Under the null hypotheses, difference between the obtained means \((M_1-M_2)\) may be either plus or minus and as often in one direction as in the other from the true (population) difference of zero.
One tailed test is a directional test, which indicates the direction of difference between the samples (control group and experimental group), under the study. When a hypothesis state that the mean of the experimental group is not higher/lower than the mean of the control group, then it is called a directional hypothesis, which indicates a direction of difference. In this case, we are concerned with only one end of the distribution. Putting it in terms of a normal curve, we are concerned with only one end of the curve. In this situation, we apply a one-tailed test. For this test at 0.05 level, the 5% area of rejection is either at the upper tail or at the lower tail of the curve and the t-value is ±1.64. For a one tailed test at 0.01 level, the t-value for rejection of the null hypothesis is ±2.33.

A two-tailed test is one in which the investigator is interested in evaluating the difference between the groups. The direction of difference is of no importance here. The null hypothesis states that the mean of the experimental group is equal to the mean of the control group, that is, there is no difference between the means of the experimental group and control group. In this case we show our concern with both tails of the distribution. For a two-tailed test at 0.05 level, the 5% area of rejection is divided equally between the upper and lower tails of the curve and the t-value is ±1.95. For this test at 0.01 level, the t-value is ±2.58.
Chapter - 4

Research Tools
The tools used for collection of data for this study have been briefly discussed in the foregoing chapter. Attitude towards math developed by the investigator to measure the attitude of secondary school students towards math. The achievement test in math also constructed by the investigator to measure the achievement in math of secondary school students. The present chapter is devoted to a discussion of the methods of their construction.

4.1 Math attitude scale:

Conventional wisdom and some research suggest that students with negative attitudes toward math have performance problems because of anxiety. Attitudinal research in the field of math has dealt almost exclusively with anxiety or enjoyment of subject matter, excluding other factors. One of the first instruments developed was the Dutton Scale (Dutton, 1954; Dutton and Blum, 1968), which measured feelings toward arithmetic. Undimensional scales were developed by Gladstone, Deal and Drevdhal (1960) and Aiken and Dreger (1961). Later Aiken (1974) constructed scales designed to measure enjoyment of math and the value of math. Multidimensional attitude scales were developed by Michaels and Forsyth (1977) and by Sandman (1980). Some researchers developed scales dealing exclusively with math anxiety. Examples of such scales are the Mathematics Anxiety Rating Scale (Richardson & Suinn, 1972). The Mathematics Anxiety Rating Scale - Revised (Plake & Parker, 1982) and the Mathematics Anxiety Questionnaire (Wigfield & Meece, 1988). The Fennema - Sherman Mathematics Attitude Scales were developed in 1976 and it has become one of the most popular instruments used in research over the last three decades. The Fennema-Sherman Mathematics Attitude
Research Tools

scales consist of a group of nine instruments such as (1) Attitude Toward Success in Mathematics scale (2) Mathematics as Male Domain Scale (3) and (4) Mother/Father Scale (5) Teacher Scale (6) Confidence in Learning Mathematics Scale (7) Mathematics Anxiety Scale (8) Effectance Motivation Scale in Mathematics and (9) Mathematics Usefulness Scale.

Ashcraft and Kirk (2001) describe the common belief because of long-term avoidance of math and their lesser mastery of the math that couldn't be avoided, high-math-anxiety and individuals are simply less competent at doing math (P. 224). The competence explanation is central to Fennema's model (Fennema, 1989), which explains math performance as merely an interaction of affect (attitudes and math anxiety) and behaviour during learning tasks. Ashcraft and Kirk regard this explanation as simplistic.

Fennema's theory is based on research with the Fennema-Sherman Mathematics Attitudes Scales, which has clearly been the most popular instrument in research about attitudes toward math (Fennema & Sherman, 1976). The instrument has 108 items and takes 45 minutes to complete. It purports to have nine scales but subsequent research has questioned the validity & reliability (Suinn & Edwards, 1982) and integrity of its scores (O'Neal, Ernest, Mclean & Templeton 1988).

Other researchers suggest that students may find math to be simply unappealing or socially unacceptable, although, they may actually have high aptitude. In any case, it is crucial that any investigation of attitudes be assessed with an instrument that has good technical characteristics if research conclusions are to be meaningful. The relationship of affect to course selection, performance, achievement and cognitive processes must be based firmly on a valid, reliable measure of attitudes. Attitude scales must withstand factor analysis that important
dimensions of attitudes and require a minimum amount of time for administration. Finding a need for a shorter instrument with a straightforward factor structure the Mathematics Attitude Scale (MAS) was developed for this research work.

4.1.1 Procedure

At a first step towards the construction of the Math attitude scale, 75-items expressive of attitude towards math were written after a careful study of related literature and discussion with several experienced math teachers. The draft form thus prepared was released for experts opinion who were requested to judge the worth of each statement against the following criteria:

- The statement should be in simple and understandable language.
- The statement should be clear and unambiguous semantically, so that it is interpreted uniformly by all respondents.
- The statement should not be double barreled; it should express one single idea or issue.
- The statement should be relevant, i.e. there should be congruence between the statement and the definition of the concept of MAS as accepted in the study.

As a result of experts comments some of the statements were modified and some omitted. The revised version of the initial MAS contained 40 items. For further elimination of some more items of the scale, scale discrimination technique developed by Edward and Kilpatrick (1948) was used. The scale discrimination technique eliminates the least discriminating items which other methods, including Likert's judging technique, fail to do. The revised version of the initial MAS contained 31
Statements. Instructions to the subjects required them to respond to each of the items on a 5-point scale, the response categories being strongly agree, agree, undecided, disagree and strongly disagree for construction of MAS, Likert's technique was preferred to Thurstonian technique because the former is simpler and less time consuming and does not involve judgments for scaling the statements. Moreover, Thurstonian approach lacks good indices of validity of items and requires weighting of responses on a priori basis and not on the basis of item analysis data. Several popular and widely used attitude scales have followed Likert's technique, Hall (1934), for example, used the method summated ratings (Likert's technique) in his survey of attitudes of employed and unemployed men because of its relative simplicity. Rundquist and Sletto (1936) used this same method in developing the attitude scales contained in the Minnesota Survey of opinions because according to them, it is less laborious than that developed by Thurstone.

4.1.2 Try Out

The initial form of MAS was administered to 150 students (75 males & 75 females) randomly sampled from six-secondary schools out of which two were girls, one was co-educational and rest were boys schools located in rural and urban areas of Lucknow district. These schools belong to different categories of management and range from good to poor in regard to standard of performance of their pupil. Thus, the sample selected for try out of the MAS constituted a cross-section of the secondary school students. After permission was obtained from the principals of the schools, the sheets were distributed to the students of these schools. From the approximately 170 students in the six schools, 150 completed sheets were received representing an 88% response rate.
4.1.3 Scoring

The scheme of scoring response categories involved differential weighting such that the response category, strongly agree was given a weight of 5, agree a weight of 4, undecided; a weight of 3, disagree, a weight of 2 and strongly disagree a weight of 1, in respect of responses pertaining to positive statements. The scoring is reversed for the negative worded items. The attitude score of a subject is the sum total of scores on all the twenty two items of the scale. Theoretically, the range of scores on this scale extended from 22 to 110. The higher the score the more positive attitude of students towards math. A specimen of MAS tool is given in Appendix A-1.

4.1.4 Item analysis

An item analysis to determine the discriminating power of each statement was completed using Pearson Product Moment Correlation Technique. The aim of the try out was to make the MAS homogeneous by checking consistency of each item with the total test and discarding all such items as were found inconsistent. To achieve this end, scores on each item of the subjects were correlated with total scores (table 4.1). The items found to have a correlation of 0.37 or less with the total test were discarded. Such items are 18 in number. To remove the effect of the eliminated item scores of the subjects on them were deducted from their total score and item total correlations again computed in respect of the remaining 22 items. Out of 22 items 11 were positive (1, 3, 4, 7, 8, 9, 10, 11, 12, 15, 19) and 11 were negative (2, 5, 6, 13, 14, 16, 17, 18, 20, 21, 22). The reiterative procedure increased the original coefficients such that none of the 22 items was found to have a correlation less than 0.41 with the total test (table 4.2). Statement numbers correspond to these given in final version of the MAS.
The instrument in its finished form consisted of 22 statements of the following types:

1- Mathematics is boring because it is very difficult to learn.
2- I am happier in mathematics class than in any other class
3- I really enjoy doing math.

Table 4.1 Item total correlations of the 40 items of the draft of MAS

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The asterisk (*) items were rejected
Table 4.2 Item total correlations of the 22 items of the draft of MAS

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4.1.5 Reliability

Reliability is the most fundamental quality which any measuring instrument should possess. In order to find as to what extent the MAS developed by the investigator possess this quality, split-half method was employed. A split-half reliability coefficient was found by correlating scores of the subjects on odd items of the form with their scores on even items. There are several ways of splitting the scores into two, each with some merits and some demerits but the most common method used by test constructors is odd-even method, specifically when the items are assumed to be homogenous, which is the case in the present
scale. The reliability was calculated by using the scores of 150 subjects on the 22 items of the final MAS test. The correlation coefficient thus, obtained was 0.91 which when correlated by Spearman-Brown Prophecy Formula increased to 0.96. Yet another formula used for estimating reliability was a simplified form of general Kuder-Rechardson Formula. The estimate of reliability by this formula yielded a coefficient of 0.93.

4.1.6 Validity

The major types of validity are content validity and construct validity. Content validity is based on a careful comparison of the items to the definition of the domain being measured (Allen & yen, 1979). Content validity of the items was ensured through rational logical analysis of the math teachers and experts in questionnaire construction. Correlation between total scores and item scores were also used for validity. This approach assumes that the total score is valid; thus the extent to which the item correlations with the total score is indicative of construct validity for the scale.

4.1.7 Usefulness

This study has identified a set of 22 items which cohere to produce a scale of Attitude towards math for use of students which operationalises the affective attitudinal domain independently of the behavioural and cognitive dimensions. It appears to be useful for teachers and research scholars. The students of psychology & education can also use it to study the development of attitude towards math. The data, supporting the reliability, homogeneity, content validity and construct validity of this scale commend the instrument for further use. Further, studies are now needed in order to test the usefulness of this scale in
specific research contexts. MAS seems to represent a promising measure of students attitude towards math.

4.2 **Math achievement test:**
Achievement tests generally measure the present proficiency, mastery ad understanding of general and specific areas of knowledge, largely, they are measures of instruction and learning. They are used to evaluate teachers effectiveness, method of teaching, the school standards and in making surveys of pupils performance. Thus, it enables us to know the progress of pupils in specific area of works or the whole performance in learning process of subjects for a particular period of time.

4.2.1 **Procedure**
Keeping in view the importance of analysis of subject in the construction of math achievement test, the investigator first reviewed the text books of math for classes VIII prescribed by NCERT and U.P. board. The subject matter included in these text books was analysed thoroughly and an outline of the content was prepared. It is presumed that students entering into any class have the concepts and mastery of the content learned in the previous class. So students of class IX are expected to have sufficient knowledge and understanding of the math they have studied in class VIII.

The investigator decided to construct multiple-choice objective type items because these types of items have several additional merits as compared to other types of objective questions. Multiple-choice type of items can be used to measure more complex outcomes like comprehension and application along with knowledge objective. Murry (1938) regarded multiple choice type as one of the best measure of test judgment that is available, Huwkes and Lindquist (1936) too considered
it definitely superior to other types of items for measuring educational objectives. Cronbach and Murwin (1950) observed that multiple choice item has deserved popularity as an aid in assessing achievement, ability and personality.

Actually, there is no hard and fast rule to govern the number of items to be constructed but the number of item, constructed for try-out had to be, because of necessity, larger than the number needed for the final test. Vaughn (1951) suggested that the number of item which should be constructed for try out is always considerably larger than the number needed for the finished test, while writing down the test items the investigator kept in mind the following suggestions given by Gronlund (1966)

- The stem of the item should be meaningful by itself and should present a definite problem.
- The item stem should include as much of the item as possible and should be free from irrelevant material.
- A negatively stated item stem should be used only when significant learning outcomes require it.
- All the alternatives should be grammatically consistent with the stem of the item.
- An item should contain only one correct or a clearly best answer.
- All distracters should be plausible.
- The relative length of the alternatives should not provide clue to the answer.
- The correct answer should appear in each of the alternative positions approximately and equal number of times but in random order.
- Use of special alternate such as none of the above" or 'all above' should be made sparingly.

The achievement test in math for class IX students that is used in the present study was constructed by the investigator. This is very comprehensive test based 14 chapters of class VIII math text book (NCERT). The test, at the initial stage consists of 100 items of multiple choice type, representing achievement at various units of math, such as 35 items in arithmetic, 30 items in algebra, 10 items in geometry, 15 items in mensuration and 10 items in statistics. The test was based on the latest syllabus prescribed by the NCERT and U.P. board.

The draft form thus prepared was released for experts opinion who were requested to judge the worth of each question against the following criteria.

- Appropriateness of content
- Accuracy of the scoring key
- Consistency of the text items
- Avoiding undesirable over lapping
- Accuracy of language

As a result of experts comments some of the questions were modified and some omitted. The revised version of the initial math achievement test contained 80 items. For further elimination of some more items of the test, scale discrimination technique developed by Edwards and Kilpatrick (1948) was used. The scale discrimination technique eliminates the least discriminating items which other methods, including Likert's judging technique, fail to do. The revised version of the initial MAT contained 70 questions.

4.2.2 Try out

The initial form of MAT was administered to 200 students (125 male 75 female) randomly sampled from six-secondary schools, out of
which two were girls, one was coeducational and rest were boys schools located in rural and urban areas of Lucknow district. These schools belong to different categories of management and range from good to poor in regard to standards of performance of their students. Thus, the sample selected for tryout of the MAT constituted a cross-section of secondary school students. After permission was obtained from the principals of the schools, the sheets were distributed to the students of these schools. From the approximately 250 students in the six schools, 200 completed sheets were received representing an 80% response rate.

