CHAPTER - II

REVIEW OF RELATED LITERATURE

2.0 OVERVIEW

This chapter presents the review of studies related to the theme of the Investigator chosen for his study. It comprises of six sections. The first section is an overview of the entire chapter. The Second section points out the importance and the need for the review of the related studies. The Third section explains some of the Indian studies briefly which are related to this investigation. The Fourth section gives a comprehensive account of a number of foreign studies related to the theme of the Investigator. The Fifth section summarizes the outcomes and recommendations of the studies cited in this chapter. The sixth section is solely for documenting the references cited in this chapter.

2.1 NEED FOR THE REVIEW OF THE RELATED LITERATURE

The survey of literature is a crucial aspect of the planning of the study and the time spent in such a survey invariable a wise investment. A review of previous investigations relevant to the present investigation is necessary to gain better perspective of the problem. It provides a greater understanding of the problem and its crucial aspects and ensures the evidence of unnecessary duplication. It highlights the methodology employed in the earlier studies with references to sampling design, type of data gathering instruments used and the procedure of administering the tool on the respondents. Examining the strengths
and weakness of many research reports prevents the Investigator from plugging the procedural pitfalls.

According to **JOHN, W. BEST** (1982) "A familiarity with the literature in any problem area helps the students to discover what is already known, what methods of attack have been promising or disappointing and what problems remain to be solved".

Development in any field is built upon the previous experiences in the same field as well as in connected fields. Research is a continuous process and research work in connected subjects is interrelated. No research work can stand by itself, it should have its foundation in previous research done in related fields and it should be followed up by future investigation.

"A study of related literature implies locating, reading and evaluating reports of research as well as reports of casual observation and opinions the related to the individual's planned research Project". An Investigator must know what sources are available in his field of enquiry. He must be familiar with the sources that are likely to use and he must know where and how to find them, the Investigator can get much help in formulating hypotheses, theories and explanations by surveying the literature related to his study. For the selection of problem, the Investigator can find out the area where the research is needed and can understand whether the evidence already available duplication thus is avoided.
2.2 CLASSIFICATION OF THE STUDIES

The Investigator has gone through few of the researches related to the present problem. Hence an attempt was made by the Investigator to put forth the reviews related to the present investigation. The Investigator identified studies conducted in India and abroad. Of these studies twenty two studies were conducted in India and the remaining nine studies were done in abroad. The detail of the above studies is given below. The Investigator suitably located the related studies and they are presented here:

2.2.1 Studies Conducted in India

Twenty two studies conducted in India are presented here in the Alphabetical order.

A. Psychological Behaviour and Ability in relation to Achievement in Mathematics.

BARNES, (1960) in his research in the field of organizational climate says that in a relatively closed system, external concepts of bureaucrat rationally prevents. These serve to discourage subordinate autonomy interaction and upward influence. In the more open systems external system values and goals and to emphasize technical expertise quality and developmental work, these serve to encourage subordinates autonomy interaction and upward influence.
The studies conducted in India are arranged in three aspects such as Psychological Behaviour and ability in relation to Achievement in Mathematics, Methodology in teaching Mathematics and Competencies in Mathematics.

**MARTIN and WILLOWER, (1981)** conducted a study on the managerial behaviour of High School Principals and developed four major categories and a fifth residual category for the analysis of work behaviour of high school Principals. They have observed the Principals in their daily activity and maintained chronological record, correspondence record, contact record etc.; the major categories are organizational maintenance, school programme, pupil control and extra-curricular activities.

**SHUKLA, P.C. (1981)** in his study entitled "Leadership behaviour in relation to Teacher's Morale" has pointed out that

1) There is significant difference in the level of the two groups of high desirable and low desirable leadership

2) High and low initiating structure style of leadership behaviour is significantly related to teacher's morale and

3) There is a significant difference between the levels of morale of two groups.

The objectives of the study were

i. To provide a standard and valid tool to measure Mathematical Ability of pupils of classes IX and X,

ii. To establish norms of a Mathematical Ability test for classes IX and X,

iii. To study Mathematical Ability Grade-wise, Sex-wise and Area-wise,

iv. To study Mathematical Ability in the context of some cognitive variables, viz. Syllogistic Reasoning and Space Visualization and

v. To study Mathematical Ability in the context of some affective variables, viz. Attitude towards Mathematics and Anxiety for Mathematics.

The mathematical ability test was constructed by following the usual method of test construction. The test was standardized over a sample of 1250 students of class IX and 1035 students of class X. The reliability of the test by the test-retest method, split-half method and K.R. Formula-20, was found to be 0.91, 0.88 and 0.89 respectively. The concurrent validity was established by correlating the score on the test with teachers' opinion and was found to be 0.76. The predictive validity was established by correlating the score on the test with marks obtained in Mathematics. The congruent validity was found to be 0.68. The percentile rank norms and T-score norms were established for urban and rural areas. The other tools used for collecting the necessary data were, (i) Space Visualization Test (SVT), (ii) Syllogistic Reasoning Test in Mathematics (SRTM), (iii) Mathematical Attitude Scale (MATS), and (iv) Mathematical Anxiety Scale (MANS). The reliability of the SVT was 0.90, and 0.95 by the
split-half method and test-retest method respectively. The reliability of SRTM was 0.93 and 0.91 for classes IX and X respectively. The reliability of MATS by the test-retest and split-half method was 0.86 and 0.74 respectively. The reliability of MANS ranged between 0.84 and 0.89. The 2X2X2 factorial design was adopted to study the effect of cognitive and effective variables.

Some of the findings were:

a. The population under the testing programme was normally distributed and the curve was leptokurtic in nature.

b. There were no significant sex differences with regard to mathematical ability of pupils of classes IX and X.

c. There was a significant difference between mean scores of pupils of urban and rural areas; hence norms for these two areas were established separately.

d. The pupils possessing high reasoning ability were found to be better in mathematical ability than those with low reasoning ability.

e. The pupils having good space visualization were found better in mathematical ability than the pupils having poor space visualization.

f. The pupils possessing a favourable attitude towards Mathematics were found better in mathematical ability than those with a less favourable attitude.
g. The pupils possessing high anxiety were inferior in mathematical ability to pupils having low anxiety.

h. The pupils of class IX having favourable attitudes were found superior to pupils of class X possessing unfavourable attitudes; hence the interaction effect between grade and attitude was significant, and the rest of the interactions were not significant.

