Chapter 2

REVIEW OF RELATED LITERATURE

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2.1 INTRODUCTION

Review of related literature provides a way of summarizing the state of the art of a field. It creates a real picture in front of the researcher about the work that has been carried out in an area of investigation. It enables the researcher with an up to date account and discussion of the research findings in a particular topic. It gives an insight to the methodology for carrying out research by studying about the ways other scholars have conducted their own research projects and the methodological approach followed by them. Seeing what others have done helps to understand our own research work. At times it leads to a more systematic planning for the steps of research. The critical analysis based on the review of the related work in a particular area directs to a more demanding study through identification of the research gaps.

This chapter is an attempt to give a brief sketch of the researches carried out in the field of mathematics education in India and abroad. The studies have been taken from 1970 to 2000. The sources used were: Sixth Survey of Educational Research 1992-2005, Fifth Survey of Educational Research 1988-92, Fourth Survey of Research in Education 1983-88, Dissertation Abstracts International, Indian Educational Abstracts, Research Abstracts in Primary Education 1994-2000, Theses and Journals.

The research scenario is given based on studies reported in Fourth, Fifth and Sixth Survey of Research in Education. A brief analysis about the variables, levels, areas is also specified. The research gaps identified in Fourth, Fifth and Sixth Survey is also mentioned. Implications for the present study are discussed along with the concerned study. Indian and foreign studies are presented separately. Studies dealing with diagnosis and remediation, both Indian and foreign studies, are dealt separately.

2.2 INDIAN STUDIES

The studies from First Survey, Second Survey, Third Survey, Fourth Survey, Fifth Survey, Sixth Survey, Indian Educational Abstracts, Perspectives in Education, Experiments in Education, and Research Abstracts in Primary Education have been discussed here. They are described under the five different sections as follows:

Achievement and Learning in Mathematics

Correlates of Achievement

Attitude towards Mathematics

Teaching of Mathematics

Diagnosis and Remediation

2.2.1 Achievement and Learning in Mathematics

Sharma (1978) studied achievement in mathematics of pupils of secondary schools with particular reference to the state of Assam. The sample included 1295 pupils from ten schools. The study was confined to the areas of arithmetic and algebra of school mathematics. A battery of sequential achievement tests, were constructed for standard five to ten The major factors found responsible for low achievement in mathematics were imparting of limited knowledge, blind use of heavy syllabus, lack of natural urge, in sufficient drill at primary and absence of methodical approach of classroom teaching.

Manika (1983) tried to investigate the relationship between acquisition of concept in mathematics and some personal and environmental variables of the pupils at primary school level in Bombay. The data was collected from 524 pupils from different schools of urban area from grade one through grade five. Some of the tools used were Raven's coloured progressive matrices, mathematical concept test. The Study revealed that: (i) the majority of the pupil who were promoted to the next grade did not show acquisition of concepts of the lower grade, (ii) pupils did not acquire any concept to the fullest form in one grade but the growth of concepts took place at all levels with different degrees of individual differences among the acquisition of mathematical concepts at primary school level, (iii) concepts of higher mathematical hierarchy could not be developed unless lower concepts were acquired, (iv) for the better development and acquisition of mathematical concepts, individualized instruction was found useful.

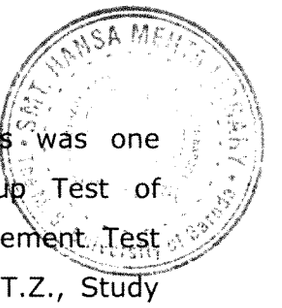
Shah (1985) made a psychometric exploration to study relationship between achievement in arithmetic and three psychological factors viz. intelligence, problems faced by children, parent-child relationship, in few primary schools in Choryasi Block for first grade. The sample was selected through the purposive sampling technique. A total population of 897 children was included from twenty two primary schools of choryasi block. Data was collected using Arithmetic Education Test, Interview Schedule for the parents, student problem inventory, Individual Intelligence Test. The major revelations were: (i) inattentiveness of parents towards children, (ii) schools had no special programmes for finding out

academically backward children. None of the schools had schedule for remedial teaching (iii) it was found some teachers were not qualified to teach arithmetic. They had to teach all subjects and they had not undergone any special training in teaching of mathematics.

Mohapatra (1990) looked into the critical appraisal of the secondary school mathematics curriculum of Orissa. The sample consisted of two hundred and twenty secondary school teachers and five hundred and fifty six students. The tools used were questionnaires for students studying mathematics and for teachers teaching mathematics. The mathematics teachers were conservative in their outlook as far as the objectives of teaching mathematics were concerned. They emphasised the Fundamental mathematical operations, familiarity with mathematical concepts and terms, development of mathematical skills, objectives like development of discipline, determination and a sense of proportion were given the least importance. The students were, by and large, pragmatic in their approach and considered mathematics to be a utilitarian subject. The teachers provided high ranking to the traditional topics and resisted the intrusion of new topics.

Sarangapani (1990) used the Piagetian view for analysing curriculum design and materials for critical evaluation of the NCERT primary mathematics series. Document analysis was used in the study. The concept of specific learning objectives and minimum levels of learning put forward by the National Curriculum Framework were found to militate against child-centredness. There was overall mismatch between the various tasks and objectives prescribed and the operational level of the age-group for which they were meant. Problems were either numerical computation or involve situations removed from the child's reality and did not encourage Operativity. All the concepts were sequenced logically rather than psychologically. There was also a high level of algorithmisaton which may help children in coping with what has to be learnt, but which will also impede conceptualisation, as it rules out the scope of children inventing conceptual links.

Rajyaguru (1991) studied the achievement in mathematics, personal characteristics and environmental characteristics of over-achievers and underachievers. The sample of one thousand and ninety three was selected by stratified, proportionate and cluster sampling. The subjects were selected from six Urban, six semi-urban and thirteen rural schools. The total number of



overachievers was one hundred thirty three and underachievers was one hundred and fourteen. The tools used were Desai-Bhatt Group Test of Intelligence Bhausar Numerical Aptitude Test. Mathematics Achievement Test developed by the researcher, Mathematics Anxiety Scale by Patel T.Z., Study Habit Inventory by Patel B.V., Mathematics Aptitude Scale by Desai, H.G , Interview Schedule and Rotter's Locus of Control Scale adopted by Bhogayata (in Gujarat). There was positive and significant correlation between (a) intelligence and achievement in mathematics, (b) achievement in mathematics and numerical aptitude, (c) intelligence and numerical aptitude. Overachievers and underachievers did not differ in (a) intelligence, (b) numerical aptitude, (c) locus of control. Overachievers had (a) better study habits, (b) more positive attitude towards mathematics and (c) less mathematics anxiety There was no association between achievement in mathematics and (a) sex, (b) with order of the students, (c) income of fathers, (d) locality. There was found association between achievement in mathematics and (a) fathers' academic achievement and (b) their receiving external help or not.

Dandapani (1992) identified the process variables and the characteristics of mathematics teachers which contribute to the effective teaching of mathematics. The sample consisted of six hundred and eighty nine teachers of high schools and higher secondary schools of Tanjore district in Tamilnadu. The tools used to collect data developed by the investigator included a Teacher's Perception Scale of Effective Teaching of Mathematics and Characteristics of Effective Mathematics Teachers Description form. It was found that female teachers had a significantly higher perception than the male teachers. Teacher's perception had been found to vary with their years of experience. The perception of teachers did not differ because of their qualification, place of work, type of management, type of school and number of periods of teaching mathematics.

Sashidharan (1992) investigated about learning intellectual skill as an educational outcome in relation to student entry characteristics and quality of instruction. The sample consisted of fifteen secondary schools of Palghat district. A total of 2432 students of standard ten were included, as sample The data was collected using the tools constructed by the researcher and also the tenth standard results of June, 1990. The major findings were: (i) the average academic achievement was less than pass mark. In the case of mathematics achievement results were still lower (ii) most of the students are not cognitively

prepared to learn mathematics, (iii) the prevailing promotion policy gives opportunities to children to attend tenth class even through 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.

Srivastava (1992) studied the learning outcomes in terms of objectives in mathematics. The sample consisted of one thousand and thirty students selected at random by multi-stage random sampling technique. The tools used in the study were: an Achievement Test in Mathematics, the Socio-economic Status Scale by S.P. Kulshreshta and the Culture Fair Test of Intelligence (Form A) by R.B. Cattell. Intelligence and socio-economic status both were such which contributed significantly and positively to the development of learning outcomes in mathematics in terms of knowledge, understanding, application and skill. Male and female students of urban schools showed better gains in all types of learning outcomes in mathematics than their counterparts of rural areas. Male and female students belonging to high socio-economic status group were better in all the four types of learning outcomes in comparison to low socio-economic status group.

Thampuratty (1994) examined the interaction effects of creativity, attitude towards problem solving and social position on the achievement of mathematics of secondary school pupils. The study was conducted on a sample of seven hundred seventy school pupils. The tools used were the Test of Achievement in Mathematics by Sumangala and Thampuratty, a Comprehensive Test of Creativity for Secondary school pupils by Sumangala, Scale of Attitude towards problem solving by Pillai and Scale for Social Position by Sumangala and Thampuratty. Significant differences existed in the mean scores of achievement in mathematics between the three group pairs of creativity. Significant differences existed in the mean scores of achievement in mathematics between three group pairs of attitude towards problem solving. Positive, high and significant relation existed between attitude towards problem solving and achievement in mathematics.

Nagalakshmi (1995) examined the construction of a problem-solving ability test in mathematics and also examined the problem-solving abilities of students of Class X in twin cities of Hyderabad. This study was conducted on one thousand students of Class X selected from, schools of twin cities in and around

Hyderabad using normative survey method. Tools used to collect the data included problem-solving ability test in mathematics and a personal data blank. There was a significant difference in the problem solving ability in mathematics of students of rural and urban areas in favour of the latter group. There was no difference between the performance of boys and girls regarding problem-solving ability in mathematics. The higher qualification of the parents, the better was the performance of the students with reference to problem-solving ability in mathematics. The school climate influenced the performance of the students.

Sharma (1999) studied the effect of mathematical instructions on students' performance interactions in mathematics. The researcher followed the following stages while developing mathematical exercises on the proposed topics. Stage I: Preparation of the program, Stage II: Writing the exercise, Stage III: Try-out for Modification, and Stage IV: Evaluation of the Program. The program developed by the researcher was evaluated on the basis of the try-out in terms of: (i) Error rate; (ii) Sequence progression; (iii) Criterion test findings and (iv) Exercises Analysis. Unit wise error rate, sequence program chart, criterion test findings and exercises analysis were prepared. Experimental findings in terms of error rate, criterion test and significance of difference between mean show that: (1) 85% of the learners were able to perform sums correctly. (2) 85% of the learners were able to perform 85% of the items of criterion test correctly. (3) Researcher also found that there was a significant difference in mathematics attainment of the learners studying through mathematical instructions as compared to conventional instructions.

Prakash (2000) investigated into the relationship between each of the independent variables i.e. problem solving ability, anxiety, environment including home, school, social and physical environment and socio-economic status with each of the dependent variables i.e. mathematical creativity and mathematical achievement. The sample comprised 400 students (boys and girls) of VII class who were studying in government / private senior secondary schools of rural-urban areas of Chandigarh. The sample was selected by stratified random sampling method. Comprehensive Anxiety Scale by Sinha, Socio-Economic Status Scale by Kulshreshtha, Test for Creativity Thinking in Mathematics by Moghe, Problem Solving Ability Test, Environmental Factors Scale and Achievement Test in Mathematics developed by researcher were used for data collection. The data were analyzed by mean, SD, t-test and correlation

technique. The findings of the study were: The variable of problem solving ability was found to be positively and significantly related with mathematical creativity of the elementary school children. The problem solving ability was having significantly positive correlation with the mathematical achievement. Mathematical creativity and mathematical achievement separately were found to be insignificantly correlated with anxiety. Environmental factor (total) and SES was found to be significantly positively correlated separately with mathematical creativity and mathematical achievement.

Patel (2002) worked on Construction and Standardization of an Achievement Test in Mathematics for the students of Grade IX. A sample of 3012 students of grade IX was selected by stratified random sampling method from among the secondary schools of 25 districts of the state of Gujarat. Initially 399 objective type items were constructed on the basis of syllabus of grade IX and was tried out on 178 students. Item analysis was done and 50 items for which point biserial was significant at 0.05 levels were selected for the final test. The reliability of the test was established by Test-Retest Method and Rational Equivalence method. It was found to be 0.73 to 0.89. Face validity of the test was established using opinions of the teachers and the concurrent validity was established using school examination results and intelligence test. It was found to be between 0.7 and 0.89. The Norms were established using percentile rank and T-Scores. The major findings of the study were: (1) There was no significant difference in the achievements of mathematics between boys and girls of state of Gujarat. (2) Students of Kutch had higher achievements in mathematics as compared to the students of Northern Gujarat, Central Gujarat, Southern Gujarat and Saurastra. (3) Difference in the achievement in mathematics of boys and girls of Central Gujarat, Southern Gujarat and Saurastra was found significant and hence separate norms for boys and girls were developed for those areas.

