CHAPTER II

REVIEW OF RELATED LITERATURE
Review of related literature is an important pre-requisite to actual planning and for the execution of any research work before embarking on making a fresh study. Feeling the importance of review, Best (1977) says, "... a familiarity with the literature in any problem area helps the students to discover what is already known, what others have attempted to find out, what methods have been promising and disappointing and what problems remained to be solved".

Secondly, the study of related literature helps in avoiding duplication, guides in carrying out the investigation successfully and makes the researcher familiar with the steps.

Keeping in mind the above considerations, the following research investigations gleaned from a survey of literature were selected on the basis of their scientific prominence, historical educational importance and for being noteworthy contributions of knowledge in the field of mathematics related to objectives, curriculum, methods of teaching, evaluation technique and facilities available in the institutions. With a view to direct the efforts in an appropriate direction, as also to capitalise on the research conducted by the
previous researchers for the formulation of hypotheses, a review of research literature related to problem under study has been grouped under two headings — (a) studies related to objectives, curriculum, methods, evaluation techniques and facilities in the institution when different subjects are taken into account, (b) studies related to objectives, curriculum, methods, evaluation technique and facilities available in the institution when the subject of mathematics is taken into account.

2.1 STUDIES RELATED TO OBJECTIVES, CURRICULUM, METHODS OF TEACHING AND EVALUATION TECHNIQUE WHEN DIFFERENT SUBJECTS ARE TAKEN INTO ACCOUNT:

SIE (Gujarat) in the year 1965 conducted a study with the aim to get an overall picture of the position of primary education in Gujarat with a special reference to the economic and educational position of teacher educators of primary teacher training institutions. It also aimed at finding their views about the syllabus. The findings of the study revealed that (i) the syllabus needed to be modified, (ii) the examination system required to be improved, (iii) seventy six per cent of the teacher educators were trained in basic education, (iv) twenty two per cent of them had accepted the profession as their own choice, (v) they felt that their economic position was satisfactory, and (vi) twenty eight per cent of them liked to have further study.

A study was undertaken by Patole (1967) to explore the existing weaknesses of teaching science in primary schools and devise methods for improvement in the existing situation. It
was delimited to rural areas mainly. The following objectives were kept in view: (i) to study the existing facilities available for teaching of science in rural primary schools; (ii) to frame general science syllabus for standards I to VII, (iii) to study the effectiveness of activity based method and traditional method of teaching the subject; (iv) to suggest measures which can help to improve the teaching of science in rural primary schools. The area selected for the study was the entire Kohlapur district. A sample of 100 schools was taken and a questionnaire was given to the school teachers. The important findings were: (i) about seventy four per cent teachers and sixty-one per cent trainees were of the opinion that science should be a separate subject from standard 1st. and should not be integrated with social studies in first four grades; (ii) sixty per cent of the teachers have passed their P.S.C. examination, thirty nine per cent have passed the S.S.C. examination and the remaining have taken higher education; (iii) the average number of pupils per teacher in standard I was 73.40 which gradually decreased in upper standards and in standard VI it came to 27.27; (iv) only ten schools possess a complete set of equipment for the practical demonstration of experiments; (v) none of the schools had a separate science room; (vi) none of the schools subscribed to any periodical devoted to scientific knowledge and information; (vii) there was no significant difference in the boys and girls as regards interest in science; (viii) th
number of questions asked by pupils decrease as they advance in age; (ix) the topics in which pupils seemed most interested were our body, health and hygiene; mechanics, diseases, heat, senses, air, water and food for plants; (x) the topics in which pupils showed less interest were pests on plants, seasons, insects, fishes, other animals, reproduction of animals, and reproduction of human beings; and (xi) the activity based method was found superior to the traditional one.

