CHAPTER: 6

SUMMARY AND IMPLICATIONS

6.0. INTRODUCTION

School plays the crucial part to impart the education. It is the formal institution of education. It enables student to play his role in appropriate way. School education is mostly divided in to three stages primary, secondary and higher secondary. In this all, after secondary stage majority of the students will go into the world of work. Scientific attitudes and skills developed at this stage would become base for more growth. Mathematics is the key for the intellectual development of the students. From the beginning, Mathematics is a part of the educational system. Mostly students feel that Mathematics is the difficult subject. NCF (2005) has mentioned some problems in Mathematics education such as a majority of children have a sense of fear and failure regarding Mathematics. The current curriculum does not address this problem. Exercises and methods of evaluation are mechanical and too much emphasis on computation. But, actually Mathematics is an easy subject when understood properly.

Mathematics considered as one of the most difficult subjects in every stage of school learning because intention of teaching Mathematics is more oriented to prepare only for examination and achievement in Mathematics. In this situation, some studentsare considered as under achievers or average achievers as their weaknesses are accumulated. Gradually students develop lack of interest in the subject.

Every stage of education has its own significance. Successful achievement of secondary stage is prerequisite for admission into various vocational coursesas well as the world of work. Primary education lays the basic foundation of all type of education. The school performs the function of selection and segregation among students on the basis of their academic achievement. Mathematics is the core necessity for many professions. The secondary stage marks a beginning for the transition from the upper primary stage to the study of Mathematics as a discipline. More students from primary education with learning difficulties attend secondary stage. They cannot maintain pace between two stages. There seems hierarchy in Mathematics learning. Hence, student's achievement in Mathematics at any level of the study seems to be influenced by his/her weaknesses in the previously attained

basic knowledge, skill and understanding regarding the subject. Students with different social-economical status, mental abilities, aptitudes, emotional characteristics, motivation, attitudes, diversified interest and values in classroom are reality. Less or more these all variables affect the achievement of students. These variables generally referred to as correlates of achievement. Principals, teachers and others who are involved in the task of helping students to achieve better would like to have knowledge of the extent of influence these correlates exert on achievement.

So, the present study is an attempt to find out the relationship of selected variables with achievement in Mathematics for students of standard VII. The outcomes of the study will be equally useful for school authorities particularly in the field of educational guidance and for diagnosis, whenever required.

6.1. Objectives of Teaching Mathematics

According to the position paper on teaching of Mathematics (2006) one main goal of Mathematics education is the mathematisation of child's thought process and higher aim that of developing inner resources of growing child. According to Framework of the curriculum for ten year schooling (1975) the objectives of Mathematics Education at school stage should be:

- ➢ To enable the students to cultivate a mathematical way of thinking. i.e., in terms of carrying out experiment with numbers and geometric forms, making hypothesis, verifying them with further observations and experiments, generalizing them, trying to find proofs and making abstractions, etc.
- ➢ To enable the students to quantify their experience of the world around them andto understand the process of applying mathematics to real life problems.
- ➢ To enable the students to learn the basic structures of mathematics through unifyingconcepts and to motivate the learning of structure through applications and concretesituations.
- ➢ To stimulate the students to study mathematics on their own and to develop a taste and feeling for mathematics

6.2. The Place of Mathematics in the School Curriculum

Everybody needs some knowledge of Mathematics in one way or the other. The knowledge of Mathematics acquired during the primary and middle stages is sufficient to deal with day to day life problem. The education commission (1964-66)

recommended Mathematics as a compulsory subject for all school students. According to NCF (2000) one of the basic aims of teaching Mathematics in school is to inculcate the skill of quantification of experiences around the learners. In the first two years, the basic number concept related to size, length, mass etc., are introduced to the child. Here one should develop the skills of classification, grouping of different geometrical shapes and numbers. In class III to V, the four fundamental operations and computational skill related to them are introduced to the students. At this stage student is able to apply his/her knowledge of geometrical forms and figures in the environment. At the upper primary stage, students should acquire knowledge and understanding of concepts, facts and principles of the Mathematics for daily use. Text book of standard VII published by GCERT contain major seven learning areas such as number system, algebra, geometry, statistics, measurement, arithmetic and Mathematics related to daily life. Chapters like integer, decimal integer, power and exponent are the part of arithmetic. Profit and loss, simple interest and compound interest considered as Mathematics related to daily life. While factorisation, equation, polynomial are included as a part of algebra. Parallel lines and quadrilateral introduced as the concept of geometry. Basic statistical concept of bar chart and bar-graph also introduced. At the secondary stage, the curriculum has includes number system, algebra, geometry, trigonometry, statistics, deductive reasoning. These all stages of learning are hierarchically interrelated.

6.3. Mathematical Weaknesses

Mathematics is hierarchy of knowledge, skills and understanding. Weakness is there when interrelated learning is weak or absent. Rastogi (1983) has found that one of the important causes of backwardness in Mathematics was the poor command over basic arithmetic skills. Sharma (1978) has found that the major defect was lack of knowledge of fundamentals. Jain (1979) has significant correlates of high school failures and revealed that knowledge of mathematical concepts was one of them.

The learner exhibits deficiency when the underlying skills are not mastered. Thakor (1980) has found that students of class V did not have clear concept of fraction. They did not understand the place value of respective figures in decimal fractions. They did not understand addition, subtraction, multiplication and division of decimal fractions. Rawool (1988) studied that students failed to use concepts at the understanding and

application levels. Raman (1989) has identified that the errors most students committed were conceptual errors. Wagh (1991) has also found that students committed common error in the basic concepts.