4.2.3 Scoring

All the answer sheets were then scored with the help of the master scoring key. Each correct response was assigned one mark while the incorrect ones were assigned zero marks. When all the two hundred answer sheets were scored, they were arranged in descending order of scores for item analysis. The achievement score of a subject is the sum total of scores on all the 60 items of the test. Theoretically the range of scores on this scale extended from zero to 60. A specimen of MAT is given in Appendix A-2.

4.2.4 Item analysis

An item analysis to determine the discriminating power of each item was computed using Pearson product moment correlation technique. The aim of the try out was to make the MAT homogenous by checking consistency of each item with the total test and discarding all such items as were found inconsistent. To achieve this end, scores on each item of the subjects were correlated with total score (table 4.3). The items found to have a correlation of 0.34 or less with the total test were discarded such items are 10 in number. To remove the effect of the eliminated item
scores of the subjects on them were deducted from their total score and item total correlations again computed in respect of the remaining 60 items. Out of 60 items, 20 questions from arithmetic, 19 from algebra, 6 from geometry, 11 from mensuration and 4 from statistics. The reiterative procedure increased the original coefficients such that none of the 60 items was found to have a correlation less than 0.34 with the total test (table 4.4). The question numbers correspond to those given in final version of the MAT. The test in its finished form consisted of 60 items of multiple choices.
Table 4.3 Item total correlations of 70 items of the draft of MAT

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Table 4.4 Item total correlations of 60 items of the draft of MAT

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<td>8</td>
<td>.66</td>
<td>38</td>
<td>.54</td>
</tr>
<tr>
<td>9</td>
<td>.39</td>
<td>39</td>
<td>.41</td>
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<tr>
<td>10</td>
<td>.37</td>
<td>40</td>
<td>.39</td>
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<tr>
<td>11</td>
<td>.59</td>
<td>41</td>
<td>.36</td>
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<tr>
<td>12</td>
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<td>42</td>
<td>.54</td>
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<td>13</td>
<td>.38</td>
<td>43</td>
<td>.38</td>
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<td>14</td>
<td>.49</td>
<td>44</td>
<td>.47</td>
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<td>15</td>
<td>.66</td>
<td>45</td>
<td>.66</td>
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<tr>
<td>16</td>
<td>.45</td>
<td>46</td>
<td>.52</td>
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<tr>
<td>17</td>
<td>.48</td>
<td>47</td>
<td>.51</td>
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<tr>
<td>18</td>
<td>.41</td>
<td>48</td>
<td>.38</td>
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<tr>
<td>19</td>
<td>.45</td>
<td>49</td>
<td>.57</td>
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<tr>
<td>20</td>
<td>.55</td>
<td>50</td>
<td>.62</td>
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<tr>
<td>21</td>
<td>.56</td>
<td>51</td>
<td>.39</td>
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<tr>
<td>22</td>
<td>.35</td>
<td>52</td>
<td>.58</td>
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<tr>
<td>23</td>
<td>.48</td>
<td>53</td>
<td>.47</td>
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<td>24</td>
<td>.44</td>
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<td>25</td>
<td>.46</td>
<td>55</td>
<td>.49</td>
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<tr>
<td>26</td>
<td>.39</td>
<td>56</td>
<td>.49</td>
</tr>
<tr>
<td>27</td>
<td>.54</td>
<td>57</td>
<td>.64</td>
</tr>
<tr>
<td>28</td>
<td>.38</td>
<td>58</td>
<td>.38</td>
</tr>
<tr>
<td>29</td>
<td>.69</td>
<td>59</td>
<td>.66</td>
</tr>
<tr>
<td>30</td>
<td>.71</td>
<td>60</td>
<td>.37</td>
</tr>
</tbody>
</table>
4.2.5 Reliability

Reliability is the most fundamental quality which any measuring instrument should possess. In order to find as to what extent the MAT developed by the investigator possesses this quality, split half method was employed. A split-half reliability coefficient was found by correlating scores of the subjects on odd items of the form with their scores on even items. There are several ways of splitting the scores into two, each with some merits and some demerits, but the most common method used by test constructors is odd-even method, specifically when the items are assumed to be homogeneous, which is the case in the present case. The reliability was calculated by using the scores of 200 subjects on the 60 items of the final MAT test. The correlation coefficient thus, obtained was 0.89 which when corrected by Spearman-Brown prophecy formula increased to 0.94. Yet another formula used for estimating reliability was a simplified of general Kuder-Rechardsan formula. The estimate of reliability by this formula yielded a coefficient of correlation of 0.92.

4.2.6 Validity

The major types of validity are content validity and construct validity. Content validity is based on a careful comparison of the items to the definition of the domain being measured (Allen and Yen, 1979). Content validity of the items was ensured through rational logical analysis of the math teachers and experts in test construction. Correlation between total scores and item scores were also used for validity. This approach assumes that the total score is valid, thus the extent to which the item correlations with the total score is indicative of construct validity of the test.
Chapter 5

Presentation, Analysis and Interpretation of Data
PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

To bring the study to its successful completion, the huge mass of data collected were critically analysed and responded through textual discussions, tabular and graphical devices. Tables and figures were used to clear the significant relationship. They are so constructed that they are self-explanatory. Textual discussions may be used to point out generalization and significant interpretation. Tables and figures are simple and point out only one relationship.

The raw data was first organized in separate tables for each variable of the study. For computation of needed statistics and application of appropriate statistical tests, most of the data was analysed on SPSS. A part of the data was manually treated.

The present chapter is devoted to presentation, analysis and interpretation of the data as per the following scheme:

- Study of students’ achievement in math and their personal factors.
- Study of students' achievement in math and their familial factors.
- Study of students’ achievement in math and their institutional factors.

The objectives of the present study were to empirically test the assumptions regarding relationship between student achievement in math and their personal, familial and institutional factors. In order to test the hypotheses F and t-tests were employed to study the difference between the means of personal, familial and institutional factors. If the differences approached significant level, it would prove that personal, familial and institutional factors affect the math achievement of students.
5.1 Relationship between personal factors (gender, attitude, TV watching and sports activities) and math achievement of students.

The statistical method used in testing the hypotheses is the t-test for difference between mean of achievement scores of two groups using two tailed test. The mean (M), standard deviation (SD), degree of freedom (df) and t-value (significant difference between the two means) of the two groups are given in tables and figures. F-test is also applied where more than two groups involved in this study. F-test shows there were overall significant difference among the means, hence t-test was applied for further investigation. If F-test is found insignificant then there is no use of t-test for further investigation.

5.1.1 Relationship between gender difference and math achievement.

The total numbers of male and female students were 793 and 334 respectively as indicated by the table 5.1. Out of 60 scores, the mean achievement scores in math of male student is 20.24 and SD=8.94. In case of female students, the mean math achievement score is 20.42 and SD=10.70. The statistically calculated t-value is 0.26 which is not significant at 0.05 level with 1125 df. The result clearly indicates that there is no significant difference between mean math achievement score of male and female secondary school students. Both are equally good. Thus the first hypothesis stating that “Male and female students do not differ significantly on achievement in math” is accepted. The graphical presentation of mean achievement scores of both sexes is given in fig. 5.1
Table 5.1  Comparison of mean math achievement scores of male and female students

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>Mean score</th>
<th>SD</th>
<th>t</th>
<th>df</th>
<th>Sig./Not sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>793</td>
<td>20.24</td>
<td>8.94</td>
<td>0.26</td>
<td>1125</td>
<td>Not</td>
</tr>
<tr>
<td>Female</td>
<td>334</td>
<td>20.42</td>
<td>10.70</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 5.1 Gender wise graphical presentation of math achievement
5.1.2 Relationship between attitude toward math and achievement in math of students.

The total students were divided into three groups that is positive, average and negative on the basis of their attitude scores. The range of score defining average attitude is determined by ± 6 points to 66, the students whose scores were found above and below of this range were considered as positive and negative respectively. An examination of table 5.2 shows that out of total sample (1127) 280 were found as having positive attitude, 267 having negative and rest 580 having average attitude towards math. The table also shows that the percentages of positive, average and negative attitude of total sample were 24.84%, 51.45% and 23.69% respectively. Further, result shows that the percentages in respect of male and female students were 25.61, 52.50 and 22.10 and 23.45, 50.51 and 26.04 respectively. Graphically it is shown in figure 5.2. Thus, it is evident from this analysis that one fourth of the total sample have positive attitude towards math and also one fourth of the sample have negative attitude towards math and rest nearly half of the sample have average attitude towards math. The results of the analysis also makes it clear that male and female both have the same pattern as the total sample has and they do not differ in their attitude towards math.

The technique of analysis of variance was employed to find out the influence of students attitude towards math, which is categorized as positive, average and negative students on the basis of their attitude scores. The mean achievement scores of positive, average and negative attitude students were found to be 25.58, 16.60 and 16.26 respectively. When these means were examined by the analysis of variance, the F-ratio obtained in table 5.3 was found significant (F=78.56, P<0.01, df=2, 1124)

In this study F-test was found significant, hence t-test was applied for further investigation. When the data was analyzed to see
significant difference in math achievement among three groups of the students i.e. positive, average and negative, t-tests were employed. It is evident from the table 5.4 that number of students having positive, average and negative attitude towards math are 280, 580 and 267 respectively. The mean of the math achievement score of students having positive attitude is 25.58, SD=10.64, while the mean of math achievement score of student having average attitude is 16.60, SD=8.46, while the mean of math achievement score of students having negative attitude is 16.26, SD=7.77 respectively. The statistical method used in testing the major hypothesis was the t-test for the difference between the means of three groups. The t-values obtained by comprising each group mean achievement score with that of every other group show that all the 3 t's were found to be significant at 0.01 levels with df 858, 545 and 855 respectively. Thus, math achievement scores of positive attitude, differ from those of average and unfavourable groups. It becomes clear that the students have positive attitude have more achievement in math than the average and negative attitude groups. Student having average attitude have more achievement in math than the negative group.

The analyses do not confirm the prediction hypothesised in this study for the present sample. A relationship between students attitude and math achievement has been demonstrated by this findings. Hence, the second hypothesis stating that, "there is no significant difference between attitude towards math of students and achievement in math" was rejected at 0.01 level of confidence. The graphical presentation of math achievement score of three groups is given in figure 5.3.
Table 5.2 Percentage of students having positive, average and negative attitude towards math

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Group</th>
<th>Number of students in each group</th>
<th>Percentage of students in each group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1127</td>
<td>Positive</td>
<td>280</td>
<td>24.84</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Average</td>
<td>580</td>
<td>51.45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Negative</td>
<td>267</td>
<td>23.69</td>
</tr>
<tr>
<td>Male</td>
<td>793</td>
<td>Positive</td>
<td>202</td>
<td>25.61</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Average</td>
<td>417</td>
<td>52.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Negative</td>
<td>175</td>
<td>22.10</td>
</tr>
<tr>
<td>Female</td>
<td>374</td>
<td>Positive</td>
<td>78</td>
<td>23.45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Average</td>
<td>168</td>
<td>50.51</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Negative</td>
<td>87</td>
<td>26.04</td>
</tr>
</tbody>
</table>
Fig. 5.2 Distribution of students in each category on the basis of their attitude
Table 5.3 Summary of analysis of variance in respect to math achievement and math attitude of students

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>df</th>
<th>sum of squares</th>
<th>Mean square</th>
<th>F</th>
<th>Sig. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between group</td>
<td>2</td>
<td>12448.26</td>
<td>6224.13</td>
<td>78.56</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>within groups</td>
<td>1124</td>
<td>89048.76</td>
<td>79.22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1126</td>
<td>101497.02</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.4 Comparison of mean achievement score on the basis of students having positive, average and negative attitude towards math

<table>
<thead>
<tr>
<th>Math attitude</th>
<th>N</th>
<th>Mean ach. score</th>
<th>SD</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P</td>
</tr>
<tr>
<td>Positive(P)</td>
<td>280</td>
<td>25.58</td>
<td>10.64</td>
<td>x</td>
</tr>
<tr>
<td>Average(A)</td>
<td>580</td>
<td>16.60</td>
<td>8.46</td>
<td>8.23</td>
</tr>
<tr>
<td>Negative(N)</td>
<td>267</td>
<td>16.26</td>
<td>7.77</td>
<td>11.74</td>
</tr>
</tbody>
</table>

*Sig. at p<0.01 levels
Fig. 5.3 Graphical presentation of achievement for students having positive, average and negative attitude
5.1.3. Relationship between T.V. watching and math achievement of students.

The present study explores the time spent on television viewing of secondary school students and its impact upon their math achievement. The total sample was categorized into four groups of students on the basis of time spent on T.V. watching i.e. zero hour, less than one hour, 1 to 2 hours and more than 2 hours. The mean math scores of these groups were 17.77, 21.77, 20.68 and 19.19 respectively. The scores of these groups were put to analysis of variance. The results are contained in table 5.5. Analysis of variance of the mean scores of the four groups yielded F. value which is significant at 0.01 level, with df 3, 1123 as the obtained value F was 8.86. This implied that there is significant over all difference in the means of these groups. Hence, the t-test was applied for further investigation.

When t-test was applied to compare each mean with every other means significant difference obtained between the means group A and B, A and C, B and D (t=5.44; P<0.01, df=660, t=4.18; P<0.01, df=777 and t=2.53; P<0.05, df=446 respectively). A perusal of table 5.6 shows that the mean score of only group A, has a significant difference with mean scores of groups B and C, which indicates that the students with zero hour watching TV have less mean achievement scores than those watching TV less than 1 hour and 1 to 2 hours. Students watching TV less than 1 hour also differ from those watching TV more than 2 hours i.e. students watching TV less than 1 hour have more achievement in math than the students watching TV more than 2 hours. In all cases students watching TV less than 1 hour and 1 to 2 hours have more achievement scores than those watching TV zero hour and more than 2 hours. Hence, the third hypothesis static that “T.V. watching of the students is not significantly
related to achievement in math” is partially rejected at 0.05 and 0.01 levels of confidence. Graphical presentation is given in fig. 5.4.