**KOLHE, S.P. (1985)** did a study on the Construction of Attitude Scales and Measurement of Attitudes of Students of Jalgaon District towards Mathematics. The main objective of the study was to find out the influence of sex and urban-rural location on the attitudes of students of class X towards Algebra, Geometry and Mathematics as a whole.

The sample comprised 2000 grade X students from urban and rural secondary schools of Jalgaon district of Maharashtra State. The Boys and Girls were 1000 each. The Tools used to collect data were three Likert-type attitude scales developed by the Investigator-one scale for Attitude towards Algebra, a second for Attitude towards Geometry, and a third scale for Attitude towards Mathematics. The reliability of the scales as determined by the Split-Half method using the Spearman-Brown Formula was 0.87, 0.91, 0.90 for Algebra, Geometry and Mathematics attitudes scales respectively; t-test was used to examine the various null hypotheses formulated on the basis of objectives.
The major findings of the study were:

a. The students had favourable attitudes towards Algebra, Geometry and Mathematics as a whole.

b. There were significant differences between the attitudes of Urban and Rural students towards Mathematics and Algebra, irrespective of the Sex. Urban students had more favourable attitudes than Rural students.

c. Urban boys had more favourable attitudes towards Mathematics as a whole than Rural Boys.

d. There were no significant differences between the attitudes of Urban Girls and Rural Girls regarding Algebra and Geometry.

e. There were significant differences between the attitudes of Urban Boys and Urban Girls towards Mathematics as a whole, Algebra and Geometry. Urban Boys had more favourable attitudes than Urban Girls.

f. There were significant differences between the attitudes of Rural Boys and Rural Girls towards Mathematics as a whole, Algebra and Geometry. Rural Boys had more favourable attitudes than Rural Girls.

g. There were significant differences between the attitudes of Boys and Girls. Boys had more favourable attitudes towards Mathematics as a whole, Algebra and Geometry than Girls, irrespective of the area they lived in.
The major implications are that teachers of Urban and Rural schools should be trained to develop favorable attitudes towards Mathematics. The attitudes of Urban and Rural children-Boys and Girls, need to be improved. This can be achieved only by making teaching of the subject more interesting.

**PRAKASAM, D. (1986)** conducted a study on Teacher Effectiveness as a Function of School Organizational Climate and Teaching Competency. The objectives of the study were

1. To study the effect of school organization climate on teacher effectiveness,
2. To study the effect of teaching competency on teacher effectiveness, and
3. To study the effect of school organizational climate on teaching competency.

The sample of the study consisted of 800 teachers teaching in classes IX, X and XI of different Higher Secondary schools of Raipur and Bilaspur districts of Madhya Pradesh, along with 92 Principals of these schools. In all 504 teachers were teaching in Government schools, 73 in local body schools, 163 in private, non-Christian schools, and 60 in Christian schools. The relevant data were collected by employing the School Organizational Climate Description Questionnaire by Moti Lal Sharma, the General Teaching Competency Scale by B.K.Passi and M.S.Lalitha, and the Teacher Effectiveness Scale by Parmod
Kumar and D.N.Mehta. Mean, t-values, coefficient of correlation, ANOVA and F-ratios were computed for analyzing the data.

The findings of the study were:

a. Teachers working in an open school climate were better in teaching competency and teacher effectiveness than those employed in schools with autonomous, familiar, controlled, paternal and closed climates.

b. Teachers working in schools situated in industrial areas were found better in teaching competency than teachers working in semi-urban and rural, areas whereas teachers of semi-urban and rural areas were better in teacher effectiveness than the teachers of industrial areas. However, teachers working in schools situated in urban areas were better than teachers of all other areas on both teaching competency as well as teacher effectiveness.

c. No significant difference was found in the teaching competency and teacher effectiveness of the teachers working in government and non-government schools in global terms. However, teachers working in schools run by local bodies were found better in teacher effectiveness and teaching competency than those working in government schools, Christian schools and non-Christian schools.
d. No significant difference was observed between male and female teachers on the tests or teaching competency and teacher effectiveness on the global scale though female teachers were found moderately better in teaching competency under all types of variations, whereas, they were found moderately better than male teachers in teacher effectiveness only under Christian management. In other types of variations no significant differences were observed in the teacher effectiveness of male and female teachers.

SAVADAMUTHU, T. (1988) in his study "Leadership behaviour and teacher morale of secondary school teachers" has pointed out that no difference between the rural and urban school teachers on leadership behaviour and teacher morale shows that the area will not be a factor on teacher's routine work and job satisfaction. The experienced teachers are higher on teacher morale and leadership behavior than the less experienced teachers shown the attitude towards teaching. Since, most of the trained graduate teachers are having long experience in teaching, they are higher on both leadership behaviour and teacher morale. The specialization of subjects does not seem to be a good factor for the development of positive attitude towards teaching.

VARALAKSHMI, B. (1996) in her study on relationship between self concept and achievement of higher secondary students included the following objectives (i) to find out the difference in the achievement of boys and girls,
Urban and Rural Students academic and vocational students and government and private school students and (ii) to find out the relationship between the self concept and achievement of higher secondary student. The sample consisted of 281 boys and 160 girls belonging to five higher secondary schools of Dharmapuri District. She used Self-Concept Inventory constructed by Sagar Sharma and the achievement test was constructed by the Investigator.

The major findings were

i. There exists a significant difference between achievement of boys and girls as well as students studying in government and private schools.

ii. There exist no significant difference was found between students of urban and rural areas as well as students studying in academic and vocational stream of education and

iii. There exist positive and significant relationship between self concept and achievements of pupils were found.