According to Rastogi (1991) some factor responsible for low achievement in Mathematics are as follow:

➢ Defective teaching
➢ Defective examination
➢ Injudicious double promotion
➢ Lack of guidance
➢ Negligence of school and home work
➢ Lack of interest and motivation for the challenging work
➢ Lack of Diagnostic and remedial teaching

Sharma (1978) studied that all the pupils did not acquire understanding and application of different topics because undue emphasis on the mechanical learning of Mathematics. He has found that major factor responsible for low achievement in Mathematics was the impartation of limited knowledge and absence of the methodological approach of the classroom teaching. Jain and Burad (1922) has found causes responsible for low results and revealed that irregular attendance of students and lack of child centered teaching. Hariharan (1992) has found that the attitude of high school students towards homework was related to their achievement level in Mathematics. Lalithama (1975) has found that interest in Mathematics is one of the factors which affect achievement in Mathematics. Pal (1989) has found significant correlation between self concept in Mathematics and academic motivation. So, these all factors are potent deterrents in the normal or expected achievement of students.

6.4. Correlates of Mathematics Achievement

School has a unique role to develop different capabilities in students with changing field of education and in making necessary change in the instructional process. As the educational institutes are on the way to improving their quality, so naturally more concern to the quality of performance or academic achievement. Academic achievement is the prime concern of any educational institution because it ensures that students have acquired the basic competency. It helps to know the learning difficulties

of the students in the content area. On the basis of academic achievement we can select and discriminate the students for further learning.

Mathematics occupies a very significant role in student learning and ignorance of Mathematics will stop the progress of one's studies in many other subjects. The subject Mathematics plays an important role in the school curriculum to develop thinking, reasoning and problem solving abilities of students which will enable them to become good citizen of the present cybernetic world. So achievement in Mathematics is the prime concern of students, teacher and school. Researchers have come out with variables which promote achievement in Mathematics and what are deterrents to it. It has been such indicated that a good number of variables, such as personality characteristics of the learners, socio-economic status from which they hail, attitude towards Mathematics, intelligence, higher cognitive abilities etc. to mention a few, influences achievement in varying degrees. Lalithama (1975), Jain (1979), Sarala (1990), Kasat (1991), Setia (1992), Sumangala (1995), Srivastava (1993), and Patel (1997) have found that the higher level of intelligence, higher will be the achievement in Mathematics.Jain (1979), Patel (1984), Nagailiankin (1991), Hariharan (1992), Rosaly(1992) have shown that attitude is also one of the factors which greatly affect the achievement in Mathematics. Lalithama (1975), Sarala (1990), Setia (1992), Nagalaksmi (1996) andPatel (1997) have found that socio-economic level of parents had a large impact on the achievement. Therefore principal, teacher and others who are involved in the task of helping students in maximise their achievement need to have knowledge of factors affecting achievement like attitude, SES, intelligence.

6.5. Rationale of the Study

Mathematics has always occupied an important place in school curriculum. The education commission (1964-66) recommended mathematics as compulsory subject for students at school level. In the teaching of mathematics emphasis should be more on the understanding of basic principles than on the mechanical teaching of numerical computation. Later the National Policy on Education (1986) also considered the importance of mathematics in general education and suggested that mathematics should be visualized as the vehicle to train a child to think, reason, analyze and to articulate logically. Apart from being a specific subject it should be treated as concomitant to any subject involving analysis and reasoning.

Primary stage is very crucial stage at school level. It is the base of students' comprehensive development. So, it is foundation for secondary and higher education too. Mathematics helps to develop accuracy, rational and analytical thinking, reasoning and positive attitude. In primary stage, standard VII plays very important role. It is transition phase between primary and secondary stages. These stages of learning are hierarchically interrelated. Without clarity of basic concept one cannot move for further information and application of the concept. Sashidharan (1992)has investigated that, the prevailing promotion policy gives opportunities to children to attain tenth class even though they cannot perform basic operations in mathematics. The initial deficiencies have a long term damaging effect because the content of education is organized in such a way that learning in each class is dependent on prior learning.

It is observed that in the average school, instruction still conform to a mechanical routine. So, it remains as dull and uninspiring. That makes mathematics as one of the most difficult subject in school. Datta (1990) has found the disabilities are there because there were no experiment to strengthen the teaching of geometry; and the relation of geometry and physical space is not explored. Even Rawool (1988) has found that students fail at 'understanding' and 'application' levels. Raman (1989) has also identified that the errors most students committed were conceptual errors and he has developed remedial package which reduces errors significantly. Also there exists a relation between the concepts learnt at every stage. Mathematics is a core requirement for many professions. Most of the students enter in standard X without proper clarity of concepts and hence find themselves incapable to share well in mathematics.

In this era of 21st century competition makes students more anxious and the eagerness of whether they can pass exam or not. In the present educational system more importance is given to academic achievement. Reviews show that researches have found certain factors like intelligence, study habits, attitude of pupil towards mathematics, different aspect of their personality, SES which influence achievement of mathematics. Knowledge of factor affecting achievement in mathematics will help the teachers to provide proper condition for enhancing achievement in mathematics.