Table 5.5 Summary of analysis of variance in respect to math achievement and T.V. watching

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>df</th>
<th>sum of squares</th>
<th>Mean square</th>
<th>F</th>
<th>Sig. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between group</td>
<td>3</td>
<td>2346.831</td>
<td>782.28</td>
<td>8.86</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>with in groups</td>
<td>1123</td>
<td>99150.18</td>
<td>88.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1126</td>
<td>101497.01</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.6 t-value obtained from comparison of mean achievement score of four groups of students formed on the basis of T.V. watching

<table>
<thead>
<tr>
<th>Group</th>
<th>T.V. watching</th>
<th>N</th>
<th>Mean ach. score</th>
<th>SD</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>A</td>
<td>Zero hour</td>
<td>321</td>
<td>17.77</td>
<td>7.66</td>
<td>x</td>
</tr>
<tr>
<td>B</td>
<td>Less than 1 hour</td>
<td>341</td>
<td>21.77</td>
<td>9.65</td>
<td>5.44</td>
</tr>
<tr>
<td>C</td>
<td>1 to 2 hours</td>
<td>458</td>
<td>20.68</td>
<td>10.03</td>
<td>4.18</td>
</tr>
<tr>
<td>D</td>
<td>more than 2 hours</td>
<td>107</td>
<td>19.19</td>
<td>9.02</td>
<td>1.40</td>
</tr>
</tbody>
</table>

*Sig. at p<0.05 level, Sig. at p<0.01 levels
Fig. 5.4  Graphical presentation of mean achievement of four groups of students
5.1.4 Relationship between sport activities and math achievement of students.

The analysis of variance was employed to find out the influence of sports activities of students on math achievement. The total sample were categorized into three groups i.e. never, sometimes and always on the basis of students participation in sports activities. The mean achievement scores of never, sometimes and always participation of students in sports activities were found to be 17.58, 20.13 and 21.57 respectively. The total sums of squares between and within means were computed. Analysis of variance of the math scores of the three group yielded F. value as 7.34 which is significant at 0.01 level with df=2, 1124. Table 5.7 shows that there is significant overall difference in the means of these groups. Hence, F-test was found significant therefore, t-test was applied for further investigations.

When t-test applied for further investigation, the mean scores, SD and t values are given in table 5.8. The mean scores in math achievement of the above three defined groups (never, sometimes and always) are 17.58, 20.13 and 21.57 respectively. From the trend it is quite clear that as the involvement of the students increases in the participation in activities, the achievement in math also increases accordingly. When t-test was applied to compare each mean with every other mean achievement scores, significant difference were obtained between all the three means. (t=2.97, P<0.01, df=808; t=4.27, P<0.01, df=420; and t=2.26; P<0.05, df=1020; respectively). Hence, the fourth hypothesis stating that “sports activities of the students do not influence the achievement in math” is rejected at 0.01 and 0.05 levels of confidence. The graphical presentation is given in fig. 5.5.
Table 5.7  Summary of analysis of variance in respect to math achievement and sport activities of students

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>df</th>
<th>sum of squares</th>
<th>Mean square</th>
<th>F</th>
<th>Sig. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between group</td>
<td>2</td>
<td>1309.29</td>
<td>654.64</td>
<td>7.34</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>with in groups</td>
<td>1124</td>
<td>100187.72</td>
<td>89.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1126</td>
<td>101497.01</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.8 Comparison of mean achievement scores in math of three groups of students formed on the basis of participation in sport activities

<table>
<thead>
<tr>
<th>Group</th>
<th>Sports</th>
<th>N</th>
<th>Mean ach. score</th>
<th>SD</th>
<th>t-value</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Never</td>
<td>105</td>
<td>17.58</td>
<td>7.93</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Some times</td>
<td>705</td>
<td>20.13</td>
<td>9.72</td>
<td>2.97</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Always</td>
<td>317</td>
<td>21.57</td>
<td>9.26</td>
<td>4.27</td>
<td>2.26</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

*Sig. at p<0.05 level and Sig. at p<0.01 levels
Fig. 5.5 Math achievement of three groups of student based on participation in sport activities
5.2 Relationship between familial factors (parental education, occupation, size of the family and parental assistance in solving math) and math achievement of students

5.2.1 Relationship between parental education and math achievement of children.

Parents play an important role in their children learning. Aside from being actively involved in their children education, parents also provide a home environment that can affect learning. Parents serve as a model for learning, determine the educational resource available in the home and hold particular attitudes and values towards education. Although, it is difficult to examine the home environment of each student, the parental education serve as an indicator of the values and resources with which parents create this environment.

For studying relationship between fathers education and their children achievement in math the data was categorized into three groups, i.e., illiterate, having received education upto class 12th, and degree levels and above, on the basis of their fathers education. The mean math scores of their children of these groups are 16.04, 17.55 and 27.11 respectively. The scores of these groups were put to analysis of variance. The results are given in table 5.9. Analyses of variance of the mean scores of the three groups give F-value as 164.96, which is significant at 0.01 level, with df =2, 1124. This implied that there is significant overall difference in the means of these three groups. Hence, t-test was applied for further investigation.

When t-test was applied for further investigation, the mean scores, SD and t-values are obtained and given in table 5.10. The mean achievement scores of children of illiterate fathers is 16.04, SD=6.99 and
in case of children of up to class 12\textsuperscript{th} fathers education, the mean achievement scores is 17.55, SD=7.99 and in case of children of degree level and above fathers education is 27.11, SD=9.40. The calculated t-values are 2.11, 13.49 and 16.05 respectively, which are significant at 0.05 and 0.01 levels of confidence with df 783, 458, 1007 respectively. From the trend it is quite clear that as the father’s education increases, the achievement in math score of their children also increases accordingly. The lowest mean scores in math is found of the children whose fathers are illiterate and on the other hand the highest scores in math achievement is found of the children whose fathers are highly educated. The graphical presentation is given in fig. 5.6.

For studying the relationship between mother’s education and their children achievement in math, three groups of mothers i.e. illiterate, up to class 12\textsuperscript{th}, degree level and above were formed on the basis of their education. The math achievement scores of children of these groups of mothers are 15.87, 19.55 and 27.12 respectively. The scores of these groups were put to analysis of variance and t-test. The results are contained in table 5.11 and 5.12 and graphical presentation is given in fig. 5.7.

Analysis of variance of the scores of the three groups yielded significant F value as 101.60 which is significant at 0.01 level with df=2, 1124. This implied that there is significant overall difference in the means of these groups. When t-test was applied to compare each mean with every other mean, significant difference was obtained in all the three groups and all t-values are found significant at 0.01 level of confidence with df 899, 461 and 888 respectively. From the trend it is quite clear that as the mother’s education increases the achievement in math of their children also increases accordingly. The lowest mean scores in math is found of the children whose mothers are illiterate and on the other hand
the highest math achievement score is found of the children whose mothers are highly educated. The children whose mother's education was upto 12th, is found in middle position in case of math achievement.

Hence, the fifth hypothesis stating that “parental education of the children is not significantly related to achievement in math” is rejected at 0.01 and 0.05 levels of confidence. The results indicate that parental education effects the math achievement of their children. Hence there is a positive relationship between the educational levels of the parents and their children performance in math.
Table 5.9 Summary of analysis of variance in respect to math achievement and father's education of children

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>df</th>
<th>sum of squares</th>
<th>Mean square</th>
<th>F</th>
<th>Sig. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between group</td>
<td>2</td>
<td>23031.69</td>
<td>11515.85</td>
<td>164.96</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>within groups</td>
<td>1124</td>
<td>78465.32</td>
<td>69.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1126</td>
<td>101497.01</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.10 Comparison of mean achievement scores in math on the basis of their father's education.

<table>
<thead>
<tr>
<th>Group</th>
<th>Father's education</th>
<th>N</th>
<th>Mean ach. score</th>
<th>SD</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>A</td>
<td>Illiterate</td>
<td>118</td>
<td>16.04</td>
<td>6.99</td>
<td>x</td>
</tr>
<tr>
<td>B</td>
<td>Up to class 12</td>
<td>667</td>
<td>17.55</td>
<td>7.99</td>
<td>2.11</td>
</tr>
<tr>
<td>C</td>
<td>Degree level and above</td>
<td>342</td>
<td>27.11</td>
<td>9.40</td>
<td>13.49</td>
</tr>
</tbody>
</table>

*Sig. at p<0.05 level and Sig. at p<0.01 levels
Fig. 5.6 Presentation of math achievement on the basis of their father's education
Table 5.11 Summary of analysis of variance in respect to math achievement and mothers education.

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>df</th>
<th>sum of squares</th>
<th>Mean square</th>
<th>F</th>
<th>Sig. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between group</td>
<td>2</td>
<td>15540.02</td>
<td>7770.01</td>
<td>101.60</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>within groups</td>
<td>1124</td>
<td>85956.99</td>
<td>76.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1126</td>
<td>101497.01</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.12 Comparison of mean achievement scores in math on the basis of their mothers education.

<table>
<thead>
<tr>
<th>Group</th>
<th>Mothers education</th>
<th>N</th>
<th>Mean ach. score</th>
<th>SD</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>A</td>
<td>Illiterate</td>
<td>237</td>
<td>15.87</td>
<td>7.43</td>
<td>x</td>
</tr>
<tr>
<td>B</td>
<td>Up to class 12</td>
<td>664</td>
<td>19.55</td>
<td>8.83</td>
<td>6.21</td>
</tr>
<tr>
<td>C</td>
<td>Degree level and above</td>
<td>226</td>
<td>27.12</td>
<td>9.72</td>
<td>13.94</td>
</tr>
</tbody>
</table>

*All t-value Sig. at p<0.01 level
Fig. 5.7  Presentation of math achievement on the basis of their mother's education
5.2.2 Relationship between parental occupation and math achievement of their children.

Parental occupation may influence student performance in various ways for example, occupation related to income may determine access to learning opportunities and resources and so play a role in learning outcomes. The education and types of skills associated with different occupations and modeled by parents may motivate students to develop their own skills in particular ways. Parental occupation may also influence how students perceive the value of math learning, their beliefs about the usefulness of math and the learning environment at home. If occupation is considered as an indicator of parental skill, it appears that students whose parents worked in occupation with greater skill requirements also performed better in math. However, the large overlap between groups also indicates that there are still large differences within occupational categories.

To find out the relationship between fathers occupation and achievement in math of their children, the total sample of the students was categorized into four groups on the basis of fathers occupation i.e. professionals, businessman, agriculturist and others. Analysis of variance was employed to determine the significance of differences in math achievement scores of the children of their four groups of fathers. The total sum of squares between and with in the means of the children were calculated. The F ratio came out to be 36.82 and found to be significant at 0.01 level for df=3, 1123. This means that there were significant difference in the means of math achievement of the children of professional, businessman, agriculturist and others (table 5.13).

A glance at the table 5.14 denotes that the mean achievement scores of children of professional, businessman, agriculturist and others fathers were 25.72, 23.14, 16.95 and 19.33 respectively. t-test was
applied to compare each mean with every other mean, significant difference were obtained between all the means. All the 6ts were found significant at 0.05 and 0.01 levels. The df of these six groups were 383, 391, 571, 554, 734 and 742 respectively. From the trend it is quite clear that children of professional groups have highest score in math than other three groups and on the other hand children of low occupational status (agriculturist) have lowest scores in math than other three groups. Children of businessman have more achievement in math than the children of others and agriculturist and less achievement than the professional groups. Children of others group have less achievement than professional and businessman and more than agriculturist groups. The tendency that becomes clear from the study that father’s occupation effects the achievement of their children in math. The graphical representation is given in fig. 5.8.
Table 5.13 Summary of analysis of variance in respect to math achievement and fathers’ occupation

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>df</th>
<th>sum of squares</th>
<th>Mean square</th>
<th>F</th>
<th>Sig. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between group</td>
<td>3</td>
<td>9090.41</td>
<td>3030.14</td>
<td>36.82</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>with in groups</td>
<td>1123</td>
<td>92406.60</td>
<td>82.28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1126</td>
<td>101497.01</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.14 Comparison of mean achievement scores in math on the basis of their fathers’ occupation.

<table>
<thead>
<tr>
<th>Group</th>
<th>Fathers occupation</th>
<th>N</th>
<th>Mean ach. score</th>
<th>SD</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>A</td>
<td>Professional</td>
<td>112</td>
<td>25.72</td>
<td>10.21</td>
<td>x</td>
</tr>
<tr>
<td>B</td>
<td>Businessman</td>
<td>273</td>
<td>23.14</td>
<td>10.18</td>
<td>2.25*</td>
</tr>
<tr>
<td>C</td>
<td>Agriculturist</td>
<td>281</td>
<td>16.95</td>
<td>6.71</td>
<td>8.40**</td>
</tr>
<tr>
<td>D</td>
<td>Others</td>
<td>461</td>
<td>19.33</td>
<td>9.33</td>
<td>6.03**</td>
</tr>
</tbody>
</table>

*Sig. at p<0.05 level and **Sig. at p<0.01 levels
Fig. 5.8  Presentation of math achievement on the basis of their father's occupation
For studying relationship of mothers occupation and achievement in math of their children, mothers were categorized into two groups i.e. housewife and working mothers. It is clear from table 5.16 that the numbers of children of housewife and working mothers were 1052 and 75 respectively. The mean achievement score of children of housewife mothers was 20.28, SD=9.29. In case of children of working mothers, the mean achievement score was 20.56, SD=11.98. The calculated t-value was 0.20 which was not found to be significant at 0.05 levels with 1025 df. This result clearly shows that there was no significant difference between the means achievement scores in math of children of housewife and working mothers. Graphical presentation is given in fig. 5.9.