**HASEEN, T. (1999)** conducted a study on Administrative behaviour and dogmatism of secondary school heads in relation to their school academic achievement aimed to study the impact of administrative behaviour of High school heads on their school academic achievement and the achievement and the effect of dogmatism of heads on their school academic achievement. A stratified proportionate academic of 98 male and female High school samples of 98 male and female High school heads were selected randomly in Bangalore city. The
Administrative Behaviour Description Scale developed by Educational Administration department of M.S. University Baroda. Pragmatism scale of Risk.

TRIPATHI, S.N. (1999) studied the development of intelligence and Minimum Level of Learning in Mathematics. He scrutinizes verbal intelligence test items (and to see whether to test items based on MLL competencies) of Karnataka division by Binet test by Kamat.V. The rationale for preparing test items for intelligence tests from problems in Mathematics is that school going child will pick up certain competencies pertaining to Mathematics, which are not so much dependent on the quality of teaching as on the growth of findings were included

i. Academic Anxiety and Academic Achievement are inversely and Significantly related

ii. Students belonging to different levels of academic anxiety differed Significantly on their Academic Achievement

iii. Boys and Girls belonging to Government and Private schools differed Significantly on their Academic Achievement

iv. Boys and Girls irrespective of their Management schools did not differ significantly.

sample. For purpose of measuring academic performance of the schools, they grouped into low, average and high. The study revealed that the overall organizational climate was found to be high. The schools do not differ significantly with respect to the type and categories of schools and the schools differed significantly with respect to their academic achievement as low, average and high performance and overall organizational climate of the schools.

B. METHODOLOGY IN TEACHING MATHEMATICS

KRISHNAKUMARI, (1980) did an investigation into the Use of Mathematics Textbook (Class II) as a Tool of Teaching in Haryana. The objectives of the study were (i) to find out how far the teachers were conversant with the content given in the textbook of Mathematics (class II) and taught this content to their students, (ii) to verify if the teachers taught Mathematics in class II according to the approach given in the textbook, (iii) to find out to what extent the teachers followed the old and traditional methods other than those suggested in the textbook for teaching Mathematics, and (iv) to find out whether the teachers had gone through the textbook themselves and whether the teachers actually felt the necessity of the textbook as an essential tool of teaching.

Sampling was done at two stages. At the first stage 33 primary sections were selected from Primary/Middle/ High schools of Gurgaon District and at the second stage 771 students (315 girls and 456 boys) were selected for the study. Three tools were developed and used, viz. first, a questionnaire for checking the
methodology and aids used by the teachers while teaching; second, an interview schedule for confirming the validity of responses of the questionnaire; and third, written/oral tests for the students for assessing their achievements. Chi-square values were calculated to test the hypotheses.

The main findings were:

1. Thirty-six per cent of the teachers did not at all look into the methodology provided in the textbook; rather they continued with the old pattern of teaching methods and did not even study the change in the syllabus.

2. Forty-nine per cent of the teachers made partial use of the methodology suggested in the textbook.

3. Fifteen per cent of the teachers studied the textbook thoroughly and tried their best to assimilate the new concepts and methods.


The objectives of the study were

i. To find out the efficiency of the Programmed Learning Method over the Conventional Learning Method in the instruction of Mathematics in school education,
ii. To determine the variation in learning gains in the pupils in the Rural and Urban dimension,

iii. To determine whether there was any difference in learning due to Sex variation of the pupils,

iv. To investigate into the variations in achievement gains of the pupils in Mathematics owing to variation in their general mental ability level under programmed learning instruction and

v. To find out the differential learning gains in the pupils owing to school climate, with special reference to Private and Government management of Institutions.

The design was an experimental cum field investigation. Two matched groups of students were exposed to programmed learning and conventional classroom teaching. The subjects were matched on the rural-urban variable, sex, IQ, stage of instruction and management of schools. A sample of 300 students from grade V and 296 students from grade X was taken. Equal numbers of students were assigned to the programmed learning group and conventional learning group in both the grades. The tools employed for data collection were The Hyderabad State Bureau of Education Group Test of Intelligence (1980), an interview schedule to know the attitude of students, and achievement tests in Mathematics for students of grades V and X.
The findings of the study were:

a. The mean performance scores of the Programmed Learning group and Conventional group on the Achievement test were less than the normative means of the tests.

b. The mean performance scores of all the Programmed Learning groups were higher than those of the corresponding Conventional Learning groups.

c. The performance of urban students was superior to the performance of the rural students under the programmed learning method, irrespective of grade.

d. The difference between the mean performance scores of the Programmed Learning and Conventional Learning groups was the highest in the case of urban students of Grade X.

e. In Grades V and X, Girls scored higher than Boys.

f. There existed no Sex difference in the learning gains of the programmed learning groups separated on the basis of Sex.

g. The mean performance scores of groups of subjects of High, Average and Low level of General Mental Ability were the order of their categorization.

h. The significant differences were very high in the case of mean performance scores of the programmed learning and conventional learning groups of subjects in the category of high level of general mental ability.
i. Subjects of Grade X gained more by the Programmed Learning method than subjects of Grade V.

j. The increase in mean performance score of subjects of Private schools was more by the Programmed Learning method of instruction as compared to that of Government schools.

k. The difference between mean performance scores of the Programmed Learning and Conventional groups was the highest in the case of the subjects of Grade V of Private schools.

l. The learning gains in Mathematics were maximized by the Programmed Learning method in the case of subjects of Urban Private Schools.

m. The Girls of the Private schools, irrespective of their stage of instruction, scored higher than the Boys by the Programmed Learning method of instruction in Mathematics, though these differences were not found to be Significant.

n. Subjects of high general Mental Ability of Private schools were the highest beneficiaries of the Programmed Learning method of instruction in Mathematics.