Review of related literature shows that many studies have been conducted in the area of correlates of achievement in mathematics. Research centering on student's attitudes towards mathematics study has received increasing attention. Jain (1979), Patel (1984), Rosaly (1992) and Nagailiankin(1991) have revealed that attitude has impacted students' achievement. While Lalithama(1975), Jain(1979) and Sarala(1990) have found that intelligence is one of the correlates of mathematics achievement. But investigator did not come across any such study which has been conducted on Gujarati medium school for standard VII even after introduction of new textbook. Even no any researcher has standardised the attitude scale for standard VII to measure attitude towards mathematics. So, the purpose of this study is to construct and standardise attitude scale for standard VII. Sarala(1990), Lalithama (1975), Nagalakshmi (1996), Patel(1997) have found that SES is positively related with mathematics achievement. But Srinivasan(1999) did not find any such relation. So, researcher has taken SES is one of the variable to check its relation with mathematics achievement. As standard VII is the transition period between two stages of education, it is essential to identify correlates of achievement and to make the base of mathematics sound. So, this is worthwhile to find out relationship between selected variables (Attitude, Intelligence, SES, and Parents Qualification) and achievement in mathematics of standard VII in Gujarati medium school. Thus, it is hoped that the present study will not only provide basis for further research but also give tool in the hands of teacher in improving the mathematical achievement of students under their care.

6.6. Statement of the Problem

A Study of Correlates of Achievement in Mathematics of Students of Class VII with Respect to Certain Variables in SuratCity

6.7. Objectives of the Study

1. To study achievement in mathematics of class VII students.
2. To construct and standardise an attitude scale to measure attitude towards mathematics for standard VII students.
3. To construct a test of mathematical weaknesses to measure weaknesses in mathematics for standard VII students.

4. To study the Achievement in Mathematics with respect to,

     i. Attitude towards Mathematics

    ii. Intelligence

   iii. Socio Economic Status (SES)

iv. Mathematical   weaknesses

5. To study the interaction effect of selected variables,

     i. Attitude towards Mathematics

    ii. Intelligence

   iii. Socio Economic Status (SES)

iv. Mathematical   weaknesses

on Achievement in Mathematics

6.8. Hypotheses

HO 1: There will be no significant difference in the mean achievement of Mathematics class VII with respect to Attitude towards mathematics.

HO 2: There will be no significant difference in the mean achievement of Mathematics class VII with respect to Intelligence.

HO 3: There will be no significant difference in the mean achievement of Mathematics class VII with respect to SES.

HO 4: There will be no significant difference in the mean achievement of Mathematics class VII with respect to Mathematical Weaknesses.

HO 5: There will be no significant interaction effect between Attitude towards Mathematics and Intelligence on achievement in Mathematics.

HO 6: There will be no significant interaction effect between Attitude towards Mathematics and SES on achievement in Mathematics.

HO 7: There will be no significant interaction effect between Attitude towards Mathematics and Mathematical Weaknesses on achievement in Mathematics.

HO 8: There will be no significant interaction effect between Intelligence and SES on achievement in Mathematics.

HO 9: There will be no significant interaction effect between Intelligence and Mathematical Weaknesses on achievement in Mathematics.

HO 10: There will be no significant interaction effect between Mathematical Weaknesses and SES on achievement in Mathematics.

HO 11: There will be no significant interaction effect between Attitude towards Mathematics, Intelligence and mathematical Weaknesses on achievement in Mathematics.

HO 12: There will be no significant interaction effect between Attitude towards Mathematics, Intelligence and SES on achievement in Mathematics.

HO 13: There will be no significant interaction effect between Attitude towards mathematics, Mathematical weaknesses and SES on achievement in Mathematics.

HO 14: There will be no significant interaction effect between Intelligence, Mathematical weaknesses and SES on achievement in Mathematics. .

HO 15: There will be no significant interaction effect between Attitude towards Mathematics, Intelligence, Mathematical weaknesses and SES on achievement in Mathematics.

6.9. Operationalization of the Terms

6.9.1. Achievement in Mathematics

This refers to the average of total marks obtained by students in Mathematics subject in first term and second term final examination conducted by NagarPrathmikShikshanSamiti, Suratfor the academic year 2012-13 for class VII.

6.9.2. Attitude towards Mathematics

This refers to the score obtained by students on an attitude scale which was constructed and standardised by investigator to measure the attitude towards Mathematics of standard VII students.

6.9.3. Intelligence of students

The score obtained by students on an Intelligence Test which was constructed by Shah and Patel (2010) reflect the Intelligence of students.

6.9.4. Socio Economic Status (SES)

The score obtained by students on the Socio Economic Status (SES) scale which was designed by Patel and Patel (2005) reflect the SES of students.

6.9.5. Mathematical Weaknesses

Mathematical Weaknesses measured by administrating a test constructed by the investigator based on the basic concept of mathematics which students have studied in previous classes (Class I to VI).

6.10. Delimitation of the Study

The present study was delimited to the students of VII standard, Gujarati medium schools of SuratCity managed by Nagar PrathmikShikshanSamitiSurat.

The items of Mathematical Weaknesses were delimited to the arithmetic and algebra up to class VI of Gujarati medium textbook published by GCERT.

6.11. Population

The population of the study consisted of all the students of standard VII, Gujarati medium schools of Surat city managed by Nagar PrathmikShikshanSamitiSurat. There were 282 schools which includes 177 Gujarati medium schools. Other schools were in Hindi, Urdu, Marathi, Telugu and Udia medium. So, all students in 177 Gujarati medium schools of SuratCity managed by Nagar PrathmikShikshanSamitiSurat formed population of the present study.

6.12. Sample

In the present study demanded three sets of sample. The try out study conducted for tool to measure attitude towards Mathematics and test of mathematical weaknesseswhich was phase-I of the study. The phase-II dealt with establishment of psychometric property and the phase-IIIdealt with the study of achievement in Mathematics with attitude towards Mathematics, Socio Economic Status (SES), Intelligence and Mathematical Weaknesses.