Hence the sixth hypothesis stating that “parental occupation of the children is not significantly related to achievement in math” was partly accepted and partially rejected. Parental education and father’s occupation influence the math achievement of their children but mother’s occupation does not influence the math achievement of their children.
Table 5.16 Comparison of mean achievement scores in math between children of housewife and working mothers

<table>
<thead>
<tr>
<th>Mothers occupation</th>
<th>N</th>
<th>Mean achievement score</th>
<th>SD</th>
<th>t</th>
<th>df</th>
<th>Sig. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>House wives</td>
<td>1052</td>
<td>20.28</td>
<td>9.29</td>
<td>.20</td>
<td>1025</td>
<td>Not</td>
</tr>
<tr>
<td>Working</td>
<td>75</td>
<td>20.56</td>
<td>11.98</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 5.9 Graphical presentation of math achievement scores of children belonging to housewives and working mothers
5.2.3 Relationship between family size and math achievement.

The total sample has been divided into two groups on the basis of their family size i.e. small family (4 members) large size (more than 4 members). The number of students belongs to small size and large size were 210 and 917 respectively as indicated by the table 5.17. The mean achievement of students of small family is 23.40 and SD=10.41. In case of large family, the mean achievement score of the students is 19.58 ad SD=9.13. The graphical presentation of these mean scores is given in fig 5.10. The statistically calculated t is 5.32 which is significant at 0.01 level with 1125 df. The result clearly indicates that math achievement of students of small size of family have greater achievement than the students of large family size. The graphical presentation of these mean scores is given in fig. 5.10.

The analysis do not confirms the prediction hypothesised in this study for the present sample. A relationship between family size of the students and math achievement has been demonstrated by these findings. Hence the seventh hypothesis stating that “family size of the children is not significantly related to achievement in math” was rejected. There is relationship between family size and students’ achievement in math.
Table 5.17 Comparison of math achievement of students according to their family size

<table>
<thead>
<tr>
<th>Family size</th>
<th>N</th>
<th>Mean achievement score</th>
<th>SD</th>
<th>t</th>
<th>df</th>
<th>Sig. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>210</td>
<td>23.40</td>
<td>10.41</td>
<td>5.32</td>
<td></td>
<td>1125</td>
</tr>
<tr>
<td>Large</td>
<td>917</td>
<td>19.58</td>
<td>9.13</td>
<td></td>
<td></td>
<td>Sig at .01</td>
</tr>
</tbody>
</table>

Fig. 5.10 Graphical Presentation of math achievement according to small and large family size
5.2.4. Relationship between parental assistance in solving math problems and math achievement.

Data was categorized into three groups on the basis of parental assistance in problem solving at home of their children, viz. never, sometime and always. Analysis of variance was applied for studying relationship between math achievement of children and their parental assistance. The mean math achievement of children who have never get any assistance, sometimes and always assistance in problem solving by their parents were 17.58, 20.95 and 20.48 respectively. When these means were examined by the analysis of variance, the calculated value of F is 8.92, which is significant at 0.01 with 2, 1124 df. Table 5.18 shows that there were overall significant between the means hence t-test was applied for further investigation.

The perusal of table 5.19 shows that the number of children whose fathers never assist, sometimes assist and always assist in problem solving of their children were 176, 640 and 311 respectively. The mean and SD of these groups were 17.58, 7.87, 20.95, 9.81 and 20.48, 9.43 respectively. When t-test was applied to compare each mean with every other means math achievement score, significant difference was found between the mean of never and sometimes assistance \( (t=4.76, P<0.01) \) \( df=814 \) between the means of never and always assistance \( (t=3.63, P<0.05, df=485) \). But no significant difference was found between the mean achievement of student of sometimes and always assistance of their fathers. From the result it is quite clear that the lowest math score is found of the children whose father never assist at home and highest math achievement score is found of the children whose fathers either sometimes or always assist in problems solving at home. Also, there is no significant difference between the means of sometimes and always
assistance in problem solving of their fathers. The graphical presentation of mean achievement scores is given in fig. 5.11.

The analysis do not confirms the prediction hypothesised in this study for the present sample. A relationship between parental assistance in solving mathematical problems of their children and achievement in math has been demonstrated by these findings. Hence the 8th hypothesis stating that “parental assistance in problem solving does not influence the math achievement of their children” was rejected. There is relationship between parental help in solving the problems at home and the achievement in math of students.
Table 5.18 Summary of analysis of variance in respect to math achievement and parental assistance of children

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>df</th>
<th>sum of squares</th>
<th>Mean square</th>
<th>F</th>
<th>Sig. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between group</td>
<td>2</td>
<td>1585.88</td>
<td>792.94</td>
<td>8.92</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>with in groups</td>
<td>1124</td>
<td>99911.13</td>
<td>88.89</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1126</td>
<td>101497.01</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.19 Comparison of math achievement of children according to their parental assistance

<table>
<thead>
<tr>
<th>Group</th>
<th>Parental involvement</th>
<th>N</th>
<th>Mean ach. score</th>
<th>SD</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Never</td>
<td>176</td>
<td>17.58</td>
<td>7.87</td>
<td>x</td>
</tr>
<tr>
<td>B</td>
<td>Some times</td>
<td>640</td>
<td>20.95</td>
<td>9.81</td>
<td>4.76*</td>
</tr>
<tr>
<td>C</td>
<td>Always</td>
<td>311</td>
<td>20.48</td>
<td>9.43</td>
<td>3.63*</td>
</tr>
</tbody>
</table>

*Sig. at p<0.01 level
Fig. 5.11 Graphical Presentation of math achievement of children according to their parental assistance
5.3 Relationship between institutional factors (school type, class size and school resources) and math achievement of students.

5.3.1 Relationship between school type and math achievement.

To find out the influence of school types on math achievement of the students, the total sample was categorized into four groups on the basis of the management of the schools i.e. CBSE, Govt., KVS, Minority managed. Analysis of variance was employed to determine the significance of difference in math achievement scores of the students of the said four groups of schools. The total sums of squares between and within the means of the students were calculated and is given in table 5.20. The calculated value of F is 37.81 which is significant at 0.01 level with df 3, 1123. The result shows that there were overall significant difference between the means hence t-test was applied for further investigation.

Further support to this conclusion, it is also provided by a test of significance of difference between the mean math scores of the four types of schools as given in the table 5.21. The fig 5.12 shows the mean score of math achievement of students of four types of schools.

The statistical method used in testing the major hypothesis was the t-test for the difference between the means of four groups. The t-values obtained by comparing each group mean math score with that of every other groups show that all the ts are found to be significant. Further, the table 5.21 shows that t-value between A and B group is 16.31 which is found significant at 0.01 level with df=488. The t-value between A and C group is 8.51 which is significant at 0.01 level with df 327. The t-value between A and D group is 9.61 which is significant at 0.01 level with df 680. The t-value between B and C is 9.41 which is significant at
Table 5.20 Summary of analysis of variance in respect to math achievement and type of schools

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>df</th>
<th>sum of squares</th>
<th>Mean square</th>
<th>F</th>
<th>Sig. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>3</td>
<td>9494.41</td>
<td>3031.15</td>
<td>37.81</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>within groups</td>
<td>1123</td>
<td>92416.60</td>
<td>80.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1126</td>
<td>101911.01</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.21 Comparison of math achievement scores of students of four type of schools

<table>
<thead>
<tr>
<th>Group</th>
<th>School type</th>
<th>N</th>
<th>Mean ach. score</th>
<th>SD</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>A</td>
<td>CBSE</td>
<td>187</td>
<td>31.28</td>
<td>9.45</td>
<td>x</td>
</tr>
<tr>
<td>B</td>
<td>Govt. school</td>
<td>303</td>
<td>15.42</td>
<td>6.51</td>
<td>16.31**</td>
</tr>
<tr>
<td>C</td>
<td>KVS</td>
<td>142</td>
<td>25.49</td>
<td>7.87</td>
<td>8.51**</td>
</tr>
<tr>
<td>D</td>
<td>Minority managed</td>
<td>495</td>
<td>17.64</td>
<td>8.16</td>
<td>9.61**</td>
</tr>
</tbody>
</table>

*Sig. at p<0.05 level and **Sig. at p<0.01 levels
Fig. 5.12  Graphical Presentation of math achievement of students of different type of schools.
0.01 level with df 443. The calculated t-value between B and D is 2.51 which is significant at 0.05 level with 796 df. The calculated t-value between C and D is 5.89 which is significant at 0.01 level with df 635.

It is clear from the table that all the ts are significant at 0.01 levels except the t-value between govt. and minority school students is found significant at 0.05 level.

The result clearly shows that students of CBSE schools have highest math scores than the other three groups, then student of KVS have higher math scores than Govt. and minority schools students but lesser than the CBSE school students. Minority students have higher math score then Govt. and lesser than CBSE, KVS schools students.

These analyses do not confirm the prediction hypothesized in this study for the present sample. A relationship between math achievement scores of student and type of schools has been demonstrated by the findings. Hence the 9th hypothesis stating that “type of schools do not significantly related to achievement in math of students” were rejected.

5.3.2 Relationship between school resources and math achievement

The resources in schools were categorized as good and poor. It is clear that good resource schools have good building, play ground, furniture and other resources as compare to the poor resource schools. The mean achievement scores and SD of students of good and poor resource schools were 31.28, 9.46, and 17.64, 8.16 respectively. The statistically calculated t-value is 16.27 which is significant at 0.01 level with 717 df. Table 5.22 and Fig. 5.13 show that the mean score of students of good resource schools is found to be significantly higher than the mean score of students of poor resource schools. A relationship between math achievement scores of students and school resources has
been demonstrated by the findings. Hence, the 10\textsuperscript{th} hypotheses stating that “school resources do not significantly relate to achievement in math of students” were rejected.
Table 5.22  Comparison of math achievement scores of students on the basis of their school resources

<table>
<thead>
<tr>
<th>Resource group</th>
<th>No. of schools</th>
<th>No. of students</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>3</td>
<td>187</td>
<td>31.28</td>
<td>9.46</td>
<td>16.27</td>
<td>680</td>
<td>0.01</td>
</tr>
<tr>
<td>Poor</td>
<td>3</td>
<td>303</td>
<td>15.42</td>
<td>4.50</td>
<td>16.27</td>
<td>680</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Fig. 5.13  Graphical presentation of math achievement score and type of resources.
5.3.3 Relationship between class size and math achievement

As regards to class size i.e. number of students found in each class, the same was calculated in four types of schools and then compared with each other. These types of schools like CBSE, Govt., KVS and minority managed schools were found to differ on size of the class (table 5.23). The class size in CBSE schools was found to be 23 and in KVS schools size of the class 30 then this size was in Govt. schools, 40 as comparison to minority managed schools where it is very high i.e. 46. Further t-test was applied between the lowest and highest class size groups. Table 5.23 shows that there is significant difference in between these two groups. The mean scores makes it clear that the student of small size class achieved significantly higher score than the large class size (t=14.12, p<0.01, df=717). The graphical representation of means of these groups is given fig. 5.14. A relationship between math achievement scores of students and class size has been demonstrated by the findings. Hence the 11th hypothesis stating that “class size does not influence the achievement in math of students” was rejected.
Table 5.23 Comparison of math achievement scores of students on the basis of class size

<table>
<thead>
<tr>
<th>group</th>
<th>Class Size</th>
<th>No. of schools</th>
<th>No. of students N</th>
<th>Mean achievement score</th>
<th>SD</th>
<th>t</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smaller</td>
<td>1:23</td>
<td>3</td>
<td>187</td>
<td>31.28</td>
<td>9.35</td>
<td>9.05</td>
<td>680</td>
<td>0.01</td>
</tr>
<tr>
<td>Larger</td>
<td>1:46</td>
<td>6</td>
<td>495</td>
<td>17.64</td>
<td>8.05</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 5.14 According to class size graphical presentation of math achievement. High achievement is shown for smaller class size and low achievement for larger class size.
Table 5.24 Table of mean math achievement of the students and percentage of physical facilities available in various types of schools

<table>
<thead>
<tr>
<th>School Type</th>
<th>No. of students</th>
<th>Mean</th>
<th>SD</th>
<th>Minimum</th>
<th>Maximum</th>
<th>No. of Schools</th>
<th>Excellent</th>
<th>Satisfactory</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBSE</td>
<td>187</td>
<td>31.3</td>
<td>9.46</td>
<td>7</td>
<td>54</td>
<td>3</td>
<td>3</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Government School</td>
<td>303</td>
<td>15.4</td>
<td>4.51</td>
<td>2</td>
<td>30</td>
<td>3</td>
<td>00</td>
<td>00</td>
<td>1</td>
</tr>
<tr>
<td>KVS</td>
<td>142</td>
<td>25.7</td>
<td>9.13</td>
<td>13</td>
<td>91</td>
<td>2</td>
<td>2</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Minority Managed</td>
<td>495</td>
<td>17.6</td>
<td>8.16</td>
<td>1</td>
<td>46</td>
<td>6</td>
<td>00</td>
<td>00</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>1127</td>
<td>20.3</td>
<td>9.65</td>
<td>1</td>
<td>91</td>
<td>14</td>
<td>5</td>
<td>35.71</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 5.25 Percentage table of teachers and students ratio in various types of schools and mean math achievement of the students of respective schools

<table>
<thead>
<tr>
<th>School Type</th>
<th>No. of students</th>
<th>Mean</th>
<th>SD</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Teachers</th>
<th>Students</th>
<th>Teacher-Student Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>CBSE</td>
<td>187</td>
<td>31.3</td>
<td>9.46</td>
<td>7</td>
<td>54</td>
<td>111</td>
<td>18.8</td>
<td>2600</td>
</tr>
<tr>
<td>Government School</td>
<td>303</td>
<td>15.4</td>
<td>4.51</td>
<td>2</td>
<td>30</td>
<td>76</td>
<td>12.9</td>
<td>3035</td>
</tr>
<tr>
<td>KVS</td>
<td>142</td>
<td>25.7</td>
<td>9.13</td>
<td>13</td>
<td>91</td>
<td>105</td>
<td>17.8</td>
<td>3174</td>
</tr>
<tr>
<td>Minority Managed</td>
<td>495</td>
<td>17.6</td>
<td>8.16</td>
<td>1</td>
<td>46</td>
<td>298</td>
<td>50.5</td>
<td>13600</td>
</tr>
<tr>
<td>Total</td>
<td>1127</td>
<td>20.3</td>
<td>9.65</td>
<td>1</td>
<td>91</td>
<td>590</td>
<td>100</td>
<td>22409</td>
</tr>
</tbody>
</table>
Table 5.26 Table of teachers' qualification, teacher and students ratio, training of teachers and teaching experience and medium of instruction in respective schools.