Patel (2007) developed a programme for enhancing achievement of the students of class X in mathematics. The tools used for the data collection were information schedule for students, questionnaire for students, teachers and parents, unit tests and achievement test. It was a single group pre-test post-test design. Multi-stage cluster sampling was used and the size of the sample was seventy students. The programme for locating the weaknesses related to the prerequisite for teaching each unit and remediating it prior to teaching was

developed and implemented. It was found using 't' test that the programmme was effective and students were able to score high in the achievement test.

2.2.2 Correlates of Achievement

Lalithama (1975) studied some factors affecting achievement of secondary school pupils in mathematics. The study was conducted on 732 pupils of standard nine selected on a stratified random basis. The tools used were a standardized achievement test in mathematics, a study habit inventory and Raven's standard progressive Matrices. Major findings of the study were: (i) achievement in mathematics was positively related to intelligence, interest in mathematics, study habits, socio-economic status, (ii) studying lessons daily, repetition in learning, influenced the achievement in mathematics positively.

Pal (1989) attempted to find the affective outcomes of students as predictors of their mathematical ability. The sample consisted of six hundred students from rural and urban schools. The tools used were a test on Self-concept in Mathematics, a test of Attitude towards Mathematics, a test of Anxiety towards Mathematics and a questionnaire on Academic Motivation. It was found boys showed higher self-concept than girls. There existed significant correlation between mathematics self-concept, between mathematics and anxiety, between mathematics and attitude, between mathematics and academic motivation.

Baskaran (1991) studied the relationship among achievement motivation, attitude towards problem-solving and achievement in mathematics. The sample was selected by stratified sampling technique. Among the total of two hundred students, hundred were boys and hundred were girls. The researcher prepared a tool with three parts in it having achievement. Motivation Inventory Test as the first part, Attitude Scale as the second part, and Achievement Test in Mathematics as standard tenth as the final part. There was a positive relationship between the attitude towards problem solving and achievement in mathematics. Urban and rural students did not differ in their (a) achievement motivation, (b) attitude towards mathematics. Urban and rural students differ significantly in their mathematics achievement in mathematics.

Ngailiankin (1991) attempted to identify variables associated with achievement in mathematics. The sample consisted of all class ten students studying §She Central Schools located in the states of Nagaland, Meghalaya, Manipur. The tools used were Achievement Test in Mathematics, Attitude Scale

to measure attitude towards mathematics. Educational Aspiration Scale by Sharma and Gupta, occupational Aspiration Scale of Grewal, Differential Aptitude Test, and Cattell's 14 High School Personality Questionnaire. There was a significant association between (i) attitude towards mathematics (ii) educational aspiration (iii) numerical ability (iv) abstract reasoning and achievement in mathematics.

Rangappa (1992) investigated into the relationship between self-concept, reading ability and achievement in mathematics. The sample of thousand students of standard seven was selected by using stratified random sampling technique. The tools used were self-concept inventory developed by the researcher, a standardised reading test by Deve Gawda and Shivananda and Achievement Test in Mathematics. There was no significant difference in the achievement of students having different levels of self-concept. There was a significant difference in the performance of the students of rural and urban schools. There was a significant difference in the achievement of students having different levels of reading ability.

Setia (1992) addressed to the theoretical understanding of the achievement of learners at the senior secondary stage in modern mathematics in relation to socio-psychological and educational factors. The sample consisted of five hundred and ten senior secondary students and forty two teachers. The tools used were the Group Test of General Mental Ability of Tondon, the Socio - economic Status Scale of Trivedi and Udai Pareek, the Modern Mathematical Concept Test, Classroom Behaviour Questionnaire. The study found the intellectual level of rapid and average learners, SES of slow learners, personality traits of rapid average and slow learners and adjustment of rapid learners correlated significantly with their achievement in modern mathematics.

Gupta, Mukerjee, & Chatterji (1993) attempted to identify the factors affecting the academic achievement of adolescents studying in Class X in the State of West Bengal. The sample of the study comprised 1,453 subjects who were selected by stratified sampling procedure from 64 schools registered under West Bengal Board of Secondary Education. These students were all studying in Class X. Raven's Standard Progressive Matrices (SPM), Achievement Motivation Test (AMT) of Prayag Mehta and Prolonged Deprivation Scale (PDS) of Tripathi and Misra were used as tools to collect data for the study. Out of the four groups, urban girls had the least deprived average followed by that of urban

boys. The most deprived group was the group of rural boys. The rural girls were more motivated for achievement than other three groups. Intelligence was found to be most closely positively related to academic achievement but not to achievement motivation. The prolonged deprivation had negative relation with academic achievement. It was observed that girls, both of rural and urban origin were more motivated than boys. Girls in general were found more serious than the boys, possessed self respect which generated achievement motivation.

Sumangala (1995) studied some psychological variables discriminating between high and low achievers in mathematics. The study was conducted on a stratified sample of 750 (362 boys and 388 girls) students of Standard IX drawn from twenty schools of five revenue districts of Kerala. Tools used included Test of Mathematics Aptitude by Sumangala and Malini, Scale of Attitude towards Mathematics by Sumangala and Sunny, Scale of Self-concept in Mathematics by Sumangala and Malini and Generalized Test of Achievement in Mathematics by Sumangala and Jayasree. Mathematics Aptitude and its components viz., Numerical Ability, Numerical Reasoning, Ability to use Symbols, Spatial Ability and Abstract Reasoning, Attitude towards Mathematics and Self-Concept in Mathematics discriminated significantly between high and low achievers in Mathematics. The relation among the independent variables, Mathematics, Aptitude and its components viz., Numerical Ability, Numerical Reasoning, Ability to use Symbols, Spatial Ability and Abstract Reasoning, Attitude towards Mathematics and Self-Concept in Mathematics with Achievement in Mathematics were significant and positive.

Verma (1996) explored the main and interaction effects of intellectual ability and test anxiety on achievement in four school courses viz., English, mathematics, general science and social studies. The sample of the study comprised 500 students studying in Class X in ten government secondary schools of Delhi. These subjects were selected by random cluster sampling technique. The tools used to collect the data were the Group General Mental Ability (Hindi) by Jalota and Test Anxiety Inventory (Hindi) by Sharma, Sud and Spielberger. Achievement marks were noted from official records of the concerned schools. It was found that there were significant main effects of both intellectual ability and test anxiety on achievement of students in all the four school courses. However, interaction between the two variables was obtained in case of mathematics and general science only. In case of interaction, it was

observed that in mathematics and general science, high intellectual ability students on the average performed worse under high test anxiety condition but there was no significant difference in academic performance of low intellectual ability students under high and low test anxiety conditions in each of the two above mentioned courses.

Usha (2001) studied the Influence of Intelligence and Creativity on the Achievement in Mathematics among X Class Students. The study focused on identification of the levels of Intelligence and Creativity among X class students and their relation with the Achievement in Mathematics among the X students. For the study, sample comprised to 2000 students of class X studying in English and Telugu medium schools of Visakhapatnam district. Random technique was used for sampling. The study was descriptive in nature. Data Collection was done with the help of Standard Progressive Matrices (SPM) by Raven (1941) and Creativity scale developed by investigator. Mean, standard deviation, coefficient of correlation and regression equation techniques were used for data analysis. The findings of study were: (1) There is a significant positive relationship between Intelligence and Achievement in Mathematics, and significant positive correlation between Creativity and Achievement in Mathematics. (2) There exists a significant positive relationship between Intelligence and Creativity.

Shah (2004) investigated into the Conservation Ability of the Pupils as Predictor of Understanding of the Mathematical Concepts Embedded in the Syllabus of the Standard VIII and IX of the Gujarat state. A representative sample of 400 boys and girls was selected from urban and rural areas of Sabarkantha District by using Cluster Sampling Method. The Survey Method was used. The data were collected by administering Conservation Ability Test (Jean Piaget) and an SES scale developed by K.G. Desai. Using a sheet collected the primary data regarding the pupils and their parents. The data were analyzed with the help of 2 x 2 x 2 x 2 Factorial Design ANOVA and other non-parametric methods. The main findings were (1) The pupils belonging to high SES level were better than their counterparts. (2) Parents education level was also responsible. (3) Pupils having high conservation could perform better than these having low conservation ability. (4)Conservation had all pervading effect as main and as interactive factor, too. As Jean Piaget proved, it was the central, pivotal factor in educational career of the pupils. The pupils having conservation ability could understand Mathematical sub-concepts easily.

2.2.3 Attitude towards Mathematics

Rosaly (1992) attempted to find out whether high school students have a favourable attitude towards learning mathematics and whether their attitude affect their achievement in mathematics. The sample comprised of two hundred students of standard tenth in eight high schools in Dindigul, Tamilnadu. A Mathematics Attitude Scale and an Achievement Test in Mathematics were constructed and used in the study. It was found that the attitude of high school students towards learning mathematics and their achievement in mathematics were related. Urban boys and girls had a more positive attitude towards mathematics than rural boys and girls.

Singh, Ahluwalia, Sudarshan & Verma (1994) attempted to study the attitude towards mathematics as a function of some individual characteristics like sex, age and intelligence. The sample comprised 220 students of Grade IX studying mathematics in different schools of Education Department of Bhilai Steel Plant, Bhilai (Madhya Pradesh). They were divided into, High Intelligence Group (HIG), Average Intelligence Group (AIG), Low Intelligence Group (LIG), male and female groups 13+, 14+ and 15+ year groups. The tools used were the General Intelligence Test developed and standardised by S.M. Mohsin and the Attitude towards Mathematics Scale developed and standardised by Suydam, M.N. The students of high intelligence group had more favourable attitude towards mathematics compared to the students of both average and low intelligence groups. The students of average intelligence had a more favourable attitude towards mathematics than the students of low intelligence. The males did not have a more favourable attitude towards mathematics than females.

Stella, Anthony & Purushothaman (1995) attempted to study the attitude of the underachievers in mathematics with reference to sex, locale, IQ and achievement level. The sample of the study comprised 30 underachievers from each IQ category, high, average and low students studying in Class IX who were selected from three Tamil Nadu State Board Schools belonging to rural and urban areas. Tools used to collect the data included Culture Fair Intelligence Test, Scale 2, Form B of R.B Cattell and A.K.S. Cattell, and the Mathematics Study Attitude Scale of Sundararajan and Srinivasan. It was found that there existed a significant difference between the mathematics study attitude of high and low achieving students, rural and urban students, and high and low IQ

groups. The boys and girls did not differ significantly on their mathematics study attitude.

Wangu & Thomas (1995) assessed the attitude towards the achievement in Mathematics among high school students of tribal town of Aizawl. The sample of the Study comprised 300 students, covering both boys and girls, studying in Class IX of high schools of Aizwal. They were selected on the basis of stratified random sampling technique. The tools used to collect the data included the Achievement Test in Mathematics for Class IX of Ram, and the Attitude towards Mathematics Scale. It was found that there was a significant positive correlation between the scores of attitude towards and achievement in mathematics for the total sample as well as the sub-groups.

2.2.4 Teaching of Mathematics

Trivedi (1980) studied the use of branching variety of programmed learning materials in mathematics as a diagnostic and remedial tool. The sample of 80 students of class V, VI, VII, 40 male students and 40 female were divided into two groups randomly. One was control group and the other taught by the programmed learning technique. The tools used were the pre-test, the intelligence test, the programmed learning material in branching style and the post test. The major findings were:

The mean scores obtained by the conventional group students is higher than the mean scores obtained by the programmed learning group of standards V while for standards VI and VII the programme learning group achieved higher mean scores than the conventional group. There was no significant difference between the mean scores of achievement of two methods

Chitkara (1985) studied the effectiveness of different strategies of Teaching on Achievement in mathematics. In the study a pre test, post test experimental design was followed. The strategies of teaching varied in three ways (a) lecture - discussion (b) inductive - drill and (c) auto – instruction group discussion. The variable of intelligence had three levels - low average, and above average. A sample of 300 students was randomly selected from grade IX students of four schools of Chandigarh. The students were divided into three groups of 100 each. One group was taught mathematics through lecture discussion the second group was taught mathematics through inductive - drill and the third group was taught mathematics through auto-instruction group

discussion. The data collected through pre test and post test were analysed through four ways (3x2 x 2x3) analysis of variance. The major findings were:

i) All the three strategies were found to be equally effective in terms of achievement in mathematics disregarding levels of intelligence sex and personality type.

ii) Lecture discussion strategy was found in favour of average ability students as they scored significantly higher than above - average and below average groups.

iii) Inductive - drill and auto instruction group discussion was more suited to the students having above average intelligence than average and below-average intelligence.