In a study conducted by, **YADAV, (1984)** on the Effect of Mastery Learning Strategy on Pupils’ Achievement in Mathematics, their Self-concept and Attitude towards Mathematics. The Objectives of the study were
i. To compare the mean achievement scores of two groups of pupils taught Mathematics with and without the use of mastery learning strategy,

ii. To compare performance scores of two groups of pupils taught Mathematics with and without the use of mastery learning strategy,

iii. To compare the attitude towards Mathematics of two groups of pupils taught Mathematics with and without the use of mastery learning strategy and

iv. To compare the mean self-concept scores of two groups of pupils taught Mathematics with and without the use of mastery learning strategy,

The study employed a pre-test, post-test control group design involving two groups of pupils, the experimental group using mastery learning strategy, and the control groups using the conventional method of teaching Mathematics. The sampling unit for the study was the school. Six high schools in rural area of Haryana were selected and paired in three sets each comprising one from the experimental group and the other from the control group, matching them on the basis of institutional characteristics. Three schools were assigned to the experimental group and three to the control group. The experimental group had 173 students of grade IX in five sections taught by five different teachers. The control group had 189 students of grade IX in five sections taught by five different teachers. The students in the experimental and control groups were
equated on their scores on intelligence, socio-economic status and previous knowledge in Mathematics. The sample students were administered the following tools: (i) the Mathematics Attitude Scale which had a split-half reliability of 0.85 and had content validity; (ii) the Mathematics Achievement Test which had a split-half reliability of 0.73 and had content validity; (iii) the Swatva Bodh Parikshan-a test of self concept developed by Sherry et al., having test-retest reliability 0.733 and validated against content. The data so collected were analyzed with the help of t-test.

The findings of the study were:

a. Before the experimental treatment, the experimental group (mastery group) of pupils and the control group (conventional group) of pupils evinced no significant differences in respect of their achievement in Mathematics, self-concept and attitude towards Mathematics.

b. After the experimental treatment, the experimental group of pupils exhibited a significantly higher achievement in Mathematics than the control group of pupils and higher gain scores of achievement in Mathematics.

c. Different percentile achievement scores of the experimental group of pupils were found to be significantly higher than those of the control group of pupils at post-test stage.
CHITKARA, M. (1985) Studied the Effectiveness of Different Strategies of Teaching on Achievement in Mathematics in Relation to Intelligence, Sex and Personality. The objectives of the study were to find out

i. Whether achievement in Mathematics was affected by different strategies of teaching,

ii. Whether different strategies had differential effects on achievement of male and female students,

iii. Whether levels of intelligence interacted with teaching strategies in terms of achievement and

iv. Whether personality acted as a potential factor in selection of teaching strategy.

In the study a pretest/post-test experimental design, was followed. A four-way factorial design (3 X 2 X 2 X 3) was employed. The independent variables in the study included strategies of teaching, sex, personality and intelligence and the criterion variable was Achievement in Mathematics. The strategies of teaching varied in three ways-(a) lecture-discussion, (b) inductive-drill and (c) auto-instruction group discussion. The personality varied in two ways-extraverts and introverts; 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 sample subjects were administered (i) The Mathematics Achievement Test, (ii) The Jalota Group Test of Mental Ability (1972), (iii) The Eysenck Personality Inventory (1964). 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 pretest/post-test were analyzed, through four way \((3 \times 2 \times 2 \times 3)\) analysis of variance.

The findings of the study were:

a) All the three strategies, namely, (a) lecture-discussion, (b) inductive-drill, and (c) auto-instruction group discussion, were found to be equally effective in terms of achievement in Mathematics disregarding levels of intelligence, sex and personality type.

b) Boys and girls of superior ability did not show any significant difference between their mean scores on achievement in Mathematics.

c) Girls of average ability scored significantly higher in Mathematics than boys of average ability.

d) Lecture discussion strategy found favour with average ability students as they scored significantly higher than a above-average and below-average groups.
e) Strategy II and strategy III, namely inductive-drill and auto-instruction group discussion, was more suited to the students having above-average intelligence than average and below-average intelligence.

f) The strategy of lecture-discussion was found to be equally effective with above-average and below-average ability (intelligence) introverts as well as extraverts.

g) Extraverts of high ability, average ability and below-average ability scored equally well when taught through strategy I.

h) Under the strategy of inductive-drill, average-ability extraverts scored significantly higher than average-ability introverts.

i) Under the strategy of auto-instruction group discussion, high ability and low ability extraverts did not differ from the high ability and low ability introverts. But extraverts of average ability differed significantly in their achievement from average ability introverts.

j) Out of the three strategies, strategy I was more suited for below-average ability extraverts and introverts, strategy II for high ability extraverts and strategy III was most suited for high ability introverts for achievement in Mathematics.
RAO, A.V.R. (1986) conducted an Investigation into the Relative Effectiveness of Guided Discovery and Expository Approaches of Teaching Mathematics. The major objectives of the research were

i. To study the relative effectiveness of guided discovery and expository approaches of teaching mathematical concepts,

ii. To study the relative effectiveness of guided discovery and expository approaches of teaching problem solving,

iii. To study the interaction of intelligence and achievement in Mathematics vis-a-vis guided discovery and expository approaches and

iv. To study the relative effectiveness of guided discovery and expository approaches in different types of pupils, namely boys, girls and rural pupils.

The population selected for testing the above hypotheses was class IX pupils of Vizagapattanam. From this population, three samples, namely, boys, girls and rural pupils, were selected. On each sample an intelligence test was administered. Each sample was then divided into two equivalent groups on the basis of their means and SD on this intelligence test. Thus the two groups were matched for intelligence. After dividing each sample into two equivalent groups, one group was allotted to the guided discovery approach and the other was allotted to the expository approach. Identical topics from Arithmetic, Algebra and Geometry were taught to both the groups for one month. After this a test on
these topics was administered to the two groups. The randomized blocks design was based upon the principle of grouping experimental units into blocks. Blocks were formed on the basis of intelligence which was related to achievement in Mathematics.