<table>
<thead>
<tr>
<th>School Type</th>
<th>Teachers Qualification</th>
<th>Teacher Students Ratio</th>
<th>Training of Teachers</th>
<th>Teaching Experience</th>
<th>Medium of Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Graduate</td>
<td>Post Graduate</td>
<td>Physical Facility</td>
<td>Students</td>
<td>Teachers</td>
</tr>
<tr>
<td>CBSE</td>
<td>10</td>
<td>26</td>
<td>1</td>
<td>900</td>
<td>36</td>
</tr>
<tr>
<td>CBSE</td>
<td>4</td>
<td>31</td>
<td>1</td>
<td>700</td>
<td>35</td>
</tr>
<tr>
<td>CBSE</td>
<td>16</td>
<td>24</td>
<td>1</td>
<td>1000</td>
<td>40</td>
</tr>
<tr>
<td>Government School</td>
<td>10</td>
<td>40</td>
<td>2</td>
<td>1085</td>
<td>50</td>
</tr>
<tr>
<td>Government School</td>
<td>2</td>
<td>10</td>
<td>3</td>
<td>1000</td>
<td>12</td>
</tr>
<tr>
<td>Government School</td>
<td>2</td>
<td>12</td>
<td>3</td>
<td>950</td>
<td>14</td>
</tr>
<tr>
<td>KVS</td>
<td>2</td>
<td>28</td>
<td>1</td>
<td>774</td>
<td>30</td>
</tr>
<tr>
<td>KVS</td>
<td>15</td>
<td>60</td>
<td>1</td>
<td>2400</td>
<td>75</td>
</tr>
<tr>
<td>Minority Managed</td>
<td>5</td>
<td>60</td>
<td>3</td>
<td>2300</td>
<td>65</td>
</tr>
<tr>
<td>Minority Managed</td>
<td>4</td>
<td>56</td>
<td>3</td>
<td>2100</td>
<td>60</td>
</tr>
<tr>
<td>Minority Managed</td>
<td>0</td>
<td>23</td>
<td>3</td>
<td>2000</td>
<td>23</td>
</tr>
<tr>
<td>Minority Managed</td>
<td>10</td>
<td>80</td>
<td>2</td>
<td>3000</td>
<td>90</td>
</tr>
<tr>
<td>Minority Managed</td>
<td>1</td>
<td>33</td>
<td>2</td>
<td>2000</td>
<td>34</td>
</tr>
<tr>
<td>Minority Managed</td>
<td>3</td>
<td>23</td>
<td>3</td>
<td>2200</td>
<td>26</td>
</tr>
</tbody>
</table>
5.4 Discussion

The purpose of the present research was to determine the effects of personal, familial and institutional factors on academic achievement in math. These three variables were chosen for analysis because they are manipulable variables that have been identified as important influences on achievement in previous researches. Data from a large contemporary sample of high schools students were analyzed. F-test and t-test were used to determine the effects of these variables on academic achievement, while controlling for other relevant background influences.

The results of the analysis of data shows that the personal factors indices, gender, attitude, T.V. watching, sport activities, familial factors indices, parental education, occupation, family size, parental assistance and institutional factors indices, type of schools, school resources and class size, all had significant effect on math achievement scores in expected direction except gender and occupation of their mothers.

There were no significant differences in math achievement scores between boys and girls in the present study. The finding of this study is supported by Bronholt, Goodrow and Conney (1999), Ewers and Wood (1992); Skaalvik, (1990); Hilton and Berglund (1974). Awartani and Gray (1989) reported no significant differences between male and female students in math achievement. Ma (1995) studied a sample of high school seniors, based on algebra and geometry achievement. He found no gender differences in algebra but males significantly out performed females in geometry. Gender differences in achievement, especially math, have not been consistent and continue to be a much debated topic (Leder, 1992). Gender differences and the findings on gender differences in math achievement are not newly emerged fact. Long research history in this
area has demonstrated that male advantage in math achievement is a universal phenomenon (Beaton et al., 1996; Mullis et al., 2000). Researchers have shown that boys tend to score higher than girls on problems that include spatial representation, measurement, proportions as well as complex problems; whereas girls tend to score higher on computations, simple problems and graph reading (Beaton et al. 1999). According to some research findings, the gender gap in math achievement increases during middle school and becomes more disturbing at the upper secondary level (Fennema et al. 1989; Fennema, 1985). Friedman (1989) noted that until age 10 either no differences between genders or favouring girls are observed. He observed that 12th grade boys out performed girls, finally, other studies (Fox, Brody and Tobin, 1980) emphasized high math achievement being dominated by males. Leder (1992) has also reported the existence of gender differences in science subject in general as well as in math.

It is generally believed that student attitude towards a subject determines their success in that subject. In other words, favourable attitude result to good achievement in a subject. A student's constant failure in a school subject and math in particular can make him to believe that he can never do well on the subject thus accepting defeat. On the other hand, his successful experience can make him to develop a positive attitude towards learning the subject. This suggests that student's attitude towards math could be enhanced through effective teaching strategies. It has in fact been confirmed that effective teaching strategies can create positive attitude on the students towards school subjects (Bekee, 1987; Bealogun and Olarewaju, 1992; Akinsola 1994; Akale 1997, Alowojaiye 2000).

In general 24.84 percent students have favourable attitude towards math with 23.69 percent of students have negative attitude and
rest being termed as average. Generally, one fourth of the total sample have favourable attitude towards math. When the male and female students were further categorized into positive, average ad negative attitude, the trend of percentages in both the cases were found same as the total sample, Thus, it is evident from this analysis that the percentages of negative students though only 23 percent cannot be considered as flattering. The result of analysis also makes it clear that male and female students both have same trend as the total sample has.

It becomes quite clear that attitude towards math and achievement in it are positively related in this study, the higher the attitude of students towards math, higher the achievement in math of the students. Other studies lend support to this relationship. Ma (1997), observed that for trigonometry students, the attitudes that math was important and enjoyable were significantly associated with achievement in math. Jha (1992), Kumar (1980), Rech (1996) concluded that there is a positive and significant correlation between proper attitude towards math and achievement in it. The relationship between attitude towards math and ability in the subject has been found to be interactive and dynamic (Reyes, 1984). Increasing the level of math achievement may, in and of itself, actually result in more positive attitude. Pal (1989) observed that better attitude towards math ensures better achievement of the students in math at secondary level. Jayaraman (1989) found a significant relation between attitude towards learning math and achievement in math. Enemark and wise (1981) demonstrated that the attitudinal variables are significant indicators of math achievement. Steenkamp (1982) concluded that primary among the variables that determine AIM is ATM. These conclusions represent the view of a strong relationship between ATM and AIM, with correlations above 0.40 as supported by a number of researches (Kloosterman, 1991; Minato, 1983; Minato and Yanase, 1984;
Randhawa and Beamer, 1992). On the other hand, the research literature, however, has failed to provide consistent findings the relationship between attitude towards math and achievement in it. A number of researchers have demonstrated that the ATM-AIM correlation is quite low, ranging from zero to 0.25 in absolute value and they have concluded that the ATM-AIM relationship is weak and cannot be considered to be of practical significance (Abrego, 1966; Deighan 1971; Vachon, 1984; Wolf and Blixt, 1981). Robinson (1975) Concluded that ATM accounts for, at best, 15% of the variance in AIM, indicating that the relationship has no useful implications for educational practice. Thus, academic achievement in math is functionality dependent on attitude of the students towards learning math. It indicates that students with favourable attitude towards math may perform better in achievement-test in math as compared to the students with unfavourable attitude. In the light of the above discussion it is evident that attitude of the learners are the important correlates of their academic achievement.

The results presented support the idea that T.V. watching brings some benefits for students. The result shows that watching T.V. for less than 1 hr to 2 hrs per day has increasingly positive affects on achievement of students. The student have no TV in their homes and not watching TV and also students who have TV in their homes and viewing more the 2 hrs per day have increasingly negative affects on achievement. Our results suggest that more time and no time spent watching TV have negative affects on the math achievement of high schools students. In general the academic performance of both, the more TV students and no TV students was found worse. Hence amount of time spent on viewing TV is the important criteria for performance of the students. This study is supported by Williams et al (1982) who have seen a positive effect for up to 10 hr of viewing TV per week and with more viewing having increasingly
negative effects on achievement. Using a national sample from the high school and beyond longitudinal survey, Keith, et al (1986) found a small negative relationship between achievement and amount of TV watching. However, the negative effect of TV watching is not found consistently (Gortmker, Salter, Walker and Dietz, 1990); suggesting the relationship may be weak and therefore sensitive to methodological variations. Indeed, Comstock (1991) concluded that the evidence indicates a modest causal contribution by television to lesser achievement. The findings of this study, along with findings of other researches (Lemish and Rice, 1986) suggest that students benefit from TV viewing. Nevertheless, even for young children, viewing should be probably be limited to the existing estimates of optional viewing time such as up to 2hrs a day. Television viewing has traditionally been assumed to lesser achievement (Keith, Reimers, Fehrman, Pottebaum and Aubey, 1986). Simply, television viewing displaces academic activities and reduces the amount of time available for completing homework and other academic activities, thereby reducing achievement. Cooper et al (1999) observed a significant negative association between achievement and television viewing (mean viewing was 1-2 hr per night).

Knowledge of how students spend their non school hours can help predict their performance in school. The results presented support the idea that participating in sports activities brings some benefits for students. The students who participate in sport activities present significantly better academic achievement in math. Along these lines Cooper and Valentine (1999) concluded that, generally, more time in extracurricular activities and other structured groups and less time in jobs and television viewing were associated with higher test scores and class grades. Lipscomb (2007) reported that athletic participation is associated with a 2 percent increase in math and science test scores. Using a national
data base, Lisella and Serwatka (1996) found that, in almost 50 percent of the cases, male student participation in extracurricular activities was associated with lower achievement levels. For female students, the results were mixed. In 23 of the 90 different analysis run, females who participated in extracurricular activities were found to have higher achievement levels than nonparticipating females. Eide and Ronan (2001) point out that participation can be both consumption and an investment. Extracurricular involvement provides short run investment returns on outcomes that are positively correlated with labour market success. Given their popularity, society ought to have a better understanding of the benefits these activities afford. Positive associations between after school pursuits and achievement have been observed. Students involved in extracurricular activities such as sports also tend to have good attitudes, positive self concept and higher achievement than do students not involved in these activities (Holland and Andre 1987). Gerber's (1996) results indicated the school-related extracurricular activities (e.g. sports, band, honor society) and outside-school activities (e.g. hobby groups, scouting, and 4-H) were related positively to math achievement, Marsh (1992) had similar findings with small but statistically significant positive correlations between activities (e.g. sports, drama clubs, etc.) and achievement.

In this study parental education is found to be an important factor of children achievement in math. Children from highly educated parents are likely to have significantly higher math achievement scores as compared to the children of less educated parents. This study is supported by Mehra, 1980; Shukla, 1994, and Kadriye, Tanya and Vanessa (2005). The path model for both sexes showed that educated mothers had strong indirect effects on their children math achievement (Campbell and Beauetry 1998). Schools that had more resources, had higher average
parent education on average had higher mean advanced math achievement (Schreiber, 2002). Wilkins and Ma (2002) found that parent education and home resources had a positive relationship with students initial status in all three content areas (Statistics, algebra and geometry). Latest results from the Programme for International Student Assessment (2004) for student achievement in mathematics. PISA 2004 found that there is a positive relationship between the educational level of the parents and student performance in mathematics, there is also considerable overlap in the performance of students from different educational background. Hence family background was also related to student performance in math. Students whose parents were university educated performed higher than those whose parents had no more than a high school education.

It has been found that father's occupation was related to academic achievement in math. The nature of father's occupation is important for their children math achievement. Children of professional groups (Engineer, doctor, businessman, administrator, educationists etc.) fathers have got highest math score than all other groups. Children of businessman groups have got more math achievement than other two groups but less than the children of professional groups. The children of others group (Peon, Cooli, daily wagers etc.) have got more achievement than the children of agriculturist. The result shows clearly children of professional groups have got highest achievement and on the other hand children of agriculturist have got lowest achievement in math. This study suggests that the adult education programme if focussed on young mothers and fathers could be one approach to improve the students achievement in math.

It has been found that mother's occupation was not related to academic achievement in math. Children of housewife and working
mothers have been found equally good achievement in math. Although, this variable has been shown important variables in other studies (Bank and Finlayston, 1973). For example, Miline, Ginsburg, Myers and Rosenthal (1986) consistently found that mother's employment has a negative effect on both reading and mathematics achievement. In this regards Heyns and Catsambis (1986) pointed out that the effects of mother's employment are highly related to socioeconomic status of the families. In other words, they stated that by omitting students from lower socioeconomic background from the sample, also omit the positive effect of mother's employment on academic achievement.