Kothari (1985) investigated the efficacy of different instructional media into the teaching of mathematics to the pupils of class IX in relation to certain variables. The sample of 120 students was selected from two schools of Anand. The tools used were Junior Index of Motivation, Reasoning Ability and Criterion Tests. The study disclosed under observation that pupils were very eager to know about the different instructional media. It was their demand that all the units of mathematics should be taught through visual projection. In case of instructional media namely Activities and experiment, pupils were very busy in drawing figures. They enjoyed studying through this media as it was activity oriented. Visual Projection is comparatively more effective than any other Instructional media like Activities and experiment or even programmed learning material for teaching of mathematics. The low achieving pupils are comparatively more benefited by programmed learning material than the high achievers and the average achieving pupils.

Shashikala Devi (1987) studied an analytical study of effective Mathematics teaching. The study was conducted under two phases the first on the identification of effective mathematics teachers and the second analysing their teaching. The sample was 14 teachers, each teacher's 14 lessons were observed. Tools used were questionnaire for head masters, Questionnaire for teachers, bio-data sheet for teachers, Teacher's dairy, Observation schedule, pro-forma for the study of student's books, interview schedule for teachers. The major findings were:

It was found that explaining, eliciting through questioning, teacher's working out model problems, black board work, independent work by

the students, giving individual guidance, providing feedback and giving assignments were the important and most often used ingredients of effective teaching. Findings of the study suggested for Teacher's training programme regarding the specific skills which are found to characterize effective mathematics Teaching, the black board work, giving graded drill problems, making the students do independent work giving individual guidance and providing feed back.

Srivastava (1990) studied effectiveness of programmed learning as a function of anxiety under different motivational conditions. The sample comprised 257 students of urban schools and 286 students of rural school students in classes IX and X on stratified random basis. The tools used were Different Aptitude Test (DAT), Achievement test, Achievement Anxiety test. The major findings were: The use of programmed learning as a teaching device was particularly helpful for low and average achievers. Knowledge of the result and praise by the teacher were good motivators. The third motivational condition - reward under competition.

Gangopadhyay (1991) attempted to investigate the relative effectiveness of teacher's class-room teaching techniques in relation to students' achievement. The sample of 100 students of class IX divided in to four groups. The 15 teaching units were planned in lessons of four types. The tools used included Test of intelligence, pre-test and post test for Achievement. Major findings were: Technique T2 (lecturing and explanation) showed more effectiveness than T1 (lecturing). Technique T3 (lecturing and explanation with questioning answering) showed move effectiveness than T2 (lecturing and explanation) and T1 (lecturing) at the post-test level. Technique T4 (lecturing and explanation with question-answering by using feedback sequence) showed more effectiveness than T3, T2, and T1 at the post test level.

Singh (1992) compared the results of computer assisted instruction (CAI) with conventional method of instruction in teaching mathematics for certain selected units of the mathematical curriculum. The study was conducted in four higher secondary schools having facilities of three to five BBC micro computers. The students belonged to different socio-economic groups. Three units of the mathematics syllabus for class IX namely, simultaneous equations in algebra, statistical data and their graphical representation in

statistics and triangles and their congruence in geometry were chosen for the study. The tools used in the study included rating scale by the researcher, Genus Intelligence Test the Attitude scale towards Mathematics and educational software. The statistical techniques used included mean, and't' test for data analysis. The Major findings were: The group taught through CAT in all the schools showed a substantial progress. The CAI method of teaching mathematics had proved to be more effective. Both boys and girls gained from the computer treatment. A significant favourable change in the attitude of the pupils of the experimental groups over the control groups was observed.

Mishra (1998) Carried out a study on the effective use of the OB materials and other TLM to adopt joyful and activity-centred learning in mathematics in classes I to III of Sadar block of Keonjhar District. The data was collected from 20 schools (10 experimental and 10 controlled schools chosen on a random basis) involving 480 students and 27 teachers (for training them in the use of TLM and OB kits) selected randomly. The following tools, developed by the investigator in a workshop, were used: a questionnaire for teachers, classroom observation schedule, an interview schedule to record the reactions of students and students' achievement test. Major findings were: (1) Teachers with better knowledge to utilize TLM were found to have applied it more effectively. (2) The teachers evinced a great deal of motivation and resourcefulness in preparing improved and low cost teaching aids. (3) Mere a supply of TLM to schools without an understanding of its effective use was not of much help in improving the teaching process. (4) Effective utilisation of TLM encouraged students' participation in the teaching learning process much more effectually. (5) There was significant difference in the level of achievement in mathematics by students of the experimental group compared to their counterparts in the control group.

Kalita (1999) studied the impact of standard of teaching mathematics in primary classes of Chapor block in Dhubri District. The required data for the study was collected from 12 lower primary schools (out of 119). The tools used for data collection were interview schedule for mathematics teachers and head teachers, focus group discussion schedules, classroom observation schedule and achievement test for class I and II students. Major findings were: (1) The level of learning of teachers on approach was moderate. In some areas like moving from known concept to un-known one, simple to complex the level of learning of teachers was more. (2) The level of learning of teachers in areas of shape and

colour, relating to pre-number concepts were found to be excellent whereas in areas of size, weight & height it ranged from little to moderate. (3) The group-wise level of learning of class I students ranged from fair to good. The SC category of students scored the highest mean (62.67) whereas General category scored the lowest (54.40). (4) The group-wise level of learning of class II ranged from fair to excellent. The ST category scored the highest mean (78.13) the Char areas had the lowest mean (64.13). (5) The impact of DPEP intervention on mathematics teaching among teachers in terms of use of teaching aids in classroom transactions ranged from moderate to high.

Sarma (1999) prepared a study report on improvement of teaching mathematics in primary classes. The data for the study was collected from 60 schools, 111 teachers, and 1,200 students from Kalaigaon and Mazbat blocks in Darrang District. 10% of the total schools and 10 children each from class I and II were selected randomly after stratifying them into boys and girls. Interview schedule, focus group discussions (FGD) schedule, classroom observation schedule and achievement test for class I & II were the tools used for data collection. Major finding was in the area of new approach only 39% of the teachers scored good {viz 60-79% correct response) and only 6% of the teachers scored very good {viz 80% and higher). In the conceptual area, only 7% teachers scored good, though none of them scored a very good ranking.

Mukherjee (2001) Developed a Mastery Learning Program Based on Competencies in Mathematics for Standard III. The study focused on the improvement of the program for pupils having less than 50% achievement. The treatment continued for 60 days. Posttests were conducted to check the retention of teaching, one month later the implementation of the mastery-learning program. Data were analyzed by using criteria based percentage and ANCOVA. The findings of the study were: (1) Mastery is attained by the students of experimental group in all three areas, viz., measurement, fraction, geometry. As per the result of total score of posttest I and II, none of the students from control group achieved mastery, whereas in experimental group six students achieved good mastery in posttest I. Thirty-three students in posttest I and forty students in posttest II achieved excellently. One student in posttest I achieved complete mastery.

Babu (2002) evaluated the content and teaching of mathematics. An effort was made to study the opinion of the practicing mathematics teachers and subject

experts about the existing textbooks of mathematics prescribed by the government and to find out the awareness of the teachers of primary school on minimum levels of learning. The effectiveness of teaching of mathematics was also studied. The tools used were questionnaire for teachers and subject experts, classroom observation schedule and achievement test and socio-economic status scale. A favorable opinion was expressed by majority of the teachers and subject experts regarding existing mathematics textbooks of classes 3 and 5 published by the government of Andhra Pradesh on various aspects. In general, the awareness on minimum levels of learning among the teachers of class-3 and class-5 was 'low'. Majority of the teachers in the classrooms did not use any teaching-aids except the blackboard. However, the effective use of blackboard was found to be moderate, when used.

Kumar (2008) investigates on the formation of concepts in mathematics among the pupils of std. VI, VII, VIII & its relation to correlated approach in teaching learning process. The sample consisted of 948 students from the three randomly selected schools in greater Mumbai affiliated to the Maharashtra state Board of secondary & higher secondary education, Pune. The design of the study was Experimental Post test only Control group design. Tools used were Achievement Tests & data was analyzed using Mean, SD, T-test. It was found that the students who were taught using correlated approach were highly benefited. Knowledge when perceived as a whole, enables the pupils to link the previous knowledge with the present knowledge & form a better configuration of knowledge.

2.2.5 Diagnosis and Remediation

Lulla (1966) investigated the academic causes of backwardness in mathematics at the primary stage. A questionnaire was prepared and administered. The major findings were: (i) the syllabus was out-dated, lopsided, impractical, and for away from the realities, (ii) some content in the syllabus was difficult to teach. (iii) overcrowded classes, frequent transfer of teachers, irregularities of attendance contributed a lot to the low achievement of the pupils.

Das and Barua (1968) tried to find the effect of remedial teaching in arithmetic for grade four pupils of Assam. For the purpose of diagnosis of individual differences, F.J. Schnoll's Diagnostic Arithmetic Tests were adopted. Pretest-post test experimental control group design was followed In each group

there were thirty grade four pupils. The major conclusion of the study was that remedial teaching has definitely improved the achievements in arithmetic.

S.I.E. Guj. (1969) studied the basic arithmetic skills of computing addition, subtraction, multiplication and division by a diagnostic test. The sample for the study consisted of 131 pupils of standard five, 127 of standard six and eighty three of Standard eight. A diagnostic test was prepared, consisting of addition, subtraction, multiplication and division of integers and fractions for pupils of standard five, six and seven and to provide remedial teaching in the light of mistakes. It was found that: (i) when mistakes were diagnosed and remedied pupils progressed well in mathematics (ii) Pupils did not know the entire process of addition, subtraction, multiplication and addition.

Ashar (1972) constructed and standardized a diagnostic test in basic algebraic skills for Gujarati medium pupils of secondary schools. The sample consisted of 268 students in all of eight, nine, ten grade, from five different schools. Norms in terms of standard scores, percentiles, stanines were established. Some of the findings were: (i) pupils committed errors due to lack of systematic approach, (ii) the errors of conceptual type predominated the computational type. (iii) trends of errors continued to a greater extent in the higher grades.

Gupta (1972) studied backwardness in mathematic skills. The purpose was to provide a standardized tool to the teachers and researchers to be able to diagnose the weak areas in mathematics. The pretreatment tests were administered to 294 boys and 265 girls of grade eight out of which 180 boys and 176 girls were selected for final study. Diagnostic test in basic arithmetic was constructed to measure command over basic skills. The achievement in mathematics was measured by the mathematics Achievement Survey test prepared by NCERT.

Bhirud (1975) constructed and standardized a diagnostic test in algebra. The main purpose of the study was to construct and standardize a diagnostic test related to some selected units of factorization of grade nine. The try out test was administered to 370 pupils. Final test consisted of fifty-four items. It was administered to 1,044 pupils. Remedial exercises has been developed and outlined. The study revealed that weakness about signs, coefficients and indices were some of the basic hindrances to understand and perform algebraic factorization.

Jain (1979) conducted a study of the significant correlates of high school failures in mathematics and English. The data was collected by the use of measuring devices English ability test, mathematics ability test. Two groups of students, successful and failures in both the subjects were isolated and selected. The major finding was that factors affecting learning mathematics were intelligence, abstract reasoning, numerical ability, mathematical background, knowledge of mathematical concepts, rules, and principles.

Thakore (1980) constructed diagnostic tests and prepared remedial material as well as testing its effectiveness on fractions and decimals for the students of grade five of Gujarati Medium schools in greater Bombay. The major aim was construction of diagnostic tests followed by preparation of remedial material and testing its effectiveness. The major findings were: (i) the students of grade five did not have clear concept of fractions. Simplification was found to be a difficult process for them (ii) Students did not understand the place values of respective figures in decimal fractions. (iii) They did not understand addition, subtraction, multiplication and division of decimal fractions.

Bhattacharya (1982) conducted a study pertaining to diagnosis and prevention of learning disabilities of primary school students in arithmetic. A diagnostic tool in common fraction was administered in 450 students of grade five and 500 students of grade six in case of decimal fractions. The major findings were: (i) the experimental group had achieved significantly more than the control group, wherein the experimental group was taught by audio-visual materials, (ii) the experimental group showed better results and prolonged memory of the learned Materials than the control group.