The major findings were:

i. There was no significant difference in achievement in Mathematics when taught by the guided discovery and expository approaches.

ii. There was no significant difference in achievement in mathematical concepts when taught by the guided discovery and expository approaches.

iii. There was no significant difference in problem solving when taught by the guided discovery and expository approaches, except in the case of girls where a significant difference was found.

iv. There was no significant difference in variance in achievement when taught by the guided discovery and expository approaches.

v. Intelligence had no say in achievement when taught by the guided discovery and expository approaches, except in the case of urban boys.
DAS, R.C. and BARUA, A.P. (1986) did a study entitled “Effect of Remedial Teaching in Arithmetic, A Study with Grade IV Pupils, SIE, Assam”. The main aim of the study was to determine the effect of remedial teaching in arithmetic in grade IV. For the purpose of diagnosis of individual differences F. J. Schonell's 'Diagnostic Arithmetic Tests' were adopted. The first seven series of tests were used. There were altogether 604 sums. Pretest post-test experimental-control group design was followed. In each group there were 30 grade IV pupils. The experimental group was given remedial teaching and the control group was taught as usual by the class teacher. Student t-test was applied to compare test-wise and total average achievement of both the groups.

The major conclusion of the study was that remedial teaching had definitely improved significantly the achievements in Arithmetic. The major educational implication of the study is that remedial teaching, even for a small period compared to the total duration of working days in the year, can effect significant improvement in achievement in Arithmetic.


The objectives of the study were

i. To construct and standardize a diagnostic test in Mathematics for middle standard students of Haryana,
ii. To find out the types of errors committed by the pupils in the context of the nature of teaching units and

iii. To construct and try out remedial material.

The test was standardized on a sample of 1146 students (729 boys and 417 girls) belonging to Government and Aided High schools of Haryana State. The items of the test were selected from the syllabus of Mathematics prescribed by the Haryana Education Board for the middle standard examination. The items were analyzed for their clarity of direction, gradation, discriminatory value and appropriateness of content. The reliability was established through the test-retest method and validity was established through content validity, intrinsic validity and criterion related validity. On the basis of the diagnostic test, 377 programmed self-instructional exercises (117 demonstrated, 117 promoted and 143 released) were prepared.

The main features of the test and remedial material were: 1. The test consisted of three parts, that is, Arithmetic, Algebra and Geometry, comprising 202, 138 and 158 items respectively. There were supply type items for Arithmetic and Algebra and multiple choice items for Geometry. 2. The reliability established through the test-retest method had a coefficient ranging from 0.81 to 0.91 for each of the three areas and the whole test. 3. Intrinsic validity of the test for all the three areas and the whole test ranged from 0.90 to 0.95. 4. Validation of the test against students' marks in Mathematics in the public examination conducted by the Haryana Board of Education gave a value
of 0.83. 5. The items in the test were scored by giving one mark for each correct response and zero mark for each incorrect response. 6. Percentile norms were established and the scores were categorized in five-fold categories ranging from very good to very poor. 7. The error rate in all the three areas, that is, Arithmetic, Algebra and Geometry, came out to be 30.4 per cent, 50.6 per cent and 51.4 per cent respectively. 8. All programmed exercises could be completed by the students in six days taking four to five hours daily. 9. There was significant improvement in achievement of the students after they had gone through the remedial exercises.

YADAV, S. (1999) have made the following objectives in his study to estimate learning achievement of class V students in language and Mathematics and to investigate difference in achievement of different groups of students of Boys – Girls, SC-OBC- Others, Students in Rural and Urban schools. The sample consists of 335 schools 3810 V standard students, 3627 class II standard students and 529 dropouts and 814 primary teachers. He used NCRET class V language and Mathematics tests.

His major findings included that

i. The achievement of class V students in Mathematics was quite low in all the districts and more than 80 percent did not even achieve MLL level

ii. There was No Significant difference exists between Rural and Urban students in this aspect
iii. The position of Language was slightly better than Mathematics. About 30 per cent students achieved the MLL on average and

iv. No Significant Difference was found between Rural and Urban students.

C. COMPETENCIES IN MATHEMATICS

NATARAJAN, A. (1998) in his study on achievement of Mathematics competencies by the pupils of standard I, he included the following objectives

i. To find out the achievement level of standard I pupils in Mathematics competencies

ii. To find out the any significant difference in their achievement in Mathematics among the pupils of I standard in (a) boys and girls (b) Rural and Urban and (c) Private and Government school pupils.

He has randomly selected 91 primary schools of Dharmapuri District and included the 1677 boys and 1541 girls who were studying in such schools as sample. He constructed an achievement test to find out the competencies attainment level.

His major findings included that

i. The Competencies Achievement level of Standard I pupil in Mathematics was found to be 84 per cent.

ii. The Boy's Achievement level was 85 per cent and that of Girl's Achievement level was 82 per cent.
iii. There exists a Significant Difference found in the Achievement of competencies by the Rural and Urban pupils and also Private and Government school pupils.

JAYESH, A.N. (1999) conducted a study with the objectives of the different arithmetic competency of the students having high and low academic achievement and arithmetic competency of the girls and boys having high and low academic achievement. The sample of 235 students was chosen from six selected private schools of Surat city. The competency based arithmetic test was prepared for the pupils of standard I to IV classes. The study revealed that the difference was found significantly in arithmetic competency of the boys and girls having high and low academic achievement. The boys have showed marked difference in arithmetic achievement than girls.

PANDA, S.C. (2000) in their study on attainment of selected competencies in Mathematics class I and II with the following objectives

i. To develop training package on mastery learning strategy

ii. To design mastery learning strategy for attaining knowledge and skills required for selected competencies in Mathematics

iii. To develop competency among Primary school teachers in using mastery learning strategy and

iv. To study the influence of mastery learning strategy on attainment of selected competencies Mathematics in relation to locality, caste
category and mono grade teaching and multi grade teaching. They used criterion referenced competency based test for class I and class II and class room observation schedule on mastery learning strategy.

Their major findings were

i. By the use of mastery learning strategy, the urban pupils could be master the competency than the Rural based pupils

ii. Provision of more instruction and remedial teaching could significantly helped the learners to attain mastery in class I and

iii. The urban learners exhibited better performance in naming the days in class but backward cast exhibited better performance in recognizing coins in superiority in learning weight using standard castes exhibited superior performance in learning of the use of calendar and understanding the concept of division.