The prevailing perception among educational researchers is that successful schools establish practices that foster greater communication with parents, encourage parents to assist children at home with their school work and planning and recruit parents to work as volunteers or participate in school governance. The argument is that these practices, in turn, lead to higher levels of schooling outcomes. The study of parental assistance in solving math problems at home of their children and their achievement in math revealed that parental assistance is related to the performance of their child in math, calls for parent involvement in schooling are not new. In the 1970s researchers such as Sarson (1971), Lightfoot (1978) and others suggested that parents should play a greater role in school governance because both they and their children are influenced by school decisions. Milne, Myers, Rosenthal and Ginsburg (1986), focused on issues such as the degree to which parents help with homework and the relationship between parent behaviours and student achievement. Astone and McLanahan (1991) suggested a positive association between parent involvement and student achievement. However, after analysing data from the longitudinal study of American youth, Madigan (1994) developed ten indicators of parent involvement
and found that parent help with homework and the provision of rewards for good grades sometimes had a negative effect on student achievement. Sui-chu and Williams (1996) found that of the four types of parent involvement they identified, student parent discussion in the home was the most powerful predictor of student academic achievement. Milne et al (1986) found negative effects of parents helping their children with homework and suggested that this finding was attributable to the fact that parents helped more if their children were not doing well at school. Muller (1993) too, reported negative effects for parents monitoring their eight graders homework or providing more after school supervision and significant negative effects for parents frequent contacts with school. The parental environment construct used by Fehrmann et al (1987), which consists of monitoring and supervision, was also positively related to children academic achievement. Further, the only type of parent involvement which was positively related to achievement was the home based type of parent involvement. For example the Coleman report (Coleman et al, 1966) as well as Mosteller ad Moynihan (1972) and Coleman (1975) reported that home based variables were at least as important as the school based variables in accounting for the total amount of student achievement variance. Researches are underway to explain the mechanism, how parental support has facilitating impact on academic success of the children, Parental support helps children to have a clear feedback about their progress. Consistent assistance benefits children to set and meet academic goals. However the type of parental support provided to the children should be appropriate to their age and grade levels.

This study also explored the relationships between students’ achievement in math and their size of the family. Children of smaller family have got significantly higher achievement in math than the
children of larger family, i.e. there is negative correlation between size of the family and achievement in math and as the family size increases the achievement decreases accordingly. For example, Zajonc (1976) has indicated that increased externality was associated with larger family size. Also, it has been reported that the number of children in the family had a significant negative effect on academic achievement (Iverson and Walberg, 1982; Hauser and Sewell, 1985). In all subjects, the scores of children living with single parents did not differ significantly from those of children living with two parents. Moreover, students living with no parents had lower reading and science scores than other students and this effect was mediated by lower family investment and involvement (Chiu and Ho, 2006). Small families typically have higher socioeconomic status, invest more in educational resources, spend more time with their children have larger social networks for their children to top on than larger families. The small families give their children more learning opportunities, exerted more presence, were more supportive, gave more help, provided more resources and hence raise their likelihood of higher academic achievement.

Now coming to different types of schools, another important variable of the study a definite relationship has been found to exist between this variable and math achievement of the students. Different type of schools, managed by different authority has different types of influences on performance of their students. In this way sample schools range from very good to poor in their performance. For instance CBSE schools are running on the lines of public schools and have very high reputations. In these study students of CBSE schools have got highest score than the students of other types of schools. The students of KVS also achieved significantly higher achievement math score than students of other types of schools but lesser than CBSE schools, students of
minority managed schools achieved significantly higher math score than the students of the Govt. Schools. In these way students of CBSE schools are high achiever and students of Govt. schools are low achiever in math. It is clear from the present studies that in India CBSE schools are privately managed and high status English medium schools where high socioeconomic background students are able to study. This shows high SES of school and high SES of students influence the achievement in math of the students. This is the reason that students of CBSE schools were found to be academically competent than those of all the students of other types of schools. Goldhabar (1996) found that private schools have no statistically significant advantage in the education on math and reading over public schools. Similarly a study conducted by White (1992) found that the difference in achievement in private and public schools is trivial in size and highly uncertain. The reasons of the variations in the results of the students conducted in west and in India may be because in the developed world both private and public schools operate with similar basic facilities available with them which is not true in case of India. The variations in the academic achievement of students in developed world is due to family background while as in developing world including India, school factors are largely responsible for variations in achievement levels of students. Heyneman and Loxely (1983), it was concluded that the factors determining learners achievement in developed world are different from that in developing world. It was found that home environment factors are more important and reliable factors in predicting learners' achievement in the developed world where as school factors continue to be important in predicting learners’ achievement in the developing world. 

When data was analysed to see the significant difference in math achievement scores on the basis of resources of the schools, it is found that students of good resources schools achieved significantly more
achievement score in math than the students of poor resources schools. It is clear that good resources schools have good building, play ground facilities and other such facilities as compare to poor resource schools. Overall, schools that had more resources, had higher average parent education and were larger (on the basis of full time teachers) on average had higher mean advanced mathematics achievement (Schreiber, 2002). In a review of 377 studies, Hanushek (1989) observed no consistent pattern between the amount of money spent (eg. teacher: student ratio or per pupil expenditure) and achievement, numerous studies in Hanushek's review had either significantly positive or negative results or non significant positive or negative results. He concluded that no strong or consistent relationship exists between school resources and student performance and that more resources would not yield performance gains for the students. Greenwald, Hedges and Laine (1996) performed a meta-analytic review of the studies from Hanushek's review and concluded that resources do have an influence on student achievement. Neither study focused on the impact of resources on student variables that could affect performance. On the other hand school facilities like building, separate classrooms, students reading places positively influence learner achievement (Arriagada 1983, Muammwenda, 1987, Urwick and Junaido, 1991, Varghese (1994), Jangira (1994), Govinda and Varghese (1993). Chubb and Moe who stated that money is not what makes some schools more effective than others. Better schools do not require lots of expensive equipment or huge new buildings or vast libraries. The performance problems of schools have little or nothing to do with inadequate funding and they can not be corrected by digging deep into the public purse. The results suggest that the conditions of schools which are not properly equipped with the necessary basic physical facilities and
educational facilities may be considered for improvement on priority basis.

This study also explored the relationships between students achievements in math and the size of the class. Students of smaller size class have got significantly higher achievement in math than the students of larger class i.e. there is negative correlation between size of the class and achievement in math. As the class size increases, accordingly the performance of the students are decreases. It has been found that class size was related to the achievement in math. This can be explained as, when the teacher pupil ratio is low (small class), the math performance is high and on the other hand, when the teacher pupil ratio is high (larger class) i.e., ratio of students with respect to teacher is high, the achievement in math of students is significantly low such findings corroborate with the results of Bastier Sigitha (1994), Padan (1988), Duraiswamy (1999) and Satvir and Saxena (1995). Angirist and Lavy (1999), Lee and Smith (1997), Monk (1987), Lee and Smith (1995), Jencks and Brown (1975), Krueger (1999). This study recommends that the appropriate pupil teacher ratio may be helpful in improving the math achievement.
Chapter 6

Summary, Findings, Conclusion, Areas for Further Research, Implications and Limitations of the Study
SUMMARY, FINDINGS, CONCLUSION, AREAS FOR FURTHER RESEARCH, IMPLICATIONS AND LIMITATIONS OF THE STUDY

6.1 Introduction:

Education is universally recognized as the most effective tool of bringing desirable change towards the social and economic betterment and cultural transformation of a society in the status of human being and the country as a whole. It broadens the mental horizon of the human being. In one hand, education develops the total personality of the individual and on the other hand education contributes to the growth and development of society. It is only through education that the moral ideas, spiritual values, the aspiration of the nation and its cultural heritage are transformed from one generation to another for preservation, purification and sublimation into higher culture.

An ideal system of education should enable individuals to know and develop to the fullest their physical and intellectual potentialities and promote their awareness of societal and human values so that they can develop a strong character and live better lives and function as responsible members of society.

Subjects like science and mathematics have found a significant place in the curricula of secondary school education. Mathematics has become a substantial and integral part of an organized society. In today's world no one can live without mathematics for a single day.

Achievement is the end product of all educational endeavours. The main concern of all education efforts is to see that the learner achieves. Quality control, quality assurance and total quality management of achievement have increasingly gained the attention of research in education. After exploring the concept of achievement in the cognitive,
affective and psychomotor aspects of human behaviour, researchers have probed further and have attempted to understand the 'blackbox' of achievement.

It has been indicated that a good number of variables such as personality characteristics of the learner, the socio-economic status, the institutional climate, resources, types of management, curriculum planning etc. mention a few exert influence on achievement in different degrees. These variables are generally referred to as correlates of achievement. Head of the institutions, Curriculum planners, teachers and others are involved in the task of helping students to achieve better would like to have knowledge of the extent of influence of these correlates on academic performance.

The investigator is more convinced that students personal, familial and institutional factors need no longer be neglected in research efforts directed towards a study of correlates of math achievement. The reason is obvious, conceptually, they appear to influence the math achievement but their influence has not yet been empirically studied adequately. This being the reason, the investigator undertook the present study which attempts to investigate relationship of their personal, familial and institutional factors of secondary school students with their math achievement.

6.2 Review of related literature:

The research in secondary education has mostly remained confined within the developed countries and especially in U.S.A. and U.K. till the nineteenth sixties. As regards to developing countries and particularly in India research in secondary education is not providing healthily sign. A bibliography of research brought out by NCERT (Dave,
P.N. and Murthy 1994) revealed that out of 1800 research abstracts only 54 studies were carried on secondary education.

The investigator scanned the available literature on the subject that pertained to the variables in question. The critical analysis of these studies gave rise to certain substantive inquires which needed to be highlighted and addressed to for the sake of further investigation.


The contrary findings of various studies maintained above inspired the investigator to conduct a study of influence of personal, familial and institutional factors on achievement of secondary school students in mathematics.

6.3 Statement of the problem:

The problem selected for study reads as follows:

"Influence of personal, familial and institutional factors on achievement of secondary school students in mathematics."

6.4 Objectives of the study:

The present study is aimed at achieving the following objectives.

1- To compare the mathematics achievement of secondary school students on gender basis.

2- To study the attitude of Boys and girls towards mathematics

3- To study the impact of television watching on achievement in math of secondary school students.

4- To study the impact of sports activities on math achievement of secondary school students.

5- To study the influence of parental education on math achievement of secondary school students.
6- To study the impact of parental occupation on math achievement of secondary school students.

7- To study the impact of parental assistance on math achievement of secondary school students.

8- To study the relationship between size of the family and math achievement of secondary school children.

9- To study the influence of school types on math achievement of secondary school students.

10- To study the impact of school resources on achievement of secondary school students in Mathematics.

11- The study the impact of class size math achievement of students.

6.5 Hypotheses:

The following hypotheses were established:

1- Male and female students do not differ significantly on achievement in math.

2- There is no significant difference between attitude towards math of students and achievement in math.

3- T.V. watching of the students is not significantly related to achievement in math.

4- Sports activities of the students do not influence the achievement in math.

5- Parental education of the children is not significantly related to achievement in math.

6- Parental occupation of the children is not significantly related to achievement in math.

7- Family size of the children is not significantly related to achievement in math.
8- Parental assistance in problem solving does not influence the math achievement of their children.

9- Type of schools do not significantly related to achievement in math of students.

10- School resources do not significantly related to achievement in math of students.

11- Class size does not influence the achievement in math of students.

6.6 Methodology:

The method adopted for the present study can be categorized as descriptive statistical is nature. Descriptive research describes and interprets what is, It is concerned with conditions or relationship that exist, practices that prevail, beliefs, points of view or attitudes that are held, processes that are going on, effects that are being felt or trend that are developing.

6.7 Size of the sample:

The total numbers of 1127 students were involved in the study of relationship between math achievement and their personal, familial and institutional factors. That the number of the male students is more than double of those female students, their numbers are 793 and 334 respectively. All students who participated in the investigation were studying math as one of their academic subject at standard 9th level, their ages ranged between 15 and 17 years.

It should be mentioned that these student have been selected from14 different secondary schools located in different districts of central U.P. Out of these three are girls schools, five co-education and the rest are boys schools.
Again, these schools constitute different categories of management, some of them are privately managed and some by minority and some managed by government or semi-government agencies.

Also, the sample schools range from very good to poor in their performance. For instance, some English medium schools are run on the lines of public schools and has a very high reputations and is considered to be prestigious. Pupils in these schools pay high tuitions fee and belong to well to do families with a high socio cultural background. Some schools are, generally poor in quality the pupils in these schools come from lower socio-economic strata of the society.

6.8 Data collected for the study:

The following base line data were collected for carrying out the present investigation:

1. Data used for development of math attitude scale.
2. Data used for development of achievement test.
3. Scores of the student related to personal factors.
4. Scores of the students related to familial factors.
5. Scores of the student related to institutional factors.

6.9 Tool used:

The tools employed for collection of the data mentioned above included the following -

1. Math Attitude scale (MAS).
2. Math Achievement test (MAT).
3. A Personal and Familial Background Assessment Questionnaire.
4. School Information Questionnaire.
6.10 **Statistical techniques employed:**

Following statistical measures were used for analysing the data's-

1. Determinations of reliability and validity of attitude scale and achievement test in math using known techniques.
2. Computation of means and standards deviations
3. Use of linear measure of correlation (Pearson Product moment coefficient correlation)
4. Use of the Newman - Keuls test on differences between treatment means.
5. Use of F test (to see the significant difference between many means.
6. Use of the t test for measuring the significant difference between means.

6.11 **Findings and Conclusions:**

1. There exists no significant difference between male and female students so far as their achievement in math is concerned. Both the groups are equally good or bad in the same measure.

2. The attitude towards math of students and achievement in it are positively correlated in this study. The higher the attitude of students towards math, the higher is the achievement in math.

3. The result presented support the idea that TV watching brings same benefits for students. The result shows that watching TV for 1 to 2 hours per day have increasingly positive effects on achievement in math of students. The
results further show that, students have no TV in their homes and not watching TV and also students who have TV in their homes and viewing more than 2 hours per day have increasingly negative affects on math achievement

4. Knowledge of how students spend their non-school hours can help in predicting their performance in school. This result presented support the idea that participating in sports activities brings some benefits for students. The result indicated that the school related activities (sports, drama and others) are related positively to math achievement.

5. In this study parental education is found to be an important factor of children achievement in math. Children from highly educated parents are likely to have significantly higher math achievement scores as compared to the children of less educated parents.