Rastogi (1983) attempted to diagnose weakness in arithmetic, related to basic arithmetic skills and their remedial measures of standard eight students. The design of the study was experimental in nature. A diagnostic test in basic arithmetic skills was constructed and standardized. The final sample consisted of 406 students of grade eight, of nine different schools of Arunachal Pradesh. The study revealed that: (i) one of the important causes of backwardness in mathematics was the poor command over basic arithmetic skills, (ii) when command over basic arithmetic skills improved, attitudes towards mathematics became favourable and achievement in mathematics increased (iii) basic arithmetic skills could very quickly and conveniently be mastered by the course of self-help in basic arithmetic skills as developed during the study.

Bhardwaj (1987) standardized a comprehensive diagnostic test and prepared remedial material for middle school students of Haryana. Test was standardized on a sample of 1146 students. It was found that there was significant improvement in achievement of the students after they had gone through the remedial exercises.

Jain & Burad (1988) studied the problem of low results in compulsory mathematics at the secondary level examination in the state of Rajasthan. The sample of the study comprised of rural and urban boys and girls of 100 government and private schools with lower results than those of the private students of Rajasthan. The heads of the institutions were also involved. The tools used to collect data included questionnaires, for subjects experts, for heads of the institutions, for subject teachers and for students. Non-availability of mathematics teachers due to late appointment and frequent transfers, lack of appropriate classrooms, blackboards and other physical facilities, irregular attendance of students, teacher's habit of leaving the headquarters daily and lack of residential facilities in some difficult areas were the administrative causes. A low standard in the lower classes, non-availability of text books, lack of timely correction of homework, an overburdened and uninteresting curriculum, lack of child-centred training, overcrowded classrooms, lack of sufficient periods for the subject, use of guidebooks by students, lack of proper supervision were the academic causes.

Chel (1990) attempted to diagnose and suggest remediation of underachievement in the compulsory mathematics of the madhymik examination in West Bengal. The sample comprised urban, semi-urban and rural students of Class VI to X of West Bengal. The case study method was used in collecting the data. The main difficulties faced by students included content gaps, confusion in understanding mathematics language, stereotype way of presenting contents and lack of openness in training. The major mistakes found in the performances of students and teacher trainees in the area include mathematisation of verbal problems, interpretation of mathematics results and learning new topics in mathematics. Underachievement was caused due to lack of understanding of mathematics concepts of the earlier stage and the abstract nature of the mathematics.

Dutta (1990) discussed diagnosis and prevention of learning disabilities in the reasoning powers of the students in geometry. The study consisted of preventive

measures adopted by experimenter with the help of audio-visual methods and techniques. The sample comprised of 148 students covering both the genders and belonging to both rural and urban areas. Using an experimental design, the study was conducted using a diagnostic test, an attainment test and a teaching strategy. The collected data were treated with ANOVA. Major findings were: The experimental taught by audio-visual materials and techniques achieved significantly more than the control group taught by conventional method. The experimental group showed more prolonged retention and interest in the lesson than the control group. It was also found that the preventive measures had a positive impact on the group and showed more interest in the lesson.

Gurusamy (1990) attempted to diagnose the errors committed by students of class IX in solving problems in geometry, and has developed a remedial package. The case study method was used to observe the causes of committing errors by the students in solving geometry problem, questionnaire developed by the investigator was sent to 20 expert geometry teachers of standard IX. Percentages were computed for comparison and interpretation of errors. The collected data were treated with mean, standard deviation and 't' test. The remedial package was designed and implemented to the students. It was claimed that the remedial package leads to considerable reduction in errors in geometry by the students and the level of performance of the students was high.

Sarala (1990) surveyed the conceptual errors of secondary school pupils in learning selected areas in mathematics. The sample comprised of eight hundred pupils from secondary schools in Trivandrum revenue district. The tools used were diagnostic tests in sets, trignometry and in statistics, the Non-verbal test of Intelligence by Nafde, personal data sheet. The major findings were that the number of conceptual errors committed by secondary school pupils in the areas selected for the study was very high, Conceptual errors in mathematics were seen to be influenced by sex, locality of school, management of school, intelligence, study habits, socio-economic status and caste.

Kasat (1991) attempted to identify the causes of the large failures in mathematics at SSC examination marathi medium high school students in Palghar Tahsil. The sample of the study comprised of 200 students (100 B&G) of 25 marathi medium high schools of Palghar Tehsil between October 88 and October 89, who had failed in mathematics. Standardised tests of numerical ability and a self-made questionnaire for teachers were used to collect data. Low

intelligence, poor numerical ability, poor comprehensive and recall ability, no interest in mathematics and poor study habits were the causes of the large failures of boys and girls. Percentage, rational and algebraic expression, variation, probability and statistics were difficult topics in mathematics. The parents being illiterate could not help the children at home. There were no finances for audio-visual aids in the school. The teacher found that the mathematical curriculum was not child centered. Topics such as percentage and shares were difficult in arithmetic; circle, arc and area were difficult to teach in geometry.

Kapur & Rasario (1992) conducted intervention strategies for students with problems in learning arithmetic. The sample consisted of twenty five students in the age group of eight to eleven years of class four, having significant problems in learning arithmetic. Tools used in the study were the Wesheler Intelligence Scale for children and a short form of arithmetic test based on Schonell Diagnostic Arithmetic Test. It was found that: (i) despite having average intellectual abilities and having regular classroom coaching, many students fail to perform well in arithmetic. (ii) Students with problems in learning can be helped through remedial education which has varied instructional objectives.

Busamma (1995) constructed a Standardized Diagnostic Tests in Exponents and Powers for Class VII students. Using Stratified Random Sampling Technique, 1332 students of Class VII from 30 different primary, upper primary and high Schools of Hyderabad and Ranga Reddy Districts served as sample. Tools used included a Personal Data Blank and Diagnostic Test in Exponents and Powers (DETP). Mean, median, mode, SD, co-efficient of variation, skewness, kurtosis, percentile points, t-test, F-Tests and Measurement and Scheffe's Tests and Measurement for multiple comparison of the groups, student item chart, student error chart and polarogram were used to treat the data. The major findings of the study were: (1) Urban students proved to be better Achievers than rural students on DTEP. (2) The Private School students proved to be better Achievers as compared to the Government School students. (3) Girls were sufficiently better Achievers than boys on DTEP.

Subramaniam & Singh (1996) studied the mistakes committed by students in the application of different mathematical skills and developing preventive and remedial teaching strategies using metacognitive approach for qualitative improvement in teaching of mathematics. The data were collected from eight

government primary schools in the districts (Sehore and Bilaspur districts of MP). Each school was visited on three consecutive days. On the first day, test in mathematics was administered to children. These children were interviewed on the second day. On the last day, mistakes committed by children were identified, analysed and classified through a workshop and the recorded diagrams were scanned. Finally a compendium of mistakes was prepared. The Major findings were: (I) The students committed six types of mistake in addition, eight types of mistake in subtraction, 10 types of mistakes in multiplication and six types of mistakes in division. (2) Some students felt that due to confusion between multiplication and addition signs, forgetfulness of the procedures, lack of opportunity to write on the note book etc, they committed mistakes in the test. (3) Poor concept of: carrying over, zero & multiplication, introvert behaviour, lack of writing skills, etc were observed as possible causes of mistakes committed by students. (4) The teachers of the schools cited home environment, SES, physical facilities in the school, extra workload on teachers, lack of interest, motivation and discipline, large size of class, general promotion policy, etc responsible for the poor performance of children in the test.

Viswanathan (1997) studied the Effect of Diagnostic Error Learning Strategy on the Achievement of Slow Learners of Standard IX in Mathematics. Experimental method with equated group design was adopted for the study. Both the groups, the experimental and the controlled group, consisted of 150 subjects each. The tools used were: A Diagnostic test in Mathematics for standard IX pupils, Achievement test in Mathematics for standard IX by C.P.Sreekantan Nair and Viswanathan K.S., Raven's Progressive Matrices for measuring intelligence of Slow Learners of IX standard, and Attitude scale towards problem solving. The data were analyzed with the help of t-test. The findings were: There is positive significant difference in the achievement of Slow Learners treated with Diagnostic Error Learning Strategy when compared with those taught using conventional method. Slow Learners of experimental group performed better in retention than those in the control group.

Warute (1998) Developed Remedial Materials in Mathematics for Standard I and II. The focus of the study was to find out the gap between expected performance and the actual performance in mathematics of the students of standard I and II and to trace the trends of deficiencies (Hard Spots) in mathematics among these children followed by implementation of remedial

materials. The two groups pretest-posttest design was used for experimental study. Groups were equated on IQ and SES factors. The remedial programs, developed for the study, included instructions, games and practice sheets in mathematics. The findings of study were: (1) A large number of students in the conventional classroom situation do not achieve the expected level of performance in mathematics even at the end of the academic year in standard I and II. (2) All students learn concepts differently. (4) Concrete materials help standard I and II students in understanding and acquiring mastery over the mathematical skills. (5) Remedial materials help in improving the performance of students in mathematics. In standard I scores improved from 20% to 35%, similarly, in standard II scores improved from 37.5% to 81.25% after using the remedial program.

Ramanuj & Shah (1999) diagnosed students' deficiencies in learning area-'fraction' of class IV mathematics (Gujarat: GCERT). The study was on construction of a diagnostic test to diagnose deficiencies of the students in learning area: fraction. The sample of the study comprised of all the 1,704 students from the 17 schools run by Nagar Prathmik Shikshan Samiti and government-recognised private schools. A rating scale was constructed containing items pertaining to 60 competencies in the five (total) learning areas. Hardspots relating to fraction were identified on the basis of experience of 20 teachers'. After analysing the hardspots, the test was constructed relating to six competencies. Major findings: (1) About 70% of the students were found to be weak in competency number 4.4.1 as viewed in the context of MLL norm (70x80). (2) By and large, students were found weak (50x50) in competency number 4.4.3. (3) Nearly 81% of the students attained 50% achievement level in competency number 4.4.4. (4) About 68% of the students were found to be weak in competency number 4.4.5. (5) Most (90%) of the students were found to be weak in competency number 4.4.6. (6) Almost all (98%) the students were found to be weak in competency number 4.4.1.

Venkateshwarlu (2001) worked on Diagnosis and Remediation of Mathematical Difficulties at primary level studying in III and IV standard. Sample for the present study was obtained from different schools of Bareilly city of Uttar Pradesh studying in III and IV standards. All the 1480 children were administered tests for diagnosis of mathematical learning disabilities. Out of 1480, only 113 were selected on the basis of specific criteria adopted for

diagnosis of mathematical learning disabilities. The various tools employed in the study were identifying questionnaire prepared by investigator, grade level assessment device for children with learning problems in schools by Janti Narayan and arithmetic diagnosis test for primary children by Rama. The data were analyzed with the help of t-test. The findings of the study was Remedial methods are superior to conventional methods. Remedial treatment had equal effect on the achievement of mathematical learning disabled boys and girls. Remedial treatment had equal effect on the achievement of urban and rural mathematical learning disabilities.

George (2003) investigated into the Mathematical Backwardness and its Remediation in Goa. The focus of the study was on construction of a diagnostic test in mathematics for standard VII, identification of the causes of backwardness in mathematics and to formulate remedial programs for the selected case studies. The sample was selected from a population of forty-one schools of Ponda Taluka. Of these schools, ten were government schools; one missionary school and remaining were privately run management schools. The study involved samples for various purposes at various stages mainly for Standardization of the test, Diagnosis and Case study. Tools used in the study were Standardized Mathematics Achievement Test, Diagnostic Test, Cattle's Culture Fair Intelligence Test Scale three Form-A, Raven's standard Progressive Matrices, Interview Schedules, Home Background and other details Questionnaire for Backwardness. Study includes both qualitative and quantitative data. The findings of study were: (1) Mean for entire sample as well as Highest score of entire sample was much lower than the norms itself (2) Percentages of correct response on diagnostic test revealed areas of backwardness. Big surprises were with Linear equations where even fill in the blanks were not responded correctly. (3) Case study findings were such that the expectations of students from mathematics teacher and kind of teacher behaviors appreciated by the students were posing questions about prevalent teacher practices. (4) Remedial programs showed improvement in terms of attitude and performance.