2.2.2 STUDIES CONDUCTED ABROAD

The studies identified Abroad were classified in two different aspects namely, Development of Mathematics Ability and Different Methods of Teaching in Mathematics.

A. DEVELOPMENT OF MATHEMATICS ABILITY

KREBS, A.S. (1999) did a study on the Students' algebraic understanding entitled as a study of middle grades students' ability to symbolically generalize functions. This study investigates students' learning in a reform curriculum of the
National Science Foundation funded curriculum projects to address the vision described in the Standards. After these materials were developed and implemented in classrooms, questions arouse surrounding students' learning and understanding. The data surrounded the solutions of four performance tasks, completed by five pairs of students. These tasks were posed for students to investigate linear, quadratic, and exponential situations. The data was collected and analyzed from the students' written responses, video recordings of the pairs' work and follow-up interviews of ten students who were typical students in her classroom to participate in this study of Heartland Middle School, a pilot site of the CMP.

The two major findings of this study surrounding students' understanding of Algebra was that the students who had three years in the Connected Mathematics Project curriculum demonstrated deep understanding of a significant piece of Algebra. And secondly the teachers can learn much more about students' understanding in Algebra by drawing on multiple sources of evidence and not relying solely on students' written work.

**COVINGTON, C.L.M. (2001)** did a study on the Effects of the Connected Mathematics Project on middle school Mathematics achievement. The purpose of this study was to examine the three-year effect of the Connected Mathematics Project (CMP) on the Mathematics achievement of Middle school students in an urban school district. This was accomplished by (1) comparing the Mathematics achievement of Eighth graders who have completed three years of
CMP with the achievement of Eighth graders who have completed three-years of a traditional curriculum; (2) comparing the interaction and communication patterns in the two types of classrooms; and (3) comparing the Mathematics achievement of historically underrepresented students in both curricula.

The overall design employed in this study was quantitative and qualitative methodologies. The quantitative section of the study examined the mathematical achievement of 700 of the 1999-2000 Eighth graders as evidenced by their State Basic Standards Test (BST) scores. The qualitative segment of the study explored the experiences of the primary participants, the teacher and the students. Using the State Basic Standards Test as the dependent variable, there was no significant difference between the Mathematics achievement of CMP students and that of traditional students after three years of the respective curricula. The achievement gap between CMP Caucasian students and CMP African, American students were smaller than the achievement gap between these groups in the traditional curricula. The classroom interaction and communication patterns were very different. CMP classrooms provided more opportunities to learn Mathematics than traditional classes. Moreover, CMP students demonstrated algebraic reasoning skills at the same level as the traditional students and demonstrated conceptual understanding through the use of multiple strategies at a higher level than traditional students. Overall, CMP students had a higher level of satisfaction and more positive experiences in their Mathematics classes than did traditional students.
HALLAGAN, J. E. (2003) conducted a study on the Teachers' Models of Student responses to Middle School Algebraic Tasks. The purpose of this study was to describe Middle school Mathematics teachers' models on Interpretations of students' responses to middle school algebraic tasks. The research questions focused on the nature of the teachers' developing ideas and interpretations of student responses from selected algebraic tasks involving the distributive property and equivalent expressions. Models and modeling framework guided the study's design. Model-eliciting activities were used to perturb and at the same time reveal their thinking. These activities consisted of asking the teachers to create a "Ways of Thinking" sheet based upon students' responses to the selected algebraic tasks, and to select, analyze and interpret samples of student work. Five teachers participated from two Middle schools.

Data collection included classroom observation, artifact collection from the model-eliciting activities, semi structured interviews, and team discussions. Two sets of findings emerged from this study. Firstly the models and modeling perspective is indeed an effective methodology to elicit teachers' models of their students' algebraic thinking. Secondly the following five aspects are central to teachers' models of student responses to tasks with equivalent expressions and the distributive property. Teachers recognized that students: (a) tended to conjoin expressions, (b) desired a numerical answer and (c) had difficulty writing algebraic generalizations. In addition, teachers identified that (d) visual representations were highly useful as instructional tools. And finally (e) the
teachers in this study needed more experience in analyzing and interpreting student work. The findings from this study revealed consistent information across the Ways of Thinking sheets, library of student work, individual and team interviews, and classroom observations.

**KATWIBUN, D. (2004)** did a study on the Middle school students' Mathematical dispositions in a problem based classroom. The purpose of this study was to describe middle school students' mathematical dispositions in a problem-based learning [PBL] classroom. Eight volunteer students from one 6th grade Mathematics classroom participated in this study. The curriculum used was the Connected Mathematics Project [CMP]. The main sources for data collection were classroom observations, the Attitudes and Beliefs questionnaire, teacher interviews, and student interviews. The teacher acted as a facilitator and encouraged her students to try new ideas without fear of making mistakes. The teacher in this study had her students investigate Mathematics problems within cooperative small groups and share their ideas in large group discussions.

The findings revealed that almost all of the students in this study demonstrated positive mathematical dispositions. They volunteered and shared their ideas, both in small cooperative group investigations and in large group discussions. They believed Mathematics was about "learning new ideas" and Mathematics was "life" because it was everywhere in their lives. They also mentioned the usefulness of numbers, measurement, and geometry in their daily lives. All eight participants liked hands-on activities and working on a
Mathematics project. Most of them agreed that they liked Mathematics because it was fun and interactive. Most also saw themselves as good at Mathematics. All of them agreed that Mathematics was useful, and that one's Mathematics ability could be increased by effort. They also believed that there were no gender differences in Mathematics, even though in their class, they realized that boys outperformed girls. Most of the students agreed that they could solve time-consuming Mathematics problems and that it was important to understand mathematical concepts. None of them had negative feelings about group work; they learned from each other. Finally, an analysis of the participants' mathematical dispositions was discussed.