6. It has been found that father’s occupation is related to their children achievement in math. The nature of father’s occupation is important for their children’s math achievement. Children of professional group have got highest math score than all other groups. Children of businessman group have got more math achievement than other two groups but less than the professional group. The children of others group have got more achievement than the children of agriculturist group and on the other hand children of agriculturist group have got lowest math achievement scores. It has been found in this study that mother’s occupation was not related to academic achievement in math. Children of housewife and working
mothers have been found equally good or bad in math achievement.

7. The present study of parental assistance in solving math problems at home of their children and their achievement in math revealed that parental assistance is related to performance of their children in math.

8. This study also explained the relationships between students achievement and their family size. Children of smaller family size have got significantly higher achievement in math than the children of larger family size.

9. In this study the school type has emerged as a significant contributor in the determination of math achievement. The students of CBSE schools have got highest score than the students of other types of school. The students of KVS also achieved significantly higher achievement math score than students of other types of schools but lesser than CBSE students. Students of minority managed schools achieved significantly higher math score than the students of the government schools. In this way students of CBSE schools are highest achiever and students of government schools are lowest achiever in math.

10. The school resources and math achievement was positively correlated with each other. The better school resources lead towards higher scores in math achievement. In other words the level of math achievement was very high where school resources were superior.

11. Students of smaller class size have got significantly higher achievement in math than the students of larger class size.
There is negative correlation between size of the class and achievement in math. As the class size increases, accordingly the performance of the students decreases. In other words the low teacher-pupil ratio was positively associated with math achievement of students. The CBSE and KVS schools operated with comparatively low teacher-pupil ration than government and minority managed schools.

6.12 Area for further research

As the present project was in progress, certain problems closely related to the area of this work sprang up. These problems, if investigated, can go a long way in clarifying certain conceptual misgivings and confusions and increasing further in sight into the intricacies and complexities of students achievement in math besides adding more empirically explored knowledge to what is already known in this area and helping development of much needed theory of achievement. Some research problems in the area for the benefit of future researchers who may try to enrich the area with some scientific probing into it are listed below.

1. Relationship between gender difference and math achievement of muslim and non muslim students.
2. Attitude of students towards math on gender basis.
3. Relationship between type of T.V. programme watched and math achievement of students.
4. Effect of other after school activities on math achievement of students.
5. Relationship between parental income and math achievement of students.
6. Relationship between School size and math achievement of students.

7. Effect of teacher's quality on math achievement of students.

8. Relationship between computer experience and achievement in math.

9. Influence of teaching methods on students attitude towards math and achievement in it.

10. Students attitude towards computer and achievement in math.

11. Students anxiety and achievement in math.

12. Mathematics achievement and attitude towards mathematics with respect to learning style according to gender.

13. Student achievement in math in relation to their perceptions and family backgrounds.

14. Student achievement in math in relation to cognitive style and attitude towards math.

6.13 Implications:

This study and its finding highlighted some significant concerns in education. Several studies on Correlates of achievements come with conclusion that students personal, familial, institutional factors are determinants of math achievement. There are other studies also that give contrary results. But this study as many other studies gave mixed type of results. For example, on the whole it was found that school resources was positively correlated with math achievement. There are several major implications of this study. The implications can be classified in two broad categories. These are:

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6.13.1 Research Implications

On the serious considerations of the findings of this study and its implication, it logically generates certain hypothesis and research questions. It would be important and necessary to conduct a number of studies in order to come to conclusive decision about whether or not personal, familial and Institutional factors have impact on learning. Some of the major issues and research questions are recommended for further research.

1. This study was conducted in selected few districts of Central U.P. only. Sample was necessarily purposive this was warranted because of the nature of this study. Although one can be confident that finding would be generalizable to the all districts of central U.P. and to the other districts of the country, it would be necessary to carry out more studies in this format in several other districts in the state or other parts of the country. Such lateral replications would provide a stronger base for generalization.

2. It is also necessary to conduct studies at other class levels particularly at 10th and 12th classes where pressure for performance is significantly high. Together with the lateral replications this vertical replication would provide for larger base for testing the hypothesis on personal familial and Institutional factors.

3. In this study the expenditure were centered round only on institutional expenditures. It has not taken into consideration the household expenditure on the education. So, there is need to conduct a study that will extend the
dimension of expenditure to include the household expenditures too.

4. In this study though major portion of syllabus was made the base for the construction of achievement testes but a limited portion was dropped on the grounds, peculiar to turbulent situations in central U.P.. There is a cope for further studies taking the whole course content into consideration.

5. Research is needed to examine the dimensions of school resources too. School resources as operationally defined is this study can be limited or expanded to new dimensions in the ever changing social set up taking into consideration the latest technologies and the use of electronic media in education Every body is concerned about the quality in education, so there is ample scope on this area of research.

6. Economic (Parent education and occupation as an indicator of financial resources) disparities exist among secondary school students obviously, more work still needs to be completed to eradicate the disparity.

7. A important observation is that attitudes toward mathematics did not have a strong association with achievement in some school, which indicates that there my be school or teacher factors that reduce the impact of a poor attitude.

8. An important result for future inquiry for researchers is that factors were observed to very from school to school.

9. One area gram that needs research is the amount of time and the type or programme watched, In previous research and in this study, they type of programmes the students are
watching was not known and differential viewing preference may expose different associations with achievement.

10. Finally in this study, I simultaneously examined achievement as a composite of several factors—both school and student levels. Schools are complex systems, and achievement should be examined as a system.

6.13.2 Management implications

The actual observations and responses of teachers, Headmasters and students and the responses to the questionnaires indicated that in all the sectors education there is need of gradation and minimum management inputs into the system are imperative like.

1. The manpower facilities are inadequate in terms of requirement, though the number may be more or sufficient but the dearth of math and science teachers is a common phenomena in public schools which needs a special intervention. There is no permanent teaching staff available in private schools and teachers in this sector are comparatively less qualified and less paid. The credit of comparatively better achievement levels of students in private sector goes to parents who take the education of their children very serious.

2. The lacks of infrastructural facilities are great hurdle in running the school smoothly. This largely affects the capacity of school to retain a child fairly for a good period of time in public schools. The lack of furniture and furnishing was a common problem in public schools.
3. The monitoring on the services a school offers to children is negligible at secondary stage of education. The classroom activities are not monitored by those who are responsible for the job especially in public sector schools. The lack of accountability on part of teachers was also noticed by the investigator. All these short communing need to be taken seriously.

4. The lack of parental seriously and support for the education of their children was observed by the investigator especially in case of public school students.

6.14 Limitations:

It is not possible in a single research study to cover every aspect of variables associated with the problem under investigation. Although, the problem is very natural and is prevalent everywhere yet due to shortage of time and resources all the aspects variables could not be covered and the study is limited in several ways. It had to be determined in terms of population covered, sample selected, scope of variables studied, and the scope of generalizability of finding and so on.

1. The study was conducted on the students of few districts of central U.P. only. One can not generalize the findings of this study to all the institutions of India due to number of differences in their conditions and circumstances.

2. The number of students included in the sample was limited to 1127.

3. The study was limited to class 9th only due to limitation of time and resources.
4. The study can be conducted taking different variables which may contribute math achievement but only selected personal, familial and institutional variables have been taken into consideration.

5. The results that have been reported reflect merely what students are like have and now. The finding may be quite different at another time or in other cultural setting.

6. It is desirable that the researcher reaches first hand or original sources for the study, but as access to some material was not possible materials taken from available secondary sources has been used.

7. Collecting of data in two siting may be one more delimitation as a number of students are present only in one of the two sessions. Through a third visit is made to cover such students, some drop outs still remain beyond reach of the investigator and have been dropped from the study.
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Appendices
<table>
<thead>
<tr>
<th>Statements</th>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Given fresh opportunity to choose subject, I will choose mathematics.</td>
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<td>2. Mathematics is boring because it is very difficult to learn.</td>
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<td>3. Mathematics provides opportunities for satisfaction of my abilities</td>
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<td>and capabilities.</td>
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<tr>
<td>4. I am happier in mathematics class than in any other class.</td>
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<td>5. It is like a headache for me to do maths assignments at home.</td>
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<td>6. I am always under stress in a mathematics class</td>
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<td>7. I advise my friends to opt maths as a subject at XI class.</td>
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<tr>
<td>8. I would like to continue maths as one of my subjects in higher</td>
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<tr>
<td>education.</td>
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<td>9. I really enjoy doing maths.</td>
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<td>10. Mathematics is the only subject that helps to develop concentration</td>
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<td>11. I feel a special kind of pleasure in solving a mathematical problem.</td>
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<td>12. Teaching of mathematics at the school level should be made compulsory</td>
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<td>13. I am always under stress in a mathematics class</td>
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<tr>
<td>14. Solving mathematical problem is boring for me</td>
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<td>15. People who have knowledge about mathematics, do their work effectively</td>
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<td>16. If choice is given, nobody would study mathematics.</td>
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<tr>
<td>17. Mathematics is a dull subject and it requires a lot of efforts and</td>
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<td>also is of no use.</td>
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<td>18. Mathematics should not be a compulsory subject but an optional one.</td>
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<tr>
<td>19. For me it is always pleasant to solve mathematical problem.</td>
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<td>20. Life can run smooth without the knowledge of mathematics</td>
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<tr>
<td>21. I do not like mathematics because it takes more time</td>
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<tr>
<td>22. Tests should not be held in every month for mathematics</td>
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MATHEMATICS ACHIEVEMENT TEST
गणित उपलब्धि परीक्षण
CLASS IX (कक्षा 9)

Time- 2 Periods

This test is given to you to assess your achievement in mathematics you have studied so far. The performance in this test will not effect your result in final examination. The marks you get in test will not be shown in your report card. So, feel free to answer as you understand the question.

The questions are very easy. Each question in followed by four answer only one answer in correct. You have to show this answer as given below.

For example:

Q. (a-b)^2 is equal to
   a) a^2-2ab+b^2,
   b) a^2+2ab+b^2,
   c) (a-b)(a+b),
   d) None of above

Answer Key

Q. A B C D
   √   ☐   ☐   ☐

I hope you will enjoy this test. Go ahead and answer as many question as you can.

Instructions: Each question is followed by four choices numbers as A, B, C, and D. Out of which One choice is correct. Select choice you consider correct and put a tick mark (√) in box provided in the answer sheet.
(1) Evaluate $(601)^3$ using formula
(a) $271081801$ (b) $217081801$ (c) $217091801$ (d) $271088100$

(2) The cube root of $91125$ is
(a) $25$ (b) $45$ (c) $55$ (d) $65$

(3) The players of Class IX Cricket team of a school made $15, 20, 3, 0, 50, 16, 35, 61, 20, 5, 6$ runs, their average score is:
(a) $20$ (b) $21$ (c) $15$ (d) $35$

(4) The formula to calculate simple interest is given by (where $P, R, T$ have their usual meaning)
(a) $SI = PR^2 / 100$ (b) $SI = PT / 100$ (c) $SI = P(R/T) / 100$ (d) None

(5) Amount can be calculated using the formula where $A, P, R, T$ and $I$ have their usual meaning -
(a) $A = P + R$ (b) $A = T + P$ (c) $A = P + I$ (d) $A = P - I$

(6) Rahim lent Rs. 500 to his friend for 2 years at the rate of 20% per annum compound interest the interest, Rahim will get after 2 years will be
(a) Rs. 210 (b) Rs. 220 (c) Rs. 230 (d) Rs. 240

(7) The smallest number by which the number $243$ must be multiplied to make it a perfect cube is
(a) $9$ (b) $3$ (c) $2$ (d) None

(8) To solve an equation in one variable means to find out the value of
(a) Known (b) Unknown (c) Right hand side (d) Left hand side

(9) $P(Q + R)$ is equal to
(a) $PQ + R$ (b) $P + QR$ (c) $PQ + PR$ (d) $PQR$

(10) If $(5x-7)/3x=2$ then the solution of this equation is
(a) $x = -35/2$ (b) $x = 35/2$ (c) $x = -7$ (d) $x = 7$

(11) The least number of 4 digit which is a perfect square is
(a) $1025$ (b) $1024$ (c) $1000$ (d) None

(12) The product of $(x+3y)(x^2-3xy+9y^2)$ is
(a) $x^3 + 27y^3$ (b) $x^3 - 12y^3$ (c) $x^3 + 27y^3$ (d) None

(13) Degree of the polynomial $x^5 + 5x^2 + 2x - 3$ is
(a) $5$ (b) $3$ (c) $2$ (d) $1$

(14) In $2^3$ the number 5 is called?
(a) Base (b) Exponent (c) Coefficient (d) Variable
(a) $1025$ (b) $1024$ (c) $1000$ (d) None

III
(15) \((1^2 + 2^2 + 3^2)^{\frac{3}{2}}\) is equal to
\[\frac{1}{(1^2 + 2^2 + 3^2)^{\frac{3}{2}}}\]
(a) 7776 (b) 7776 (c) 6667 (d) 6667

(16) The magnitude of the region occupied by a solid in space is called its
(a) Area (b) volume (c) length (d) None

(17) The ratio of radii of two circles are in the ration 2:3 the ratio of their area is
(a) 2:1 (b) 4:3 (c) 2:9 (d) None

(18) If \(x^2 + 3x + 2\) is divided by \((x+1)\) then the quotient is:
(a) \(x + 3\) (b) \(x + 2\) (c) \((x+1)\) (d) \(x - 2\)

(19) The cube of the number 0.1 is
(a) 0.1 (b) 0.01 (c) 0.001 (d) 0.0001

(20) In a week, the daily rainfall (in mm) has been recorded as follows: 3, 4, 0, 1, 2, 3, 1 the mean of the rainfall in the week is
(a) 1 mm (b) 7/3 mm (c) 2 mm (d) 13/7 mm

(21) If the arithmetic mean of 7, 5, 13, \(x\) and 9 is equal to 10 then \(x\) equals:
(a) 16 (b) 14 (c) 6 (d) 10