6.13. Tools

A research tools play a major role in any worthwhile research. Tool is the sole factor in determining the sound data and in arriving at perfect conclusions about the study.

In present study to collect the required data the following five tools were used.

6.13.1. Achievement Tests

Final examination of first term and second term of Mathematics subject for class VIIof academic year 2012-13 considered as achievement tests. Question papers of both the terms made up of80 marks. So, the total marks of both the tests were 160. **Appendix-I**

6.13.2. Attitude Scale

The tool to measure attitude towards mathematics constructed and standardised by investigator. The tool will be constructed by "The method of Summated Rating scale given by Likert (1932)".The steps are given bellow:

(1) Identification of the components of attitude scale to measure attitude towards mathematics:

The construction of attitude scale comprised of the components like usefulness of Mathematics, interest in the Mathematics and difficulties felt by students in the subject.

(2) Format and nature of statement:

Each test item presents a statement. Statements were written that are favourable and unfavourable with respect to the attitude toward Mathematics. The item was provided with five options namely, strongly agree, agree, undecided, disagree, strongly disagree. There were positive polarity items to measure foreness and negative polarity items to measure againstness to attitude.

(3) Development and Selection of the statement

Each statement distributed on the basis of component and polarity. To make a selection from the pool of total statements, a tryout study has conducted.

(4) Response mode

While an individual responds to the scale, he/she decided one of the five option namely, strongly agree, agree, undecided, disagree, strongly disagree and indicate it by putting a tick mark ' √ ' in the corresponding box.

(5) Tryout of Attitude scale:

A tryout study conducted on a sample approximate 400 students. The school selected for the final sample were not included for this purpose.

(6) Scoring procedure:

Scoring procedure suggested by Likert for positive polarity and Negative polarity followed by investigator.

(7) The final format

Final selection of the statements that differentiate the high group and the low group under the procedure, suggested by Likert (1932) has adopted.

(8) Establishment of the psychometric properties of the Attitude Scale:
The reliability of the developed score was estimated by split-half technique.
The face validity and content validity were established by researcher and Factor analysis was also done.

6.13.3. Intelligence Scale

To measure the Intelligence, the Intelligence scale constructed by Shah &Patel (2010) was used by investigator in the present study. The test-retest reliability of the test was 0.79. Split half reliability was 0.91. Reliability by Rulon formula was 0.95. Reliability by Kuder Richardson formula KR20 was 0.91 and reliability by KuderRichardson formula KR21 was 0.71. Validity of the test with Desai verbal-nonverbal group intelligence test was 0.75, verbal intelligence test was 0.85 and logical aptitude test was 0.76. Test having total 77 items based on six verbal and five non-verbal components. **Appendix-II**(Draft of Intelligence Scale)

6.13.4. Socio Economic Status Scale (SES)

To measure the SES, the SES scale constructed by Patel &Patel (2005) has been used by investigator in the present study. The test-retest reliability of the scale was 0.6. The validity of the scale was 0.7. **Appendix-III**(Draft of SES scale)

6.13.5. Test of Mathematical Weaknesses

To study Weaknesses in mathematics, first investigator has taken opinion of teachers teaching Mathematics at primary level Gujarati medium school having minimum threeyears experience. From the opinions of teachers the investigator has prepared the test referring standard VII Gujarati medium text book of mathematics. It involves the following steps,

- ➢ Item selection and writing.
- ➢ Constructing the tryout form.
- ➢ Administrating the try out form of the test on small sample.
- ➢ Validation to expert.

6.14. Data Collection

The procedure of data collection for the study was carried out in three phase. In first phase data for pilot study was collected. In the second phase data related to variables attitude towards mathematics, (Socio Economic Status) SES, Intelligence and Mathematical weaknesses were collected. And in the third phase the data pertaining to variables Mathematical achievement was collected. The details of these described below:

6.14.1. Phase-I

In the present study investigator has developed attitude scale to measure attitude towards Mathematics and constructed test of mathematical weaknesses. So, in first phase data for tryout study was collectedduring the period of February, 2012.

6.14.2. Phase-II

In the present study investigator has developed attitude scale to measure attitude towards Mathematics and for the same to establish psychometric property data was collected during the period of February, 2012. The investigator met the principal and administered the tools to all the students of standard VII who were present at the time of data collection.

6.14.3. Phase-III

During this phase, the data pertaining to variables attitude towards Mathematics, SES, Intelligence and mathematical weaknesses of students were collected from all the students of standard VII who were studying in the selected school which comprise the sample during the academic year 2012‑13.

Before the administration of four tools scale to measure attitude towards mathematics, SES scale, intelligence test and test ofmathematical weaknesses, the students were made aware about the purpose of administration of the tools and were given the following instruction regarding the tools.

6.14.4. Phase-IV

In this phase, the data pertaining to variables Mathematics achievement were collected from the respective schools record during the period of April-2013. Investigator consulted all the principals of selected schools and the data pertaining on the Mathematics achievement of all the students who were administered attitude scale, SES, Intelligence scale and Mathematical weaknesses scale were collected from the school record.

6.15. Data Analysis

In the present study, for objective one mean, median, standard deviation, skewnessand kurtosis was computed. To study the achievement in Mathematics with respect to selected variables and interactive effects of two or more selected variables on achievement in Mathematics were analysed through Analysis of variance (ANOVA).Assumption for ANOVA has been verified.