**BRAY, M. S. (2005)** conducted a study on the Achievement of Eighth Grade Students in Mathematics after completing three years of the Connected Mathematics Project. The purpose of this study was to examine the three-year effect of the Connected Mathematics Project (CMP) on the Mathematics achievement of Middle school students in a southeastern Tennessee public school district. This was accomplished by (1) comparing the Mathematics achievement of Eighth graders who have completed three years of CMP with their Mathematics achievement after completing one and two years of CMP; (2) comparing the achievement of male and female students during the same period of time; and (3) comparing the mathematics achievement of historically underrepresented students after completing one, two, and three years of CMP. In order to provide for a richer analysis of the CMP experience, the overall
design employed quantitative and qualitative methodologies. The quantitative section of the study examined the Mathematical Achievement of almost 2,900 of the 2001-2002 Eighth graders, over 3,000 of the 2000-2001 Seventh graders, and over 3,100 of 1999-2000 Sixth graders as evidenced by their Tennessee Comprehensive Assessment Program (TCAP) test scores.

The qualitative segment of the study explored the experiences of the textbook adoption committee members, teachers, administrators, and parents. Using the Tennessee Comprehensive Assessment Program mathematics total battery test score as the dependent variable, there was no significant difference between the Mathematics achievement of students completing one or two years of CMP. However, there was a significant difference in the Mathematics achievement between students completing three years of CMP when compared to their Mathematics scores after one and two years. There was also a significant difference between male and female students after completing one and two years of CMP but no significant difference was detected after the completion of three years. Though there was a significant difference revealed in the achievement between African Americans and Non African Americans after completing one, two, and three years of CMP the gap closed slightly after completing three years. Overall, CMP students performed better on the state achievement assessment the longer they were being instructed using the standards based curriculum.

O'CLAIR, K. K. (2005) made a study on the Impact on student achievement: Going to scale with a Middle school Mathematics Initiative. The
study was conducted to measure the impact of a Middle school Mathematics initiative on student achievement. A survey research design was used to categorize the levels of implementation by 7th grade Mathematics teachers. The survey targeted the teachers' participation in 4 key components of the middle school Mathematics initiative, based on an expanded model of the theory of action of standards-based reform by Elmore and Rothman (1999): district-led professional development, school walkthroughs, site-based team planning and use of standards based Connected Mathematics Programme.

In a western urban school district, 18 of the 21 contacted teachers from 2002-2003 and 26 of 33 from 2003-2004 were taken as samples. The Year 1 teacher sample represented 29 per cent of the total teacher population and their 1,259 students were 24 per cent of the total student population. The Year 2 teacher sample represented 39 per cent of the teachers and their 1,765 students were 33 per cent of the total student population. The scale scores of these students from 18 schools were the dependent variable for analyses of variance. The independent variables were the year and the level of implementation that was determined by weighting the results from the teacher survey against a rubric of implementation created by the researcher.

The major findings showed statistically significant differences by years and by levels of implementation. The 7th grade student Mathematics scale scores of the statewide standards-based assessment positively improved and the strength of the effect was small. Using a two way ANOVA to compare the 4
groups of high and low implementation in both years, there was a statistically significant difference between the students' scores who experienced higher versus lower levels of implementation in their 7th grade Mathematics classes. The students of the higher implementation group of teachers, who had less teaching experience but attended more professional development and had more team planning, had higher math scale scores. The research results conclude that there was a statistically significant small improvement. Recommendations for further research suggest investigation of the quality of instructional delivery, not only the quantity of CMP units. More involvement with instructional leaders on-site could support scheduling efforts for grade-level planning and more walkthroughs.

B. DIFFERENT METHODS OF TEACHING MATHEMATICS

WAITE, R.D. (2000) did a study on the effects of everyday Mathematics on student achievement of III, IV and V Grade students in a large north Texas urban school district. Data for this study were from student records in a large North Texas urban school district that were taught with two different Mathematics curricula to determine whether or not they had different effects on student achievement. One of the Mathematics curricula, Everyday Mathematics, was developed upon national mathematic standards, written by the National Council of Teachers of Mathematics. The other Mathematics curriculum was district-approved, using a textbook from a large publisher, with a more traditional approach.
The students selected for the experimental group came from six schools that had implemented the *Everyday Mathematics* curriculum for the Academic year 1998-99. An experimental group was formed from these students. Twelve schools with similar socioeconomic ratios, ethnic makeup and 1998 Iowa Test of Basic Skills mathematic score profiles were selected. A control group was formed from this population of students that was similar to the experimental group with the exception of having been taught using the district-approved Mathematics curriculum. These two groups were very similar in socioeconomic, ethnic, gender, and grade level makeup. Most importantly, the experimental group and control group were almost identical (there was no statistically significant difference) in their 1998 Iowa Test of Basic Skills Mathematics scores, a gauge used to demonstrate that prior Mathematics ability was equal going into the 1998-99 school year. In the statistical analysis, almost all comparisons showed that the experimental group taught with the Everyday Mathematics curriculum had higher scores on the 1999 Texas Assessment of Academic Skills Mathematics test. When compared to children with similar Mathematics ability at the beginning of the 1998-99 school years, the students in this study who were taught using *Everyday Mathematics* showed greater achievement gains than students in classes that used the district-approved curriculum.
WASMAN, D. G. (2000) Conducted a study on the investigation of Algebraic reasoning of Seventh and Eighth Grade students who have studied from the Connected Mathematics Project curriculum. This study investigated algebraic reasoning of Seventh and Eighth graders' who have studied from the Connected Mathematics Project (CMP) materials. In order to document the extent and nature of the use of CMP, all Sixth, Seventh and Eighth grade teachers completed a survey followed by researcher-conducted classroom observations. The Iowa Algebra Aptitude Test (IAAT) was administered to 100 Seventh Graders and 73 Eighth Graders. Five Seventh graders and six Eighth graders were randomly selected for individual interviews consisting of a series of twelve Algebra tasks.