(22) The total surface area of a circular cylinder with radius 3.5 dm and height 10 dm is
(a) 210 dm\(^2\) (b) 297 dm\(^2\) (c) 248.5 dm\(^2\) (d) None

(23) If \(S_1\) and \(S_2\) are the surface area of a right circular cylinder & cone having same radius of the base & height, then the correct statement is
(a) \(S_1 = 2S_2\) (b) \(2S_1 = S_2\) (c) \(S_1 > S_2\) (d) \(S_2 = S_1\)

(24) Total surface area of a cone is equal to
(a) (Lateral surface) \(x\) (base area)
(b) (lateral surface area + 2 \(x\) (base area)
(c) 2 (lateral surface area + base area)
(d) (lateral surface area + base area

(25) If the height of cone is 15 cm, and the area of its base is 314 cm\(^2\) then its volume is
(a) 1560 cm\(^3\) (b) 4710 cm\(^3\) (c) 1670 cm\(^3\) (d) 1570 cm\(^3\)

(26) If the radius of the base of a cone is doubled, its volume becomes
(a) 2 times (b) 3 times (c) 4 times (d) 8 times

(27) If the height of a cone is doubled then its volume becomes
(a) 8 times (b) 4 times (c) 3 times (d) 2 times

(28) \((2-y)/(y+7) = 3/5\) then \(y\) is equal
(a) -11/8 (b) -17/8 (c) 8/11 (d) 9/11
(29) If a car is traveling at an average speed of 56 km/hr then the distance traveled in 45 minutes times is:

(a) 43 km  
(b) 45 km  
(c) 44 km  
(d) 42 km

(30) The least number should be added to sum of squares of 9 and 10 to make it a perfect square is:

(a) 14  
(b) 15  
(c) 13  
(d) 225

(31) The smallest number by which 180 must be multiplied so that it becomes a perfect square is:

(a) 3  
(b) 2  
(c) 7  
(d) 5

(32) The factors of $a^2 - 2a + 1$ are:

(a) $(a-1)^2$  
(b) $(a-1)$ and $(a+1)$  
(c) $(a-1)$ and $(a+1)$  
(d) $(a-1)$ and 1

(33) The compound interest on a principal of Rs. 3000 at the rate of 5% per annum for 2 years is:

(a) Rs. 307.50  
(b) Rs. 105  
(c) Rs. 207.50  
(d) Rs. 249.75

(34) The compound interest that Gokul Chand will get by investing Rs. 1000 for 3 years at the rate of 10% per annum compound annually is:

(a) Rs. 331  
(b) Rs. 105  
(c) Rs. 311  
(d) Rs. 431

(35) If $x$, $y$ be any two rational numbers and $m$ be any integer then $x^m \times y^m$:

(a) $(a-1)$ and $(a-1)$  
(b) $(a-1)$ and $(a+1)$  
(c) $(a-1)$ and $(a+1)$  
(d) $(a-1)$ and 1

(36) In a cycle quadrilateral the sum of each pair of opposite angles is:

(a) 90°  
(b) 360°  
(c) 180°  
(d) 45°

(37) A quadrilateral is called cyclic if its all vertices is lie:

(a) On the circle  
(b) in the circle  
(c) outside the circle  
(d) and b both

(38) The radius of a circle is 5 cm. Its circumference (in cm) lies between:

(a) 15 and 16  
(b) 20 and 21  
(c) 31 and 32  
(d) 39 and 40

(39) If a side of an equilateral triangle is 12 cm, then the area of the triangle is:

(a) $36 \sqrt{3}$  
(b) $36 \sqrt{3}$  
(c) $72 \sqrt{3}$  
(d) $72 \sqrt{3}$

(40) $(2x-3)/(3x+2) = -2/3$ then $x$ is equal to

(a) $5/12$  
(b) $12/5$  
(c) $-12/5$  
(d) 13

(41) A divisor becomes a factor of dividend if

(a) Quotient $= 0$  
(b) Remainder $= 0$  
(c) Quotient $= $ Remainder  
(d) Remainder $\neq 0$

(42) In the Standard form of the polynomial the terms are

(a) Written in decreasing order of exponents.  
(b) Written in any order of exponents.
Appendix - A

(c) Written in increasing order of exponents
(d) a & c both

(43) \((x^2 - 4) + (x + 2)\) is equals to
(a) \((x - 2)\)  (b) \((x + 2)\)  (c) Both A & B  (d) cannot be evaluated

(44) The standard form of the polynomial \(x^2 + 5x^3 + 7x + 2\)
(a) \(2 + 7x + 5x^3 + x^2\)  (b) \(2 + x^2 + 7x + 5x^3\)
(c) \(2 + 7x + x^3 + 5x^3\)  (d) None

(45) If \(2x^2 + 5x + 3\) is divided by \((x+2)\) then the remainder is
(a) 3  (b) 2  (c) 1  (d) 0

(46) If \(m\) is a cube root of \(n\) we can express it as
(a) \(n = m^3\)  (b) \(m = n^3\)  (c) \(m = n/3\)  (d) \(m = n/3\)

(47) A number not perfect cubes is-
(a) 1728  (b) 1331  (c) 243  (d) 216

(48) If \(n\) is even number then \(n^3\) is
(a) even  (b) odd  (c) prime  (d) cannot say anything

(49) The smallest number by which the number 33275 must be divided to make it a perfect cube is-
(a) 35  (b) 25  (c) 15  (d) 5

(50) The smallest number to be subtracted from number 792 to make it a perfect cube is
(a) 63  (b) 36  (c) 280  (d) 271

(51) The cube of 0.08 is
0.08  (a) 0.00512  (b) 0.000512  (c) 0.00513  (d) 0.0000512

(52) Diagonals AC and BD of a rectangle ABCD intersect each other at the point O. If OA = 5 cm then
BD is:
(a) 5 cm  (b) 2.5 cm  (c) 10 cm  (d) \(5\sqrt{2}\)

(53) Standard unit of volume 1 cm\(^3\) is equal to
(a) 10 mm\(^3\)  (b) 1000 mm\(^3\)  (c) 100 mm\(^3\)  (d) none

(54) \((a+b) (a+b)\) can be written as
(a) \(a^2 + b^2\)  (b) \(a^2 - b^2\)  (c) \(a^2 - ab + b^2\)  (d) \(a^2 - 2ab + b^2\)

(55) The ratio of the radii of two circles is 3:2 their circumference is in the ratio
3:2  (a) 3:2  (b) 1:1  (c) 1:2  (d) 2:3

VI
(56) Square of an even number is always…………………..

(a) Odd  (b) Prime  (c) Even  (d) All

(57) \( (a-b)^2 \) is equal to

(a) \( a^2-ab+b^2 \)  (b) \( a^2-2ab+b^2 \)  (c) \( (a-b)(a+b) \)  (d) \( (a+b)^2-4ab \)

(58) ABCD is a trapezium in which AB II DC and \( \angle A = \angle B = 60^\circ \), then the measure \( \angle C \) and \( \angle D \) are

(a) 60°, 60°  (b) 120° and 60°  (c) 120°, 120°  (d) 60°, 120°

(59) The average weight of 10 students is 55 kg. It is later discovered that the weight of one of the student was wrongly taken as 45 kg instead of 55 kg. The correct average is

(a) 55.5 kg  (b) 50 kg  (c) 56 kg  (d) 65 kg

(60) Diagonals of a rhombus

(a) are equal in length  
(b) intersect at any angle other than right angle  
(c) bisect at any angle other than right angle  
(d) bisect each other at right angle

(a) सयान संख्याओं का वर्ग सदैव संख्या होती है  
(b) विस्तार किसी भी कोण पर अन्तर्भावित करती है।  
(c) सममता पर संबंधित होती है।  
(d) एक दूसरे को सममता पर संबंधित करती है।
A Personal and Familial Background Assessment Questionnaire

Name (नाम) .........................................................  Class (कक्षा) ..............
Age (उम्र) ..........................................................  Sex (लिंग) .................
School/college (स्कूल/कालेज) ..................................  Date (दिनांक) ..............

1. What is the education of your Father ..............................................................
   आपके पिता की शैक्षिक योग्यता क्या है ..............................................................

2. What is the education of your Mother ...........................................................
   आपकी माता की शैक्षिक योग्यता क्या है ..............................................................

3. What is the Occupation of your Father .........................................................
   आपके पिता का व्यवसाय क्या है ................................................................

4. What is the Occupation of your Mother .........................................................
   आपकी माता का व्यवसाय क्या है ................................................................

5. How Many members are there in your family ..................................................
   (Family Members-Father, Mother, Brother, Sister and your self)
   आपके परिवार में कितने सदस्य है ..............................................................
   (परिवार के सदस्य - पिता, माता, भाई, बहन, स्वयं)

6. How many hours do you watch television daily
   आप प्रतिदिन कितने घण्टे टीवी देखते हैं 
   a. Zero Hours (शून्य घण्टे)
   b. Less than one hours (एक घण्टे से कम)
   c. 1-2 Hours (1-2 घण्टे)
   d. 2-4 Hours (2-4 घण्टे)
   e. More than 4 hours

7. How often do your parents assist you in solving your mathematical problems
   आपकी माता-पिता गणित की समस्याएं हल करन में आपकी कितनी सहायता करते हैं
   कभी नहीं  कभी-कभी  हमेशा

8. How often do you take part in sports activities
   आप खेल कूद में कितना हिस्सा लेते हैं
   कभी नहीं  कभी-कभी  हमेशा
Appendix - A4

School Information Questionnaire

(To be filed in the Head of the School)

Instructions:

This Questionnaire consists of three parts Part 1 is the identification part. Part II consists of yes/No objective type item designed to gather information about the various aspects of your School. You have to mark a tick (✓) either on Yes/No. Part III consists of some Multiple Choice objective items framed with the same objective. In this part it is required from your good self to give your responses by marking a tick (✓) on any of the options among five given options i.e. a,b,c,d and e. Kindly read the Questionnaire thoroughly and attempt all the items.

Note: (This Questionnaire is solely designed for the research project taking in hand by the investigative. Your responses will not be exposed to any Govt. or any Non-Govt. agency).

Part-I

1. Name of the School..............................................................
2. Type of the School..............................................................
   a. Govt...........................................................................
   b. Govt. Aided.................................................................
   c. Private Aided...............................................................
   d. Private Un-Aided.........................................................
3. No of students in class IX.................................................
   कक्षा 9 में छात्रों की संख्या................................................
   Boys............................................................................
   Girls...........................................................................
   Total..............................................................................
4. No. of Male students from class I to X or XII. ........................................
   1 से 10-12 कक्षा में लड़कों की संख्या ........................................

5. No. of Female students from class I to X or XII.........................

6. Total no of students from class I to X or XII. ...........................
   कक्षा 1 से 12 तक छात्रों की संख्या............................

7. No. of Male teachers in the School.................................
   विद्यालय में पुरुष अध्यापक की संख्या..............................

8. No. of Female teachers in the School.................................
   विद्यालय में महिला अध्यापक की संख्या..............................

9. Total No. of teachers in the school...............................
   आपके विद्यालय में अध्यापकों की संख्या............................

10. Teacher-pupil ratio in your school..............................
    आपके विद्यालय में शिक्षक-छात्र अनुपात..............................

11. Medium of Instruction in your School.............................
    आप के विद्यालय में शिक्षा का माध्यम................................

12. How many trained teachers are there in your school?
    .................................................................
    आपके विद्यालय में कितने प्रशिक्षित अध्यापक हैं?................................

**Part-II**

**State whether you have the following**

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<td>Globe</td>
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<td>2</td>
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<td>Charts (Health, Social Studies, languages etc.)</td>
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<td>2</td>
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<td>Play material &amp; Toys</td>
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<td>2</td>
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<td></td>
<td>Description</td>
<td>Value</td>
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<td>Chairs for teachers</td>
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<td>13</td>
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<tr>
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<td>Dust-bin</td>
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<td>19</td>
<td>Toilet facilities</td>
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<td>Separate toilet facilities for girls</td>
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<td>Electric connection for the school</td>
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<tr>
<td>22</td>
<td>T.V.</td>
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<tr>
<td>23</td>
<td>Computer</td>
<td>1</td>
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<td>24</td>
<td>Playground facilities</td>
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<td>25</td>
<td>Annual medical check up for children</td>
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<td>Immunization facility</td>
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<tr>
<td>27</td>
<td>First aid kit</td>
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</table>
Part-III

1. Teacher’s Qualification (शिक्षकों की योग्यता):
   a. Number of teachers who have qualification of X and XII.
      10 और 12 पास शिक्षकों की संख्या..........................
   b. Numbers of Teachers with Bachelor of Degree (B.A., B.Sc., B.Com) ....................
   c. Number of teachers with Master Degree (M.A., M.Sc. M.Com)
   d. Number of teachers Doctoral Degree. ......................
   e. Number of teachers with other Degree. ......................

2. Experience of the teachers. (शिक्षकों का शैक्षिक अनुभव)
   a. Numbers of teachers having less than 5 years of experience...
      5 वर्ष से कम शैक्षिक अनुभव वाले शिक्षकों की संख्या|_____________
   b. No of teacher having 5-10 years of experience......................
      5 से 10 वर्ष से तक शैक्षिक अनुभव वाले शिक्षकों की संख्या|_____________
   c. No of teacher having 11-20 years of experience........................
      11 से 20 वर्ष से तक शैक्षिक अनुभव वाले शिक्षकों की संख्या|_____________
   d. No of teacher having more than 20 year experience. ...................
      20 से से अधिक शैक्षिक अनुभव वाले शिक्षकों की संख्या|_____________

3. How many students are being kept in one class room
   a. Above 45  b. 45      c. 40
   d. 35        e. 25 or below

4. State the type of building in which the school is housed................

5. How many rooms are there in your School.................................

6. How many mathematics teachers are there in your school ..............

Name and signature of Principal \Head Master\ with official seal.

XII