6.16. Major Findings and Conclusions

For the present study the achievement of students of standard VII of Surat city has been studied with respect to certain variables like attitude towards Mathematics, intelligence, SES and mathematical weaknesses. Major findings of this study have been listed below:

➢ The Table: 5.2 show the measure of mean and median of the distribution of achievement were 46.63 and 46 respectively. The Standard Deviation of the distribution is 12.76. The skewness of distribution is found to be 0.28 (positively skewed). This means that score were massed at the left end of the scale and were spread out more gradually towards the rightend. It is found that KU = -0.57 < 0.236. So, distribution was leptokurtic.

➢ The Table: 5.7 indicate that the calculated value of F=88.699 (p<0.01) for the main effect of factor attitude towards Mathematics exceeds the critical value. Therefore F ratio is significant at 0.01 level and the null hypothesis: 1is rejected and there is significant difference in the mean achievement of Mathematics class VII with respect to attitude towards Mathematics.

➢ The mean achievement of students whose attitude towards Mathematics is very low, low, average, high and very high on attitude Scale is 40.25806, 40.78593, 45.53691, 52.43182 and 57.19337 respectively. It means that students whose

attitude is very low, low, average, high and very high on attitude Scale do differ on their achievement in Mathematics. It can be seen that attitude towards Mathematics has an impact on Mathematical achievement. The difference is in favour of students whose attitude towards Mathematics is very high. It can be seen from Table no. 5.8 that,

❑ Significant difference in achievement is observed between students with very low attitude and low attitude towards Mathematics. Difference is in the favour of students with low attitude towards Mathematics.So, it can be concluded that those who have low attitude towards Mathematics have higher level of achievement in Mathematics

❑ Significant difference in achievementis observed between students with very low attitude and average attitude towards Mathematics. Difference is in the favour of students with average attitude towards Mathematics.So, it can be concluded that those who have average attitude towards Mathematics have higher level of achievement in Mathematics.

❑ Significant difference in achievement is observed between students with low attitude and high attitude towards Mathematics. Difference in the favour of students with high attitude towards Mathematics.So, it can be concluded that those who have high attitude towards Mathematics have higher level of achievement in Mathematics.

❑ Significant difference in achievement is observed between students with very low attitude and very high attitude towards Mathematics. Difference is in the favour of students with very high attitude towards Mathematics.So, it can be concluded that those who have very high attitude towards Mathematics have higher level of achievement in Mathematics.

❑ Significant difference in achievement is observed between students with low attitude and average attitude towards Mathematics. Difference is in the favour of students with average attitude towards Mathematics.So, it can be concluded that those who have average attitude towards Mathematics have higher level of achievement in Mathematics.

❑ Significant difference in achievement is observed between students with low attitude and high attitude towards Mathematics.Difference is in the favour of high attitude towards Mathematics.So, it can be concluded that those who

have high attitude towards Mathematics have higher level of achievement in Mathematics.

❑ Significant difference in achievement is observed between students with low attitude and very high attitude towards Mathematics. Difference is in the favour of very high attitude towards Mathematics.So, it can be concluded that those who have very high attitude towards Mathematics have higher level of achievement in Mathematics.

❑ Significant difference in achievement is observed between students with average attitude and high attitude towards Mathematics. Difference is in the favour of high attitude towards Mathematics.So, it can be concluded that those who have high attitude towards Mathematics have higher level of achievement in Mathematics.

❑ Significant difference in achievement is observed between students with average attitude and very high attitude towards Mathematics. Difference is in the favour of students with very high attitude towards Mathematics.So, it can be concluded that those who have very high attitude towards Mathematics have higher level of achievement in Mathematics.

❑ Significant difference in achievement is observed between students with high attitude and very high attitude towards Mathematics. Difference is in the favour of very high attitude towards Mathematics.So, it can be concluded that those who have very high attitude towards Mathematics have higher level of achievement in Mathematics.

➢ The Table: 5.9 indicates that the calculated value of F=22.559 (p<0.01) for the main effect of factor Intelligence exceeds the critical value. Therefore 'F' ratio is significant at 0.01 level and the null hypothesis: 2 is rejectedand there is significant difference in the mean achievement of Mathematics class VII with respect to intelligence.

➢ The mean achievement of students whose intelligence is superior, average high, average, average low, border line and defective on intelligence scale is 61.428857, 54.336, 47.96636, 43.90017, 44.4985 and 42.93443 respectively. In category very superior, number of students was very less. So, they merged with nearby category. It means that students whose intelligence is superior, average high, average, average low, border line and defective on intelligence scale do differ on their achievement in Mathematics. It can be seen that intelligence has an

impact on Mathematics achievement. The difference is in favour of students whose intelligence is superior. It can be seen from Table: 5.10 that,

- ❑ Significant differencein achievement is observed between students with defective intelligence and average intelligence. Difference in the favour of students with average intelligence. So, it can be concluded that those who have average intelligence have higher level of achievement in Mathematics.

- ❑ Significant differencein achievement is observed between students with defective intelligence and average high intelligence. Difference in the favour of students with average high intelligence. So, it can be concluded that those who have average high intelligence have higher level of achievement in Mathematics.

- ❑ Significant difference in achievement is observed between students with defective intelligence and superior intelligence. Difference in the favour of students with superior intelligence. So, it can be concluded that those who have superior intelligence have higher level of achievement in Mathematics.

- ❑ Significant difference in achievement is observed between students with border line intelligence and average intelligence. Difference in the favour of students with average intelligence. So, it can be concluded that those who have average intelligence have higher level of achievement in Mathematics.

- ❑ Significant difference in achievement is observed between students with border line intelligence and average high intelligence. Difference in the favour of students with average high intelligence. So, it can be concluded that those who have average high intelligence have higher level of achievement in Mathematics.