Pooja (2004) studied the Arithmetic Error Profile of Learning Disabled Children: Improving Arithmetic Skills. The study focused on identification the types of errors committed by learning disabled children in Arithmetic and developing an intervention program for improving the Arithmetic performance of learning

disabled children. The experimental method was used for the present research study. It employed pre-test, treatment, post-test design. A sample of 30 students of grade II were drawn from English medium public schools of Karnal city and was divided into 2 equal groups as control group and experimental group. The main findings were: (1) The prevalence rate of learning disability in Arithmetic among grade II students came out to be 7.31 percent. (2) The identification of types of errors committed by learning disabled children revealed that the highest error rate was in the dimension of 'multiplication' followed by 'subtraction' and 'addition'. It reflected that the average 55-60% of errors was committed by learning disabled children in Arithmetic. (3) Teaching through a set of intervention strategies i.e. Concrete Material Strategies, Touch Math Program, and Multi-sensory Basic Operation program was found to have a significant positive effect on Arithmetic skills on the basis of comparison between scores of experimental and control groups on pre-tests and post-test.

2.2.6 Summary of Indian Studies

From the studies in achievement in mathematics, it can be interpreted that 'achievement in mathematics is related to various factors like intelligence, study habits, attitude towards mathematics. Sharma (1978) found insufficient drill at primary and absence of methodical approach of classroom teaching while Manika (1983) concluded that unless lower concepts are developed higher mathematical hierarchy cannot be developed, as factors for low achievement in mathematics. Lack of acquisition of concepts of the lower grade was yet another factor found by Manika (1983). These conclusions lead to a fact that acquisition of concepts at the lower grade and methodical approach of classroom teaching are essential for acquisition of higher concepts of mathematics Shah (1985) found some psychological factors like inattentiveness of parents, lack of remedial teaching and teachers not qualified to teach arithmetic and lack of special training in teaching of mathematics.

In a highly literate state like Kerala, Sasidharan (1992) found lack of prerequisites even in tenth standard students, with regard to the basics in mathematics. Kapur and Rosario (1992) found that despite having average intellectual abilities and having regular classroom teaching, many students fail to perform well in arithmetic The study also reported that remedial education with varied instructional objectives can help pupils with problems in learning.

Dandapani (1992) found that the female teachers had a significantly higher perception then the male teachers and the teacher's perception about effective teaching varied with experience. Though Mohapatra (1990) did critical appraisal of secondary school mathematics curriculum, found that mathematics teachers were conservative in their out look as far as the objective of teaching and gave least importance to objectives like discipline, sense of proportion. Very few studies were devoted to teaching of mathematics. However, these findings show the factors that are not usually considered with respect to achievement or learning in mathematics. Rajya Guru (1991) found that while overachievers and underachieves differed with respect to study habits, attitude towards mathematics are anxiety, they did not differ due to sex, locality. Intelligence did play a role in achievement in mathematics. Hence, emphasis could be made on improving study habits, attitude and lowering of anxiety rather than only changing text books and teaching methods. Sarangapani (1990) analysed the curriculum design of the NCERT primary mathematics using Piagetion view and found mis-match between various tasks and the operational level of the target age group. He also found the concepts were sequenced logically rather than psychologically. These kind of studies at all levels would also help' improving achievement in mathematics. It shows the haphazard manner in which curriculum is being developed. The studies on correlates of achievement brought out factors influencing achievement in mathematics. The achievement in mathematics was found to be related to, attitude towards problem solving, Baskaran (1991), reading ability, location Rangappa (1992), prolonged deprivation Gupta et al (1993), self-concepts, mathematical aptitude Sumangala (1995). Hence, any effort to enhance mathematical achievement must also consider these factors. These differences cannot be ironed out nor neglected. Verma (1996) found high intellectual ability students performed worse another high test anxiety while low intellectual ability students did not any show significant difference. Gupta et.al. (1993) found girls in general (rural and urban) were more serious and more motivated than boys. However there was no difference in the problem solving ability between boys and girls. Nagalakshmi (1995) also found problem solving ability in favour of urban boys and girls. These findings reveal time of the vital factors influencing achievement in mathematics. Rastogi (1983) found attitude towards mathematics related to achievement in mathematics. Stella, Anthony and Purushottaman (1995),

Wangu and Thomas (1995), Singh Ahluvalia, Sudarshan, Verma (1994) also found such relations. Stella, Anthony and Purushottaman (1995) found mathematics study attitude as a deciding factor of high and low achievers. Singh Ahluwalia, Sudarshan and Verma (1994) found high intelligence group more favourable attitude towards mathematics compared to average and low intelligence groups. Rosaly (1992) found urban boys and girls had more positive altitude towards mathematics

Setia (1992) found separate factors correlated significantly to mathematics achievement i.e. intellectual level of rapid and average learners, personality traits of rapid, average and slow learners. Pal (1989) found relationship between self concept and mathematics Rajyaguru (1991), Sumangala (1995) and Thampuratty (1994) also found positive relation between attitude towards mathematics and mathematics achievement. Attitude towards mathematics found to be a deciding factor of mathematics achievement. What needs to be known is the causes of positive or negative attitude towards mathematics. Rastogi (1983) found when command over basic arithmetic skills improved attitudes towards mathematics became favourable and achievement increased. Such similar findings would reveal the causes of positive or negative attitude towards mathematics.

About twenty-six studies have been reported regarding diagnosis of mathematical backwardness. The various studies in this area have shown low achievement in mathematics due to poor command over basic mathematical skills. Gupta (1972), Rastogi (1983) and Ashar (1972) found that pupils committed errors due to lack of systematic approach while Bhirud (1975) found weakness in performing algebraic factorization due to weakness in understanding basics. There was a study Dutta (1990) discussed on preventive measures adopted by experimenter with the help of audio-visual methods and techniques and found that the preventive measures had a positive impact on the group and showed more interest in the lesson.

Looking to the record of the studies on Diagnosis and remediation there are quite many studies focusing on the identification of the mistakes and errors committed by the students, understanding the problems and causes related to the failure of the students in learning mathematics. The studies varied in terms of the area and topic of mathematics, level of mathematics. Irrespective of this it was found that when mathematical mistakes and errors were diagnosed and

remedied pupils progressed well in mathematics, S.I.E. Guj (1969), Rastogi (1983), Bhardwaj (1987), Das and Barua (1968), Kapur and Rosario (1992), and Gurusamy(1990). There are studies Busamma (1995), Ashar(1972) , Bhirud(1975), Bhardwaj (1987), George (2003), which focused on the construction and standardization of Diagnostic Tests for different topics in mathematics.

Also, Sarala (1990), Wagh (1991), Chel (1990), Jain and Bhurad, (1988), Kasat (1991), and Ramanuj & Shah (1999) also attempted to diagnose mathematical errors and high number of conceptual errors committed by secondary school students. Thakore (1980), Wagh (1991), and Ramanuj & Shah (1999) found errors committed by the students in fractions, fractional numbers, decimal numbers and their operations. This could be compared to the study by Bhirud (1975). In the cross sectional study by Chel (1990) he found difficulties faced by students included content gaps, confusion in understanding mathematics language, stereo type way of presenting contents. Similar findings were that of Manika (1983), S.I.E. Guj (1969), Sharma (1978). In their study about low results, Jain and Burad (1988) found lack of infrastructure, non-availability of teachers, and lack of child centred training, uninteresting curriculum as some of the factors responsible for low results in mathematics. A very similar finding was that of Lulla (1966).

Pooja (2004) revealed that the highest error rate was in the dimension of 'multiplication' followed by 'subtraction' and 'addition'. Similar was the result of the study by Subramaniam & Singh (1996). Slow Learners improved their achievement when treated with Diagnostic Error Learning Strategy, Viswanathan (1997). George (2003) through diagnosis of the backwardness in learning mathematics questioned the prevalent teacher practices and also concluded that Remedial programs showed improvement in terms of attitude and performance. Warute (1998) Developed Remedial Materials in Mathematics for Standard I and II and found that remedial materials help in improving the performance of students in mathematics. Venkateshwarlu (2001) found that Remedial methods are superior to conventional methods.

2.3 FOREIGN STUDIES

The studies cited here are taken from Dissertation Abstracts International. The studies being of uniquely different categories could not be put under any common category.

Tzeng Shwu-Rong (1987) studied the relationships among gender, attitudes towards mathematics, and mathematics attributions of sixth grade high, average, and low achievers in Taiwan, Republic of China. Numerous researchers have tried to "understand variables that affect a student's achievement in mathematics. The intent of this study was to examine the role of certain affective and attributional factors on the mathematics performance of Chinese (Taiwanese) students. The sample consisted of four hundred and thirty-two sixth grade students were classified to three levels - high average and low. The Fennema-Sherman Mathematics Attitudes Scales and the Mathematics Attribution Scale were used to measure students' attitudes toward mathematics and attributions of success/ failure in mathematics. The results showed that: (a) the higher the achievement, the more positive were attitudes towards mathematics, (b) there were no significant differences between male and female students in attitudes toward mathematics, except for the females' less-stereotyped perceptions of mathematics as a Male Domain, (c) the higher the achievement, the more attributions of success were due to having ability, to effort, to easy interesting tasks, and to a too effective teachers or facilitative peer groups. The lower the achievement, the more there were attributions of failure to not having ability, to task difficulty, and to lack of effective teachers or facilitative peer groups, (d) there were no significant differences between male and female students in attributions of success/ failure in mathematics, except for the variables of "success-effort" and "success-environment," where female students were more likely to attribute their success to spending time studying, effective teachers, or facilitative peer groups; and (e) in general, there were significant positive relationships among the variables under "attitudes toward mathematics", among variables of attitudes toward mathematics and variables of mathematics success attribution, and among the variables under "mathematics failure attribution." However, the relationships among variables of attitudes toward mathematics and variables of mathematics failure attribution were significant and negative.

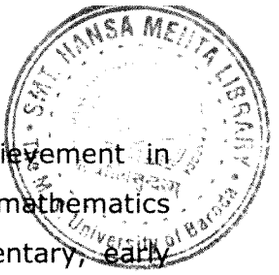
Aviles'(1989) studied the environmental and educational characterization of low-achievers' experiences and attitude towards mathematics performances using case studies. This study investigated the relationship of attitudes towards mathematics performance to the familial and academic environments of eight students identified as mathematics low achievers admitted to Puerto Rico Junior College. The aspects considered in the study were prior experiences in the familial and/ or academic environments. The study was based on personal, familial, and academic observation and interviewing. The study also considered visits to the familial and former high school environments. Moreover, written documents, such as academic records and autobiographical statements, were carefully analyzed. In the development of the study, eight questions were addressed in relation to performance, kind of family life, quality of schooling received, and self-concept related to family and academic events. These questions were not individually discussed, as they were interrelated. The study followed a naturalistic approach; students were observed in their natural environment; homes and former high schools were visited and observed in order to obtain a real view of these environments. The findings of the investigation revealed that many students are misclassified. Familial and academic environments are closely related to the development of attitudes toward academic performance. When even one of these environments is improved, the level of achievement is improved.

Kalamaros (1991) tried to study instructional method and decreased student errors on math worksheets. Teachers often express concern about student's poor performance on classroom math worksheets. Performance deficits may be attributed in part to personal internal variables and/ or to external factors such as materials or instructional methods. Unfortunately, students' math ability often is evaluated based on performance on math worksheets, regardless of the many factors that may be impacting the individual. The purpose of this study was to explore the effect that instructional methods have on student performance on math worksheets. A multiple baseline single organism study was completed with 11 third grade subjects. The subjects were referred for participation by their classroom teacher based on the teacher's belief that the student had "difficulty following written directions". Teachers need to be aware of the potential relationship between reading ability and math performance. When teachers are interested in determining students' skills in math, the effects of reading must be

taken into account. Teachers must evaluate the types of errors students made and take the time to show students explicitly how to correct those errors. Without this effort, errors are likely to be repeated. Teachers should always consider the impact that attitudes and beliefs about math ability have on student performance. Controlling for these influences increases the likelihood that students will demonstrate their true math skills.

Rose (1991) studied strategies and skills used by middle school students during the solving of non-routine mathematics problems. This study has identified the role of the teacher in mathematics learning and the need for non-routine mathematics problems as a regular part of school mathematics. This study was conducted to determine the processes and strategies selected middle school students use during the solving of non-routine mathematics problems. Qualitative research methods were used to identify the cognitive and metacognitive skills and processes used in problem Solving and to determine the affective influences on the problem solving processes. Six middle grade students were selected to particilate in the study. Each student was interviewed four times. The transcriptions were analyzed using a constant comparative method. Themes emerged from the data analysis, and findings were identified. The themes and findings led the researcher to the following conclusions. (i) Students are not aware of the various alternatives available to help them understand a non-routine mathematics problem when they first read it. (ii) The only skills which students perceive as mathematics skills are the basic computations of addition, substraction, multiplication, and division. (iii) Students model the problem solving strategies and behaviours of their teachers.