Students' performance on the IAAT and interview tasks demonstrated the well-developed nature of their understanding and use of algebraic ideas and strategies. Students demonstrated flexibility in their thinking and ability to describe linear relationships in a variety of representations. Students described rate of change arithmetically, algebraically, and/or geometrically in different situations. Students approached problems in a sense-making way, choosing a variety of different strategies (informal and formal) all of which led to correct solutions and reflected strong conceptual understanding of algebraic ideas. Eighth graders were more likely to use symbolic Algebra methods to solve problems than the seventh graders, reflecting a natural development of more symbolic strategies. Context played an important role with regard to students'
ability to interpret and symbolize mathematical ideas. Students were more likely to represent situations symbolically when they were embedded in a context-rich setting. Some students had difficulty translating from a recursive pattern to an explicit formula and interpreting a graph as a relationship between independent and dependent variables. These same weaknesses have been noted in other research studies indicating that these ideas may require more time or maturity to develop, regardless of the particular curriculum used.

**DURKIN, N. M. (2005)** did a study on the Connected Mathematics Program and its impact on the Delaware State Testing scores of 8th-grade students at Milford Middle School. This study was designed to investigate the impact of the Connected Maths Project curriculum on the student achievement of Eighth grade students participating in the Delaware State Testing Program from 1998-2004. The study included an investigation of overall student achievement of students participating in the Connected Math Project as well as specific subgroup populations such as the Black and Special Education students.

The investigation revealed that overall student performance and subgroup population performance has increased since the first administration of the Delaware State Testing Program in 1998. A pair wise comparison probability for all test years indicates the increase in mean math scale scores was significant. However, additional pair wise comparison probabilities indicate the percentages of students meeting the state math standard are significant for comparison of test year 2000 with 2003 only. This indicates that although student mean math scale
scores are increasing the percentage of students meeting the standard has not increased significantly. Student scores may be approaching the standard but not meeting or exceeding the standard. Pair wise comparison probabilities for the subgroup populations Black and Special Education also indicate a significant increase in the mean math scale scores but not a significant increase in the percentage of students meeting the standard.

2.3 SYNTHESIS OF REVIEW

The investigator has synthesized the above mentioned related studies by means of nature of the methodology of the research, size of the sample taken, variables taken up, tools used, statistical techniques adopted, and the findings drawn in different studies.

The Investigator has identified totally thirty one studies related to his research among which twenty two studies conducted in India and remaining nine studies conducted abroad. Among the twenty two studies conducted in India, the Investigator identified three different areas on Achievement and Teachers Morale which are related to his study. Among the identified studies sixteen were found to be related to Achievement in Mathematics of the students studying in the various Rural and Urban locality schools, four studies were related to Organizational Climate of the schools and two studies relating to the Teachers Morale.

The method followed in most of the studies identified by the Investigator were as follows: 7 studies were experimental studies in which two of them were
analyzing the effect of Mastery Learning Strategy in Mathematics and 13 studies survey studies in which two were related to the effect of Remedial Teaching Methodology in enhancing the achievement in mathematics among the school students.

The size of the sample of the above Achievement studies varied from a minimum of 30 to 7966 students of different schools and in their Teacher Morale studies it has include 375 to 892 teachers of various Rural and Urban locality schools. In most of all the above studies Random Sampling Technique were followed except in a study Randomized Block Design was adopted.

The Standardized Tools used in the study were such as The Hyderabad State Bureau of Education Group Test of Intelligence, Space Visualization Test (SVT), Syllogistic Reasoning Test in Mathematics (SRTM), Mathematical Attitude Scale (MATS), Mathematical Anxiety Scale (MANS), Likert –type Attitude Scale, The Jalota Group Test of Mental Ability (1972), The Eysenck Personality Inventory (1964), School Organizational Climate Description Questionnaire by Moti Lal Sharma, the General Teaching Competency Scale by B.K.Passi and M.S.Lalitha, and the Teacher Effectiveness Scale by Parmod Kumar and D.N.Mehta , F. J. Schonell's 'Diagnostic Arithmetic Tests' along with the Achievement Test in Mathematics (ATM) were utilized.

The findings of the various studies conducted in relation to the Achievement in Mathematics among the school students revealed that there was Significant Difference in the Achievement among them with respect to the


In some of the studies with respect to the locality the achievement of the students did not vary and was contradictory to the results obtained in the other studies by Yadav, S (1999) and Savadamuthu, T (1988). Among the studies conducted in the Government and Private management schools the results revealed that there was Significant Difference in the Achievement scores in Mathematics among the Private management school students than the Government school students. Rao, T.G (1983): Varalakshmi, B (1996): Natarajan., A (1998) and Prakasham, D (1986). Contradictory results were also obtained that there was no difference in the Achievement regarding the school management of Tripathi, S.N. (1999).

The results obtained from two of the studies identified reveal that Programmed Learning Packages developed by the Investigators had positive

Regarding the studies conducted in relation to the Organizational Climate and Teacher Morale the results revealed that High Organizational Climate and Teacher Morale influenced the Achievement among the students and has increased the Autonomy interaction and Upward Influence among the teachers working in the various schools. Barnes, (1960): Prakasam, D. (1986): Kumaran, D. (2001) and Savadamuthu, T. (1988).

Among the nine studies conducted abroad eight studies belong to survey design and only one was experimental. The tool used is the above studies were Achievement test is mathematics, IOWA, Basic Standard Test (BST), Attitudes and belief Questionnaire etc, Most of the studies were conducted in Connected Mathematics Programme (CMP). The size of the sample ranges from eight students to a maximum of 3000 students. In few of the studies responses from the teachers handling Mathematics were also utilised.
The studies reveal that the Achievement, Understanding among the students have improved by CMP than the traditional curriculum. It also reveals that student utilise various strategies formal and informal to solve the problems.

On the whole, the review has given the Investigator a sound knowledge of all aspects of Achievement in Mathematics and Teachers Morale as a whole and made him familiar with recent advances in the subject under study. It has also suggested the Investigator the possible and flexible techniques and procedure to be planned and applied during the current study. The present study is to find out the Achievement in Mathematics and Teachers Morale of schools in these previous researches.

The next Chapter deals with the Methodology of the study.