- ❑ Significant difference in achievement is observed between students with border line intelligence and superior intelligence. Difference in the favour of students with superior intelligence. So, it can be concluded that those who have superior intelligence have higher level of achievement in Mathematics.

- ❑ Significant difference in achievement is observed between students with average low intelligence and average intelligence. Difference in the favour of students with average intelligence. So, it can be concluded that those

who have average intelligence have higher level of achievement in Mathematics.

❑ Significant difference in achievement is observed between students with average low intelligence and average high intelligence. Difference in the favour of average high intelligence. So, it can be concluded that those who have average high intelligence have higher level of achievement in Mathematics.

❑ Significant difference in achievement is observed between students with average low intelligence and superior intelligence. Difference in the favour of students with superior intelligence. So, it can be concluded that those who have superior intelligence have higher level of achievement in Mathematics.

❑ Significant difference in achievement is observed between students with average intelligence and defective intelligence. Difference in the favour of students with average intelligence. So, it can be concluded that those who have average intelligence have higher level of achievement in Mathematics.

❑ Significant difference in achievement is observed between students with average intelligence and border line intelligence. Difference in the favour of students with average intelligence. So, it can be concluded that those who have average intelligence have higher level of achievement in Mathematics.

❑ Significant differencein achievement is observed between students with average high intelligence anddefective intelligence. Difference in the favour of students with average high intelligence. So, it can be concluded that those who have average high intelligence have higher level of achievement in Mathematics.

➢ TheTable: 5.11 indicates that the calculated value of F=6.886 (p<0.01) for the main effect of factor SES exceeds the critical value. Therefore 'F' ratio is significant at 0.01 level and the null hypothesis: 3 is rejectedand there is significant difference in the mean achievement of Mathematics class VII with respect to SES.

➢ The mean achievement of students whose SES is very high, high, average and low on SES Scale was 45.3871, 45.57759, 48.51309 and 46.5 respectively. It means that students whose SES is very high, high, average, and low on SES Scale do differ on their achievement in Mathematics. It can be seen that SES has an

impact on Mathematical achievement. The difference is in favour of students who belong to average SES. It can be seen from the Table: 5.12 that significant difference is observed between students belong to high SES and average SES. Difference in the favour of students belong to average SES. So, it can be concluded that those who belong to average SES have higher level of achievement in Mathematics.

➢ TheTable: 5.13 indicates that the calculated value of F=39.235 (p<0.01) for the main effect of factor mathematical weaknesses exceeds the critical value. Therefore 'F' ratio is significant at 0.01 level and the null hypothesis: 4 isrejected and there is significant difference in the mean achievement of Mathematics class VII with respect to mathematical weaknesses.

➢ The mean achievement of students whose mathematical weaknesses is very high, high, average, low and very low on mathematical weaknesses Scale is 44.64569, 46.04743, 54.32218, 60.2 and 57.5 respectively. It means that students whose mathematical weakness is very high, high, average, low and very low on Mathematical weaknesses scale do differ on their achievement in Mathematics. It can be seen that Mathematical weaknesses has an impact on Mathematical achievement. The difference is in favour of students with low Mathematical weaknesses. It can be seen from Table: 5.14 that,

❑ Significant difference in achievement is observed between students with low mathematical weaknesses and high mathematical weaknesses. Difference in the favour of students with low mathematical weaknesses. So, it can be concluded that those who have low mathematical weaknesses have higher level of achievement in Mathematics.

❑ Significant difference in achievement is observed between students with low mathematical weaknesses and very high mathematical weaknesses. Difference in the favour of students with low mathematical weaknesses. So, it can be concluded that those who have low mathematical weaknesses have higher level of achievement in Mathematics.

❑ Significant difference in achievement is observed between students with average mathematical weaknesses and high mathematical weaknesses. Difference in the favour of students with average mathematical weaknesses. So, it can be concluded that those who have average mathematical weaknesses have higher level of achievement in Mathematics.

- ❑ Significant difference in achievement is observed between students with average mathematical weaknesses and very high mathematical weaknesses. Difference in the favour of students with average mathematical weaknesses. So, it can be concluded that those who have average mathematical weaknesses have higher level of achievement in Mathematics.

➢ TheTable: 5.15 indicates that the calculated value of F=15.006 (p<0.01) for the interaction effect of factors intelligence and attitude towards Mathematics (A X B) exceeds the critical value. Therefore 'F' ratio is significant at 0.01 level and the null hypothesis: 5 is rejected. So, there is significant interaction effect between attitude towards mathematics and intelligence on achievement in Mathematics. It concludes that intelligence and attitude towards Mathematics jointly affect on achievement in Mathematics.

➢ TheTable: 5.16 indicates that the calculated value of F=22.547 (p<0.01) for the interaction effect of factors SES and attitude towards Mathematics (A X C) exceeds the critical value. Therefore 'F' ratio is significant at 0.01 level and the null hypothesis: 6 is rejected. So,there is significant interaction effect between attitude towards Mathematics and SES on achievement in Mathematics. It concludes that SES and attitude towards Mathematics jointly affect on achievement in Mathematics.

➢ The Table: 5.17 indicates that the calculated value of F=20.286 (p<0.01) for the interaction effect of factors attitude towards Mathematics and mathematical weaknesses (A X D) exceeds the critical value. Therefore 'F' ratio is significant at 0.01 level and the null hypothesis: 7 is rejected. So, there was significant interaction effect between attitude towards Mathematics and mathematical weaknesses on achievement in Mathematics. It concludes that attitude towards Mathematics and mathematical weaknesses jointly affect on achievement in Mathematics.