Greg (1998) studied attitudes toward mathematics and knowledge of mathematical concepts of preservice elementary, early childhood, and special education teachers. The advent of the National Council of Teachers of Mathematics (NCTM) Professional Teaching Standard requires that teachers of mathematics be competent, value mathematics, and stress the importance of solving real-world problems in teaching mathematics to successfully prepare students for the technological world of the twenty-first century. Studies have shown that teachers of elementary mathematics tend to suffer math anxiety and are weak in math content skills. Because of the tendency, the preparation of preserve elementary teachers needs to address the level of math anxiety and the achievement of appropriate content knowledge and work toward developing



a more positive attitude in mathematics and increase the achievement in mathematics content. This paper addresses the attitudes toward mathematics and achievement in math content knowledge of preservice elementary, early childhood, and special education teachers and the changes through standards espoused methods in preservice mathematics content courses are used. Students enrolled in required mathematics courses for elementary education were given an attitude instrument in fall 1997 at the beginning and end of the semester to determine their self-efficacy in mathematics, their feelings about problem solving, and how they value mathematics. Fifteen students were interviewed to determine their attitudes toward mathematics and when these attitudes were developed an achievement test based on the Third International Mathematics and Science Study (TIMMS) Population Two items was administered in spring 1998. Results of the attitude test show that students tend to improve their attitudes toward mathematics when taught by instructors who model appropriate strategies. Results of the achievement test indicate that students are weak in mathematical content.

Karen (1998) studied student attitudes toward mathematics projects. The purpose of this study was to examine if mathematics anxiety, learning preference, exposure to projects, the teacher, gender, and ethnicity are related to student attitude toward projects. This study tested 17 hypotheses and both qualitative and quantitative methods were employed. The 304 students in the study completed an attitude survey, a mathematics anxiety survey, and a learning style inventory. The qualitative portion of the study revealed that sixty one percent of students had a positive attitude toward projects and were willing to take another project class. Over forty percent of students stated that they enjoyed working groups. Students also disliked many things, including: negative group experiences, the extent of writing, the amount of work involved, and a desire for more time when working on a project. Students recommended that more time be given in class to work on projects, and that projects be consistently interesting and creative. Over fifty percent of students stated that their attitudes toward projects were also affected by the teacher, the group, and the content of the project.

Bellisio (1999) studied student's ability to work with algebraic notation and variables. For many students, algebra is a major stumbling block that prevents them from continuing their study of mathematics. Many students have difficulty

making the transition from working with numbers in arithmetic to dealing with letters that represent numbers in algebra Consequently they are unable to work with variables and notations to represent variable ideas which is critical to an understanding of algebra. The research was based on the premise that children can deal with algebraic ideas at an early age. The focus of this study was to examine the notation and letters used by children to write general rules when they are given open ended investigations that involve algebraic reasoning. In particular, the questions that guided this research are: (1) Do students' written notations match the expression of their ideas in natural language? (2) What type of notations do students invent? (3) Do particular notations help students build a solution? Forty eight students, who came from three school districts and from grades four through seven, provide a representative, diverse population for the study. The data includes videotapes of the students working together, follow-up interviews of individual students or groups or students, transcripts, detailed analyses of the videotapes and students' work. A case study analysis is used to show the development of particular algebraic ideas. For the problem tasks posed, students participated actively, discussed their ideas with each other, and invented a notation to express their ideas and to justify their solutions. The representations produced by the students were different and varied. Some students discussed and wrote rules for general cases. The notation students invented helped them keep track of their ideas and organize their data. In developing explanations to support their ideas, the notation was helpful in demonstrating, they had found all possibilities.

Dupree (1999) studied mathematical empowerment: A case study of relational classroom learning. This is a study of the relationships that developed among the students in a small class of Mathematics for Critical Thinking. The organization of the class was based on the social constructivism of Vygostsky. There was an attempt to create an atmosphere that was sensitive and nurturing in which students could trust their classmates to be supportive of their efforts to solve mathematics problems. Students were made to work together to establish the socio-mathematical norms that would enhance the development of mathematical power within the students and promote the evolution of problem-solving skills. The findings indicate that the relationships within the classroom enhanced the development of viable relationships with mathematics. There were also indications that the fact that the students were all females may have

contributed to the workable relationships with mathematics. There are strong implications that mathematics can be made more accessible to more students by restructuring the mathematics curricula to accommodate the different ways that students approach the construction of their mathematical knowledge. Findings call for college and university mathematics departments to re-examine the traditional lecture method for disseminating mathematics to large numbers of students in a lecture hall and consider more opportunities for students to engage in mathematics at a personal level. This could revolutionize mathematics education in ways that would empower all students.

Lee (1999) studied why Asian students fall behind in maths. Asian students' strong achievement in mathematics has long been recognized. However, not all Asian children excel at math. The present study examines Chinese second-grade high-math achievers (HMAs) and low-math achievers (LMAs) who are at risk of developing mathematical learning disabilities (MLD). Both groups had average or above-average intelligence, normal sensory functioning and no emotional disorders. This study aims to identify why LMAs are poor in math. The results show that, when compared to HMAs, LMAs showed a wide range of weakness in the areas of short-term memory, working memory and long-term memory. LMAs were slower to solve number facts than HMAs, in addition, they tended to use less mature and less efficient strategies to solve these problems (e.g., they use "counting all" or "counting on"), and their place-value concepts were also less mature and complete. LMAs had more difficulty solving 3-digit as opposed to 2-digit problems, which may result from their less mature understanding of place value and weak working memeory as compared to HMAs. A high frequency of LMAs errors in the multi-digit problems involved trading procedures such as increasing or reducing place value. Over the school year, although LMAs made progress on fact retrieval automatist & place-value tasks, their achievement remained poorer than that of HMAs. An analysis of errors and better understanding the underlying cognitive processes involved in arithmetic competence can provide valuable insight for us to design programs tailored to each child's individual needs.

Ridlon (1999) studied the effect of problem centred learning on the mathematics of sixth graders. This study described the effects of a problem centred approach to mathematics on the attitudes, actions, and achievement of sixth grade students at a middle school in the south-east. Two groups of sixth

graders were randomly selected to participate in a nine-week study. Both classes had students of varying ability and diverse demographics. The regular classroom teacher taught the control group of 25 students using a traditional textbook and methods. The researcher presented the experimental group of 27 students with meaningful problem tasks that were solved in small groups and then presented to the class of validation. Data sources from both groups included a pre-test and post-test, student and parent surveys, student writings, and observations by the researcher and regular teacher who were both present at all times. Additional data were collected from the experimental group through interviews of students and their parents, student journals, and student work. A quantitative and qualitative analysis of all the results showed that Problem Centred Learning was indeed effective in the opinion of the involved stakeholders. Students came to view mathematics in a more positive light, enjoyed the class, and felt they had learned more than usual. They believed attitude and achievement were measurably increased. The test scores gave strong evidence to support these convictions because the problem centerd group had a highly significant increase in achievement compared to the traditional curriculum. Thus, Problem Centred Learning appeared promising and worth further investigation.

Smith (1999) analysed the role of language and representations in children's mathematical reasoning. The central goal of the study was to understand the processes and tools of children's mathematical reasoning, the role of various factors while doing mathematics was considered (i) child's view of self, (ii) the use (formal and informal) of language, (iii) the context in which the mathematics was situated, and (iv) different forms of self-monitoring. This study found that the students' attitudes toward themselves and their beliefs about the nature of the discipline largely shape their use of the contexts of the problems, affecting their engagement with the mathematical issues entailed. By probing their understanding and then designing tasks that draw children near the boundaries of their understanding, the protocols made their decision making and tools, as well as their language and representations, visible.

Timmel (1999) studied the factors impacting the achievement and participation of high school girls in mathematics. The purpose of this study was to compare the factors of teacher, impact, student self-esteem, school culture/ organization, and parental support on the participation and achievement of high school girls in higher mathematics courses in two

suburban Westchester, New York, high schools. Factor analysis of the data did not lend support to the possibility that males and females differ in the cognitive level of their mathematics achievement. Data analysis confirmed the importance of parental encouragement, self-esteem, and mentoring and encouragement of a teacher as significant factors in girls' mathematical success and continuance to study mathematics. Neither all factors nor all dimensions studied were significant predictors of achievement and participation of girls in mathematics. Recommendations included further use of classroom processes that promote gender equity, increase student self-esteem, and in turn mathematics achievement. Also recommended was further research in a low socio economic environment, in a single-sex classroom, in a male-dominated school culture/ organization, in elementary and middle school, and finally, in other subject areas.

Duncan (2000) studied the relationship between math preparation in high school and mathematics skills of college entering students. The sample consisted of college extras. The study found that most students in remedial mathematics were exposed to the mathematics content in high school but they never learn the material sufficiently enough to acquire math skills for college. The researcher concluded that increasing the mathematics requirements in high school does not ensure students that they will have sufficient mathematics skills necessary to readily enter college.

Haralambos (2000) examined how students conceptualize various geometric concepts in tenth-grade geometry. It provided the suggestion of additional strategies for the improvement of the teaching and learning of geometric proofs. Further results of the research indicated that students write proofs that are better organized through shared knowledge than the proofs presented in the textbooks.

Nancy (2000) investigated the effectiveness of physical and virtual manipulatives on middle school students' visualization and spatial reasoning skills. Results indicated that the students in the physical and virtual manipulative groups reported a preference for using manipulatives during instruction. Students in the virtual manipulative group had higher rates of on-task behaviour than students in the physical and no manipulative groups.

Sangtong (2000) identified and explained factors associated with mathematics achievement of grade eight Thai students and explored the value of analyzing

TIMSS test data at the item level. Data were collected from curriculum, textbook, and teacher guide analysis, teacher questionnaires, teacher interviews, student, test, papers, and student interviews. Results showed that opportunity to learn is only a moderately useful predictor of achievement differences. Items on which Thai eighth graders performed exceptionally well were those that are most similar to tasks that appear regularly in texts and teaching. However, relatively poor performance appears to be caused by a variety of factors; many not directly related to missing or mistaken mathematical understanding or skills. Students treated probability problems as fraction or proportion problems and solved the problems by using fraction or proportion knowledge.

Siebert (2000) studied the coherent, dynamic accounts of prospective secondary mathematics teachers' knowledge of and beliefs about mathematics. This thesis presents accounts of the mathematical knowledge and beliefs of eight prospective secondary mathematics teachers (PSTs) as they progressed through a six-week unit on division of fractions that was designed to bring about change in their 3 knowledge and beliefs about mathematics. This study used qualitative methods, including grounded theory, teaching experiment methodology, and case studies to investigate PSTs' knowledge of and beliefs about mathematics as they participated in the division of fractions unit. The PSTs' initial knowledge of division of fractions consisted mostly of procedural expertise, with only limited conceptual understanding. They tended to perceive of secondary school mathematics as an interrelated, consistent set of rules, procedures, facts and definitions. This interrelated rules, perspective towards mathematics persisted for a short period after the PSTs began the unit. However, through a series of mathematical explorations, the PSTs were also to develop new understandings for division of fractions. This new conceptual knowledge led PSTs to rethink how they would teach division of fractions and to reconsider how they perceived mathematics. They began to view mathematics as a collection of rules and procedures that were supported by underlying concepts. Nevertheless, they continued to see rules and procedures as the major landmarks in the mathematical landscape, which in turn limited the mathematical understandings they were able to develop during the unit.

Sjostrom (2000) studied the beliefs and practices of teachers regarding the high failure rate in Algebra I. The sample consisted of four algebra teachers in a

high school with a diverse student population. The study was a qualitative case study and tools used were seen structure interviews and classroom observations. It was found that there were strong connections between the beliefs of the teachers regarding the nature of mathematics, their attributions for student failure in algebra, their self-efficacy, and the modifications they made in instructional practices.

Warrick (2000) conducted an intervention program for parental assistance with mathematical homework and the relationship with increased student achievement. The sample consisted of children of thirty parents in the experimental group and thirty five students of parents in the control group. The experimental group scored significantly higher than the control group in all section of the ITBS (Iowa Test of Basic Skills) and in addition completed more homework than the control group. These findings suggest that training parents to help their children with mathematics homework leads to ignored student achievement.

Dominguez (2001) studied about the college algebra students' understanding of the concept of variable. The sample was made up of thirteen students enrolled in a college algebra course. Think aloud procedure in class observation and analysis of the text book were used. The study found that students' level of confidence in approaching standard algebra problems was higher for familiar type of problem than for non-familiar type of.

Ward (2001) studied students' attitudes and achievement as related to immediate remediation in paced algebra. The study examines a strategy to increase student success. It utilizes flexible learning time made available through the 4 x 4 block scheduling format to provide immediate remediation. Results implied that immediate remediation had prepared students for subsequent course content. Students' attitudes were relatively stable and did not show a relationship to their achievement in Algebra I. Finally, an examination of group demographics showed that prerequisite knowledge and attendance were the most distinguishable differences between successful and unsuccessful students.