➢ The Table: 5.18 indicates that the calculated value of F=8.140 (p<0.01) for the interaction effect of factors intelligence and SES (B X C) exceeds the critical value. Therefore 'F' ratio is significant at 0.01 level and the null hypothesis no: 8 is rejected. So, there is significant interaction effect between intelligence and SES on achievement in Mathematics. It concludes that intelligence and SES jointly affect on achievement in Mathematics.

- The Table: 5.19 indicates that the calculated value of F=11.080 (p<0.01) for the interaction effect of factors intelligence and mathematical weaknesses (B X D) exceeds the critical value. Therefore 'F' ratio is significant at 0.01 level and the null hypothesis: 9 is rejected. So, there is significant interaction effect between intelligence and mathematical weaknesses on achievement in Mathematics. It concludes that intelligence and mathematical weaknesses jointly affect on achievement in Mathematics.

- TheTable: 5.20 indicates that the calculated value of F=11.736 (p<0.01) for the interaction effect of factors mathematical weaknesses and SES (D X C) exceeds the critical value. Therefore 'F' ratio is significant at 0.01 level and the null hypothesis: 10 is rejected. So, there is significant interaction effect between mathematical weaknesses and SES on achievement in Mathematics. It concludes that mathematical weaknesses and SESjointly affect on achievement in Mathematics.

- The Table: 5.21 indicates that the calculated value of F=6.309 (p<0.01) for the interaction effect of factors attitude towards Mathematics, intelligence and mathematical weaknesses (A X B X D) exceeds the critical value. Therefore 'F' ratio is significant at 0.01 level and the null hypothesis: 11is rejected. So, there is significant interaction effect between attitude towards mathematics, intelligence and mathematical weaknesses on achievement in Mathematics. It concludes that attitude towards Mathematics, intelligence and mathematical weaknesses jointly affect on achievement in Mathematics.

- The Table: 5.22 indicates that the calculated value of F=7.066 (p<0.01) for the interaction effect of factors attitude towards Mathematics, intelligence and SES (A X B X C) exceeds the critical value. Therefore 'F' ratio is significant at 0.01 level and the null hypothesis: 12 is rejected. So, there is significant interaction effect between attitude towards Mathematics, intelligence and SES on achievement in Mathematics. It concludes that attitude towards Mathematics, intelligence and SES jointly affect on achievement in Mathematics.

- The Table: 5.23 indicates that the calculated value of F=9.540 (p<0.01) for the interaction effect of factors attitude towards Mathematics, mathematical weaknesses and SES (A X D X C) exceeds the critical value. Therefore 'F' ratio is significant at 0.01 level and the null hypothesis: 13 is rejected. So, there is significant interaction effect between attitude towards Mathematics, mathematical

weaknesses and SES on achievement in Mathematics. It concludes that attitude towards Mathematics, mathematical weaknesses and SES jointly affect on achievement in Mathematics.

- The Table: 5.24 indicates that the calculated value of F= 5.746 (p<0.01) for the interaction effect of factors intelligence, mathematical weaknesses and SES (B X D X C) exceeds the critical value. Therefore 'F' ratio is significant at 0.01 level and the null hypothesis: 14 is rejected. So, there is significant interaction effect between intelligence, mathematical weaknesses and SES. It concludes that intelligence, mathematical weaknesses and SES jointly affect on achievement in Mathematics.

- The Table: 5.25 indicates that the calculated value of F=3.903 (p<0.01) for the interaction effect of factors attitude towards Mathematics, intelligence, mathematical weaknesses and SES (A X B X D X C) exceeds the critical value. Therefore 'F' ratio is significant at 0.01 level and the null hypothesis: 15 is rejected. So, there is significant difference between attitude towards mathematics, intelligence, mathematical weaknesses and SES on achievement in Mathematics. It concludes that attitude towards Mathematics, intelligence, mathematical weaknesses and SES jointly affect on achievement in Mathematics.

6.17. Discussion

Manyresearches have revealed that factors responsible for Mathematics achievement are intelligence, attitude towards Mathematics, study habits, reasoning, numerical ability, numerical aptitude, space visualisation, self concept, anxiety, academic motivation, SES, problem solving etc. The purpose of present study is to examine single as well as interaction effect of variables intelligence, attitude towards mathematics, SES and weaknesses in Mathematics on Mathematics achievement of standard VII students. The present study revealed that variables like intelligence, attitude towards mathematics, SES and weaknesses in Mathematics have impact on Mathematics achievement.

There is a huge body of researches which examined that attitude towards Mathematics is greatly affecting Mathematics achievement. Attitude towards Mathematics is positively and significantly associated with Mathematics achievement. In addition to this the present study also revealed that attitude

towards Mathematics has an impact on Mathematical achievement. The difference is in favour of students whose attitude towards Mathematics was very high. Jain (1979) studied correlates of high school failures in mathematics of Jammu division and found that the factor played a vital role in learning mathematics were attitude, abstract reasoning and numerical ability.A similar findings has been obtained by Patel (1984) and Ngailiankin (1991), Srinivasan (1999), Singh, Ahluwalia and Verma (1994); Sumangala (1995), Wangu, and Thomas (1995), and Thampuratty(1994). Marino (2005) has found that attitude toward learning Mathematics correlated with Mathematics achievement andSaun (2014) also studied that attitude towards Mathematics is one of the factor which is responsible for under achievement.