Premlatha (2002) The purpose of this study was to investigate the complex cognitive process involved in learning non-Euclidean geometry and understanding geometry as an integrated whole, taking into account both the psychological and social aspects of learning. To this end, a qualitative study was conducted to answer two research questions: (a) How does students'

understanding of straight lines and triangle develop in spherical geometry? and (b) How does prior knowledge of Euclidean geometry impact development of non-Euclidean geometry? Understanding of spherical geometry developed along the following paths: the individual's experience outside of mathematics the socio-mathematical norms of the class that encouraged students to create their own meaning of concepts and conflict resolution with prior knowledge of Euclidean geometry. Conflict was resolved by motion, analogy, mental rotation, formulating definitions and taking an intrinsic view. Prior knowledge of Euclidean geometry impacted development of non-Euclidean concepts. Students had difficulty viewing the sphere as a world in its own right: they tried to maintain their Euclidean images, transformations and definitions.

Zachary (2002) focused on the degree to which mathematics errors made at grade eight relate to the mathematics performance achieved two years later at grade ten. The study also looked at gender and race/ethnicity differences in these error categories. The context of the study was the South Carolina Basic Skills Assessment Program (BSAP). Mathematical errors were defined in five categories: quantitative, verbal, logic, visual-spatial, and others. Differences were detected between African-American and white students in all five categories of mathematics errors. Differences were also found between females and males in the four categories of mathematics errors labelled "quantitative," "verbal," "logic," and "others," but not in the "visual-Spatial" error category. In addition to mathematics achievement at grade eight, gender, and ethnicity, the use of categories of mathematics errors made at the earlier grade provided a significant increase in the power to predict HSEE (the High School Exit Examination, HSEE) mathematics achievement.

Jaguthsing (2003) found that in addition to the synthetic approach, algebraic approaches are inherent in the use of transformations, coordinates, and vectors to study geometry. This study investigated secondary students' use of algebraic thinking: the use of symbols and algebraic relations, the use of different forms of representations, and the use of patterns and generalizations in geometry and their related conceptual difficulties. The results show that the students used algebraic thinking in solving problems in geometry, but they had several difficulties as well, including: understanding the nature of a variable, writing an equation/expression, recalling and using formulae, understanding the use of different forms of representations, finding generalizations from patterns.

Sometimes a geometrical concept/idea was the source of their error and sometimes it was an algebraic concept. In addition, it was found that students' use of algebraic thinking was related to their teacher's use of the same in their classes.

Chen (2004) focused on evaluating the efficacy of mathematics intervention programs for students with learning disabilities. Different intervention programs were used and behavioural, cognitive and technology-based intervention categories were found to be highly effective for group design studies but moderately effective for single subject design studies. Results are encouraging for mathematics remediation and for students with learning disabilities. It is recommended that cognitive, behavioural, and technology-based intervention categories could be implemented effectively to students with learning disabilities in mathematics.

Louis (2006) focused on the manner in which third grade children explored, described, classified, and built three dimensional geometric solids. The goal of conducting this study was to uncover the properties of solids that children attend to while in the process of determining the appropriate schema for which to describe and classify them. It was discovered that children attended to a number of properties of solids ranging from critical attributes to aspects of stability when stacked or placed on a flat surfaces. The attribute most attended to by the respondents were vertices which were often described using visual prototypes. The context of play was also found to impact the manner in which the children attended to particular attributes. When engaged in play, the respondents grouped according to utility and tended more towards the stacking and matching of faces of solids.

Steele (2006) investigated changes in knowledge needed for teaching geometry and measurement through engagement in a practice-based course for pre-service and practicing teachers. Pre- and post-course measures showed significant teacher growth along all three aspects of knowledge needed for teaching. Teachers grew in their ability to attack non-routine problems relating dimension, perimeter, and area and dimension, surface area, and volume; and in their use of multiple solution methods, multiple representations, and production of mathematically sophisticated solutions. The results suggest that teachers can grow in their knowledge of content and pedagogy through practice-

based teacher education experiences. The results suggest a value for focusing methods courses on particular slices of mathematical content.

2.3.1 Summary of Foreign Studies

The foreign studies have used qualitative methods and focused on attitude towards mathematics, hurdles in learning of mathematics, innovations and intervention programmes for teaching of mathematics, factors affecting the Achievement of mathematics, students beliefs and understanding about the learning of mathematics, and similar such areas.

Studies on achievement by Smith (1999), Woggon (2000), Ridlon (1999), Bellisio (1999), Dupree (1999), Rose (1993), Sangtong (2000) found certain elements in the teaching-learning of mathematics. They were student's attitude towards themselves, student's decisions, their language and representations, student's beliefs, notations used by children, students construction of mathematical knowledge.

From the focus of these studies, it was possible to gauge the importance given to student and mathematics relationship. Rose (1991) demonstrated the need for teachers to concentrate on fostering student's self-esteem and positive attitudes towards problem solving. Non-routine problems should become a regular part of school mathematics. Kalamaros (1991) insisted on teacher to be aware of the potential relationship between reading ability and mathematics performance. Similar study by Steele (2006) suggested that teachers can grow in their knowledge of content and pedagogy through practice-based teacher education experiences and focused on the changes in knowledge needed for teaching geometry and measurement through engagement in a practice-based course for pre-service and practicing teachers.

These studies bring one nearer to the understanding of student's thinking and learning. Smith (1999) elicited the reasoning of children as they do mathematics, and designed tasks to know their language, decision-making tools. Woggon (2000) investigated into the learning of mathematics from the perspective of matured learners, apart from known theoretical orientations. This gave different dimension to mathematical learning leading to rethinking in mathematics education. This study was found similar in its findings to Dupree (1999), which felt need for restructuring the mathematics curricula, making students construct their own knowledge. Ridlon (1999) addressed to the

decisions made by children during middle school affecting their attitude and ability to do mathematics for the rest of their lives. Problem centered learning changed their view about mathematics in a more positive light, enjoyed the class and felt they had learned more than usual. A study very near to student's nascent knowledge, language and representation, was done by Bellisio (1999). It was found that the notations students invented helped them keep track of their ideas and organize their data. These studies indicate need for liberating the students from traditional, stereo-type teaching-learning situations. Kalamaros (1991), Tzen, Shwu-Rong (1987), Karen (1988), Greg (1998), Siebert (2000), Aviles (1989), tried to investigate into the attributes of low achievement in mathematics, effect of neglect of errors, attitude of teachers towards mathematics, knowledge and beliefs of mathematics teachers. Kalmaros (1991) emphasized need for teachers to evaluate types of errors and show how to correct them or else errors were likely to be repeated. Tzen, Shwu-Rong (1987) found higher the achievement, the more attributions of success were due to having ability to effort, to interesting tasks and to effective teachers. Hence, there was a felt need for continuous monitoring of student errors to enhance mathematics performance and ensure higher performance leading to positive attitude. Karen (1988) found students had positive attitude towards mathematics projects. Aviles (1989) found that familial and academic environment were closely related to development of attitudes towards academic performance. Hence curriculum planning and school environment, contributed towards attitude formation. Greg (1998) found that students tend to improve their attitudes towards mathematics when taught by instructors who model appropriate strategies. Siebert (2000) found that prospective secondary teacher had only limited conceptual understanding.

Teacher's attitude, beliefs and conceptual understanding influenced student's attitude towards mathematics. Lee (1999) tried to identify factors for low achievement in mathematics by low-math achievers and high-math achievers. The study found low-math achievers were slow to solve number facts used less efficient strategies, less mature concept of place values. Such studies tell about the cognitive processes involved in arithmetic competence, which should be addressed rather than mere drill. Timmel (1999) found parent encouragement, self-esteem, monitoring and encouragement of a teacher. Study by Sjostrom (2000) addresses the high failure rate in Algebra I in relation to teachers' beliefs.

The study recommended teachers must go beyond their student related alternation to design an effective instructional program, teacher educators need to teach content in connection with reformed pedagogy and challenging teachers' beliefs about mathematics, educational administrators must clearly define what students are expected to do and provide teachers with the necessary training provide a supportive environment which include manageable class sizes.

Another unique study was of Warrick (2000) who examined the difference in academic achievement between one group from parents enrolled training program and a groups who received, no such assistance. The findings suggested that training parents to help their children with mathematics homework leads to improved student achievement. This study focused on an area hardly considered in relation to student achievement in mathematics. Homework being an essential ingredient in school program, this study suggested that other than changing teaching methods, providing remedial teaching and such similar efforts, now efforts could be made to train parents, to enhance student achievement in mathematics. Studies by Warrick (2000), Sjostorm (2000), Dominguez (2001) and Duncan (2000) have brought new dimensions, new areas in mathematics education research. Such studies would contribute constructively towards finding solutions to the epidemic of mathematical backwardness.

Further, there are some studies on teaching-learning and understanding in geometry. Premlatha (2002) investigated the complex cognitive process involved in learning non-Euclidean geometry and found that the individual's experience outside of mathematics the socio-mathematical norms of the class encouraged students to create their own meaning of concepts and conflict resolution with prior knowledge of Euclidean geometry. Jaguthsing (2003) found that the students used algebraic thinking in solving problems in geometry, but they had several difficulties as well, including: understanding the nature of a variable, writing an equation/expression, recalling and using formulae, understanding the use of different forms of representations, finding generalizations from patterns. Louis (2006) focused on the manner in which third grade children explored, described, classified, and built three dimensional geometric solids. The context of play was also found to impact the manner in which the children attended to particular attributes.

Also, few studies have shown the positive effect of diagnosis and remediation on the learning and achievement in mathematics. Ward (2001) studied students' attitudes and achievement as related to immediate remediation in paced algebra and found that immediate remediation had prepared students for subsequent course content. Zachary (2002) ascertained that the use of categories for identification of mathematics errors made at the earlier grade (grade eight) provided a significant increase in the power to predict HSEE (the High School Exit Examination, HSEE) mathematics achievement. There was study on remedial programme for the learning disabled Chen (2004) recommended that cognitive, behavioural, and technology-based intervention categories could be implemented effectively to students with learning disabilities in mathematics and the results were encouraging for mathematics remediation and for students with learning disabilities.

2.4 RESEARCH SCENARIO

The Fourth Survey gives a comprehensive report about research in mathematics education. Though mathematics occupies an important place, the researches in the area have been scanty. The momentum in mathematics education picked up only in 1970-1980. Fourth Survey has included studies of Third Survey also. Research in mathematics education has been given as a separate area of research in the Fourth Survey. There are about seventy studies cited under mathematics education in Fourth survey. Below given is a brief analysis of the research studies in the field of Mathematics Education as cited in Fourth, Fifth and Sixth Survey.

2.4.1 Brief Analysis of Fourth Survey of Research in Education

The Fourth Survey reported about the studies from 1970 to 1988 in the field of Mathematics Education. It reported about seventy studies, in four different categories: (a) Teaching and teacher behaviour - twenty-three studies, (b) Curriculum and text-books - fourteen studies, (c) Factors affecting mathematics achievement –twenty-four studies, (d) Diagnostic and other tests in mathematics – nine studies. Table -1 shows the decade wise growth of Research in Mathematics Education.

Table – 1
Decade Wise Growth Of Research In Mathematics Education

Decade	Ph. D. Thesis in Education	Research Projects	Total
1941-50	1	0	1
1951-60	0	0	0
1961-70	1	0	1
1971-80	28	2	30
1981-88	37	1	38
Total	**67**	**03**	**70**

The survey has pointed out the large number of students failing in mathematics, according to NCERT analysis. The research gaps identified are given below:

i) Research based development curriculum
ii) Studies in the area of diagnostic testing
iii) Developing a major intervention programme to streamline mathematics education
iv) Designing more effective programmes for preparing teachers of mathematics
v) Experimenting on models of teaching
vi) Text-book analysis to find out their relevance to objectives, content, methodology, feedback
vii) Standardizing tests
viii) Investigate into how the attitude towards mathematics is formed

Majority of the studies have been devoted to teaching and teacher behaviour and factors affecting mathematics achievement.

The research scenario of mathematics education is not very different from other subjects in terms of the boom of research activity period i.e. 1970 onwards. However, mathematics, having higher utilitarian value, more research is expected in this area. The number of research projects also saw a slump in the 1980s. State Boards, NCERT, SCERTs could take up projects to identify causes of low achievement and high rate of failure in mathematics, also poor knowledge of basics of mathematics at various levels.

The research studies spread over a wide range of teaching methods. It was found that all teaching methods did not suit all learning styles. It also depended on the intelligence. Programmed instruction was found to be effective than traditional teaching. However, it was also dependent on urban and rural setting. Studies on Ausubel's advanced organiser and Burner's concept attainment model

found the models to be superior to traditional methods. Mastery learning model was also found to be superior to the traditional method as it enhanced mathematics achievement, attitude towards mathematics, and improved self-concept.