The accumulated research evidence shown that intelligence is one of the significant factor which is responsible for Mathematics achievement. Srivastava (1993), Sumangala (1995) and Patel (1997) have found that the higher level of intelligence, higher will be the achievement in mathematics.Lalithama (1975) has conducted study on secondary school pupils of standard IX and revealed that the achievement in mathematics positively related to intelligence and study habits. Sarala (1990) has also analysed conceptual errors of secondary school students and found that errors are influenced by intelligence and study habits. In this similar line the present study revealed that the difference was in favour of students whose intelligence issuperior.Thus, intelligence has an impact on the achievement in Mathematics.

The present study found that SES has an impact on Mathematics achievement. The difference was in favour of students whose SES is average. Lalithama (1975) has conducted study on 732 pupils of standard IX and Sarala (1990) has conducted study on 800 pupils of secondary students in the Trivendram revenue district. Stuudies revealed that achievement in mathematics positively related to SES. Patel (1997) has found that socio-economic level of parents had a large impact on the achievement. Nagalaksmi (1996) found that SES facilitated problem solving ability,Chen (2006) has examined that SES was correlated with Mathematicsachievement, while Srinivasan (1999) did not find any such relation.

Poor numerical ability, poor comprehension and deficiency to recall rules are also the part of weaknesses. Jain (1979), Kasat (1991), Ngailinkin (1991) found that poor numerical ability is also one of the responsible factor for Mathematics achievement. Rajyaguru (1991) has also revealed that numerical aptitude also affects Mathematics achievement. While Sashidharan (1992) has found that initial deficiency is also one of the responsible factors. Present study also explore that students whose Mathematical Weaknesses was very high, high, average, low and very low on Mathematical weaknesses scale do differ on their achievement in Mathematics and Mathematical weaknesses has an impact on Mathematical achievement. The difference was in favour of students whose Mathematical weakness was low.

In the present study investigator has also found the significant interaction effect of selected variables intelligence, attitude towards Mathematics, SES and mathematical weaknesses on Mathematics achievement.

6.18. Implications of the Present Study

Mathematics is considered as one of the important subject at every stage of the study. So, its study has been made compulsory upto secondary level. Due to its utilitarian, disciplinary, vocational and other values it has occupied very important place in education system. Mathematics is a subject which trains and exercise intellectual functions. So, it has occupied aimportant position in education system. Many researches have been done to study the relationship between various variables or correlates with Mathematics achievement and studies have contributed significant.

In the present study investigator has revealed single as well as interaction effect of variables intelligence, attitude towards Mathematics, SES and Mathematical weaknesses on Mathematics achievement. And study found that there is significant effect of attitude towards mathematics, intelligence, SES and weaknesses in Mathematics on Mathematics achievement. So, in any level of learning not only teaching-learning process but also some psychological factors like attitude, intelligence, deficiency in learning should be taken care of. Efforts should be made to know the previous record, personality of the students as well as from which type of SES bachground s/he belongs to give proper treatment. Teacher should find

ways to encourage students to learn Mathematics and there is a plan to provide instruction that will enhance their attitude towards Mathematics which leads to Mathematics achievement. Teachers should plan instruction in such a way which serves individual need, interest and intelligence. The finding of this study may assist theteachers to identify factors responsible for the Mathematics achievement.

6.19. Suggestions

The investigator attempts to put certain suggestions for Mathematics teachers as well as for further study based on the present research.

6.19.1. Suggestions for Mathematics teachers

➤ Teachers should make efforts to develop natural urge among students to learn mathematics.

➤ Teachers should give importance to the correction base drill work rather than mechanical teaching-learning of Mathematics.

➤ Teaching Mathematics has to bring correlated approach to enable the students to link previous knowledge with present knowledge.

➤ At primary stage, teachers should give more importance to develop numerical ability of students.

➤ Teaching of Mathematics should be based on individual instructions to develop proper understanding of Mathematics concepts and principles.

➤ Teaching Mathematics should invite child centre teaching and should allot appropriate time periods to Mathematics teaching.

➤ Teachers should incorporate various effective means like computer assisted instruction, number games etc. to make Mathematics learning effective and a better configuration of knowledge.

➤ Teachers should give motivation to enhance problem solving ability of student in Mathematics. So students should develop positive attitude towards Mathematics.

➤ Teachers should plan individual base and need base home work to serve individual differences in the class.

➤ Teachers should diagnose the learning difficulties in different area of Mathematics and analyse errors and plan remediation or intervention programme to cope up with it. Teacher can use branching programme to give remediation and concept clarity.

- Specially, in case of under achievers, teachers should develop learning materials to enhancement of Mathematics achievement. Through linear programming teacher can serve the purpose.
- Teacher should plan challenging experience and activity to develop higher order thinking skill.

6.19.2. Suggestions for further study

- Similar type of study can be conducted for different age group.
- Similar type of study can be conducted for other school subject as well as for overall achievement.
- Similar type of study can be conducted by taking different variables which significantly contribute in Mathematics achievement.
- An intervention programme can be developed to enhance attitude of students towards Mathematics and its effectiveness can be measured.
- A standardised test of mathematical weaknesses can be constructed for different levels of students as well as for different area in Mathematics.

6.20. Conclusion

In the present time Mathematics occupies an important place in school curriculum. Most of the students know the importance and usefulness of Mathematics even though its abstract nature and poor comprehension result underachievement. Present study as well as previous studies revealed that varieties of factors significantly affect Mathematics achievement. So, schools have an important role in overcoming these variables and promote Mathematics learning. Teachers should create classroom environment which involves active participation in the class as well as encourages students for exploration and investigation. This will further help the teacher and student both to make the teaching learning more meaningful and fruitful.