All these studies on teaching have shown the superiority and effectiveness of various methods. Teachers need to choose the methods rather than use same methods for all topics, academic levels, intelligence levels, locales. The survey has noted the dearth of studies on teacher preparation. Studies on developing instructional competence in mathematics teachers through micro-teaching technique would be beneficial. Studies also cite reluctance on the part of the teachers to take up non-conventional methods.

Factors affecting mathematics achievement were found to be both cognitive and affective. Variables like SES, intelligence, language mastery, attitude towards mathematics, numerical reasoning, numerical ability, were found to have significant effect on mathematics achievement. Causes of under and low achievement in mathematics vary from defective text-books, blind use of rules, insufficient drive work, absence of methodical approach, lack of motivation. Studies conducted on the mathematically gifted found having high intelligence numerical ability, abstract reasoning. The factors have been abundantly identified. Studies on how these factors can be taken care of to increase achievement in mathematics are needed.

The studies on curriculum were very few. There were studies comparing mathematics curriculum of India and other countries, utility of mathematics content in professional courses, objectives of mathematics, teaching and relevance of modern mathematics in developing student's abilities. Only five Indian states had research in the area of text-book and syllabus. One of the studies developed criteria for writing and evaluating text-books in mathematics. Other studies found teachers not using new teaching methods given in the text-book while still other studies found lack of relationship between course-content in the syllabus and the text-book. There seems to be an urgent need to look into the content, presentation and use of methods in teaching of mathematics. The relevance of mathematics course-content is also of utmost need. The various state boards could take up text-book analysis and finding the relevance of mathematics course-content vis-à-vis various professional courses.

Out of the ten studies in the area of diagnostic and other tests, only four studies were on construction of diagnostic tests and followed by suggestive remediation for specific weaknesses in Arithmetic. All of them found remedial measures were effective. There is a need to reflect on the diagnosis and remediation in other branches of mathematics viz. Algebra and Geometry. Few studies were on developing attitude scale to measure attitude towards mathematics; constructing tests in mathematical creativity were some of the other studies.

The survey observed that there is dearth of researches in developing tests in mathematics. Also, studies on how attitude is formed towards mathematics were essential. The survey had identified major issues before teacher educators in mathematics as in-depth study of the mathematics curriculum, curricular renewal, refining teaching methods in mathematics with regard to advances in pedagogy and educational technology.

2.4.2 Brief Analysis of Fifth Survey of Educational Research

The Fifth Survey reported about the studies from 1988 to 1992. A total of forty-six studies have been reported. The studies can be broadly categorized as (a) Improvement in learning and teaching of Mathematics - fifteen studies, (b) Achievement in Mathematics and its correlates - fourteen studies, (c) Diagnosis and Remediation in Mathematics - nine studies, (d)Evaluation of Curriculum of Mathematics - five studies, (e) Use of Technology in Mathematics – three studies.

The survey has cited nine studies dealing with the areas of failure in mathematics, errors committed in mathematics, diagnosis and remediation in mathematics. The number of studies in mathematics education is not very impressive and more so in diagnosis and remediation, developing creativity in mathematics, attitude towards mathematics. Fourth survey had identified several research gaps. The research gaps identified in the fourth Survey have not been satisfactorily addressed in Fifth Survey. The survey has given a new area of research, as identified by the Fourth Survey as research gap i.e. Evaluation of Curriculum, even though number of studies is few. Another area that could be identified is attitude towards mathematics. This has been found to be a determining factor in mathematics achievement.

Fifth Survey also identified twenty three research gaps. Looking at the gravity of the problem of failures and underachievement in mathematics at different levels

and particularly at secondary level, the number of studies is less. Out of the fifteen studies on improvement in learning and teaching of mathematics, two studies are on attitude towards Mathematics and two on errors committed by students in mathematics.

Total number of researches was distributed as twenty-eight theses, nine M.Phil dissertations, six Research reports, and three Research articles. The total number of researches was forty-six. This is an encouraging indicator when compared to the research situation till 1988. In order to combat problems like high failure rate, wide spread low achievement in mathematics, there needs to be more of research projects than individual researches.

The survey has cited studies pertaining to mathematics under correlates of achievement. A few of them have been cited in the present study. It is essential though, to have studies pertaining to relevance of mathematics curriculum vis-a-vis professional and academic courses. The very existence of high rate of failures, large number of errors should pose the urgency to investigate the evaluation methods and teaching methods. Teacher education is also another area where there us a dearth of studies.

The analysis clearly revealed the kind of researches reported in the Fifth Survey. It showed that researches were done in some parts of the country and in certain areas of mathematics only. It did not seem that the research gaps identified by the Fourth Survey had been taken care of. Very few studies had been identified in the area of teacher education, diagnosis and remediation. No studies were on text-book analysis.

Fifth Survey pointed out that even though the number of research studies has increased, considering the large number of problems, the number is not impressive.

2.4.3 Brief Analysis of Sixth Survey of Educational Research

The Sixth Survey reported about the studies from 1993 to 2005. A total of forty-two studies have been reported. The studies can be broadly categorized as (a) Improvement in learning and teaching of Mathematics - fifteen studies, (b) Achievement in Mathematics and its correlates - thirteen studies, (c) Diagnosis and Remediation in Mathematics - six studies, (d)Evaluation of Curriculum of Mathematics - five studies, (e) Use of Technology in Mathematics – three studies.

The survey has cited only six studies dealing with the areas of errors committed in mathematics, diagnosis and remediation in mathematics. The number of studies in mathematics education is not very impressive and more so in diagnosis and remediation, developing creativity in mathematics, attitude towards mathematics. Looking to the Sixth survey the research gaps identified in the fifth Survey have not been satisfactorily addressed. There are very few studies on Evaluation of Curriculum and text-books of Mathematics. There is a need of research in the area of attitude towards mathematics. Not a single study on attitude towards mathematics was cited in the sixth survey despite of being a factor affecting mathematics achievement. Also, in the area of creativity in mathematics there are only three studies, and that too its just investigated as an aspect related to the studies on achievement in mathematics. There are very few studies on Mathematics Education at teacher Education level. This area is yet to be explored through research support.

It's accepted that there are many causes for the universal problem of failures and underachievement in mathematics at different levels. Still the research has not contributed much in this area. Out of six studies on diagnosis and remediation in Mathematics there is no satisfactory picture addressing to the secondary level mathematics as only one research was carried out at secondary.

From the Sixth Survey its clearly observed that the number of researches in Mathematics education is reduced. Considering the fact that Mathematics is pivotal to any field of Education the researches in the area needs to increase. There were around twenty-three research gaps which were identified by the Fifth Survey. So, there was a demand of more research in order to address the gaps but the reality is not reasonable. Mathematics education is probably the most important area concerned with school education hence should be given the utmost importance for the research based contemporary changes.

2.4.4 Research Gaps

Researches are carried out in mathematics education since 1941. Much has been achieved. Looking at the researches still many areas have remained untouched, there is a need to point at the research gaps. The Surveys have thoroughly identified the research gaps. It seems it goes unseen.

The following areas were identified by the investigator as research gaps in Mathematics education.

i) Teacher education: The curriculum, the practicum in particular, inclusions in the theory, relevance with respect to school education, change in the teaching methods vis-a-vis technology and pedagogy.

ii) Evaluation. Examinations, continuous assessments, which encourages thinking and reasoning rather than rote memorizing.

iii) Text Book. Relevance of syllabi vis-a-vis the need of common citizenry, various professions, irrelevant out-dated topics, appropriate logical and psychological sequence within a textbook and between textbooks, self-explanatory, and user friendly approach, criteria for writing a textbook.

iv) Diagnosis and Remediation: Construction of diagnostic tests for various topics and various levels, Remediation programmes and their outcomes, feasibility studies for remedial programmes within school curriculum.

v) Attitude towards Mathematics: Attitude of teachers towards mathematics, attitude of students towards mathematics and the causes, effect of teacher's attitude towards mathematics on students' achievement.

vi) Survey of in-service programmes: Devise training programmes to introduce new teaching strategies, study feasibility of in-service programmes, experimenting on distance education for in-service programmes.

vii) Application of Mathematics: Projects to find mathematics in daily life and use of school mathematics in daily life, industry, other sectors, role of mathematics in advancement of mankind, mathematics in different cultures.

viii) Teaching of Mathematics: Innovative methods of teaching by using technology, students constructing their own knowledge, using inputs from culture and context.

2.5 IMPLICATION FOR THE PRESENT STUDY

From review of the related literature to the present study, it is found that most of the studies were related to the achievement in mathematics and the factors affecting it like intelligence, numerical ability, comprehension, recall ability and study habit. Low achievement in mathematics is due to many factors like gaps in knowledge of concepts, difficulties in understanding of mathematical language,

lack of openness and flexibility in teaching, difficulty in mathematisation of verbal problems and interpretation of mathematical results, the abstract nature of mathematics, fear and anxiety on the part of the students. Sashidharan(1992) and Manika(1983) found that the initial deficiencies have a long term damaging effect so this conclusion leads to a fact that acquisition of concepts at the lower grade is essential for acquisition of higher concepts of mathematics.

There are many studies which focused on the diagnosis of the mathematical backwardness among the students at different levels. Various studies in this area have shown low achievement or poor performance in mathematics due to poor command over the fundamentals of Mathematics. George(2003) and Bhirud (1975) found that the weakness in performing the arithmetic and algebraic calculations is due to weakness in understanding the mathematical basics. Gupta (1972), Rastogi (1983) and Ashar(1972) found that the pupils committed errors due to lack of systematic approach.

Further, it is found that the ratio of the studies related to diagnosis and remediation in geometry is less compared to the studies related to diagnosis and remediation in algebra and arithmetic. All the studies George(2003), Venkateshwarlu(2001), Warute(1998), Viswanathan(1997) have found the positive effect of the diagnosis and remedial programme.

The foreign studies have used qualitative methods and focused on many components of Mathematics Education like attitude towards mathematics, hurdles in learning of mathematics and achievement in mathematics. Kalamaros(1991), Tzeng, Shwu-Rong(1987), Karen(1988), Greg(1998), Aviles(1989) tried to investigate into the attributes of low achievement in mathematics, effect of neglect of errors, attitude of teachers towards mathematics, knowledge and beliefs of mathematics teachers. The foreign studies Jaguthsing (2003), Premlatha (2002), Haralambos (2000), Nancy (2000) focused much on the concept formation, and the development of skills responsible for the learning of geometry viz. visualization and spatial reasoning skills.

Amongst the studies that are carried out related to geometry most of them are related to the learning process of geometry and how students understand and conceptualize the concepts of geometry. Two studies (Dutta,1990 and Gurusamy,1990) are near to the present study. In the study by Dutta (1990)

the diagnosing patterns of learning disabilities and preventive measures for the unit 'Congruency of triangles' was focused. And in the study by Gurusamy (1990) case study method was used to diagnose the errors committed by students of class IX in solving problems in geometry, and has developed a remedial package. So the investigator has not come across any studies similar to the present study.

Having reviewed studies in mathematical Education, new areas of research emerged and provided the guidance for the present study. There are Studies Manika (1983), Rajyaguru(1991), Sasidharan (1992) and Kapur and Rosario (1992) focused on the low achievement and poor performance of the students in mathematics. Hence in the present study the investigator first tested the achievement of the students in geometry. Many studies Busamma (1995), Ashar(1972) , Bhirud(1975), Bhardwaj (1987), George (2003) on the construction and standardization of the diagnostic test provided light towards the preparation and implementation of the diagnostic test for the selected topics of geometry for the study. Also, investigator evaluated answer-books and note-books of the students as well as achievement tests and error analysis was carried out, then causes of errors were located and proper instructions were given to overcome these types of errors. The investigator encouraged the students by giving sufficient class practice. As Kalamaros (1991) emphasized need for teachers to evaluate types of errors and show how to correct them or else errors were likely to be repeated. There are studies Rastogi (1983), Bhardwaj (1987), Das and Barua (1968), Kapur and Rosario (1992), Gurusamy(1990), Venkateshwarlu (2001) and Warute (1998) focused on the problems faced by the students for learning mathematics, remedial package, and intervention programmes designed to help the students to overcome the problems. Taking the cues from such researches the investigator also devised the remedial measures offered to the students during the study. Almost all the studies have shown the positive effect of the remedial programme on different indicators of student's learning viz. achievement, performance, interest, retention, etc. The findings of these studies provided sufficient ground for the investigator and motivated to carry out the study towards the successful completion of the study.