In a similar type of study Rajagopalan (1972) examined and identified the inadequacies in respect of objectives of teaching English, present English syllabus, text-books used, audio-visual aids available, method of instruction followed, organization of English curriculum and the administrative barriers in implementing it, the evaluation procedures utilized, and to suggest remedial measures in all respects. The normative survey method was used. A sample of 104 primary and upper primary schools was taken. The tools used for this study were questionnaire, interviews and documentary analysis. The findings of the study revealed that nearly 29.3 per cent English teachers were untrained; majority of teachers and supervisors were yet out of pail of inservice training; majority of the teachers, supervisors and parents supported English to be compulsory at school stage; use of translation method, poor knowledge of English on the part of the teachers had caused
the fall in standard of learning English. It appeared that in the light of aims and outcomes listed, the syllabus fulfilled the basic requirement as far as its contents were concerned. The question papers set in the examination showed the extent of the content tested every year. It showed that the standard of achievement in English had fallen whereas that of Hindi risen and that of Malyalam remained more or less constant. Question paper coverage in mathematics was found to be exhaustive. The ability to discriminate between essential and non-essential and deep knowledge of subject matter were needed to score high in science subjects. Training in setting objective questions and improved scoring procedures were definitely going to help in raising the standards of examinations. Nationalised text-books were found cheaper and therefore, accessible. Their preparation should be entrusted to the experts and these should be revised after every three years by committees of experts. Unsuitable text-books and very poor methods of instruction were some of the most potential factors in deteriorating the learning situation; and appointment of subject inspectors of English, offering two courses in the subject - one ordinary and the other advanced identifying proper objectives of teaching English use of structural method of instruction and the use of suitable audio-visual aids, proper training of teacher, and scientific evaluation of pupils performance in the subject with more stress on internal assessment and less on public examination were some of the major remedial
measures suggested.

In another investigation undertaken by Dave and Anand (1973) it was found that the learning outcome even when not derived through a controlled teaching learning process with specific goals was found to form the hierarchy as envisaged by Bloom: the learning outcomes in terms of knowledge, understanding and application were different and were found to be hierarchically related.

Mankad (1974) conducted a study with the aim to specify comprehensive objectives of teaching Gujarati at the secondary school level and to construct an objective based syllabus. The analysis revealed that 47% teachers did not possess the syllabus and 20% of the school teachers teach on the basis of text book only and did not refer the syllabus.

Sodhi (1977) in his study on the evaluation of programme learning in chemistry in relation to taxonomy of educational objectives at the higher secondary level found that branching programme was superior to linear programme in case of total achievement, in application, comprehension, analysis and evaluation categories. Nair (1978) in his study found that the creative methods were superior to the traditional methods like verbal illustration and demonstration in attaining higher objectives in science. The creative methods were superior to the traditional methods for the sub-samples (sex, management of schools and locality schools). The creative methods
were superior to the traditional methods in the attainment of higher objectives in the case of pupils having different levels of intelligence and socio-economic status.

Sivadasan (1979) conducted a study by taking a sample of 435 science teachers in secondary schools. He found that the classroom learning behaviour was a factor which largely contributed to the attainment of objectives of science education. The group oriented classroom situation was more effective than the pupil-oriented and the teacher-oriented situations in the attainment of certain objectives. Though the classroom situation did not differ significantly in their effectiveness upon the attainment of many of the objectives, the mean achievement scores of pupils under the group-oriented situation were higher than those under the teacher oriented and pupil-oriented situations, indicating that the former had an edge over the other two situations. All the sixteen general objectives were considered relevant by a large majority of the respondents. There were no significant differences in the perception of students and teachers about the relevance of objectives except the two objectives. The specific objectives of teaching history, political science, sociology, economics and psychology were not being realised fully but all of them were considered useful and essential by a large majority of the respondents. In the core courses, about 50% items were prescribed but all the items were considered relevant and useful by a significant majority of the respondents.
In a critical study of the methods of teaching in the secondary schools of Nagaland, Dev (1979) revealed that teachers were more interested in lecture method. They had a negative attitude towards reflective type questioning. Teachers were poor in questioning skill mainly because they were weak in subject matter. The percentage of teachers having positive attitude towards making the lesson objective was the highest and it was the lowest towards ensuring assimilation. About 82 per cent teachers did not ensure whether the concept was understood by the students or not. In all, 65 per cent teachers did not strive to evoke non-coercive participation from students. About 61 per cent teachers could not effectively guide pupils' ideas towards objectives of the lesson. About 61 per cent teachers followed what had been said in text books. The majority of the teachers did not have creative ability. The existing mathematics syllabi were unscientific. The mathematics text books were defective. The teaching learning facilities were inadequate in a majority of the schools.

Mishra (1982) by taking a sample of 109 science teachers of secondary schools found that the supervisory staff perceived the performances related to the dimensions of teaching, planning, correlation in science, homework, science library and co-curricular activities more favourably, whereas science teachers perceived classroom teaching and laboratory organization more favourably. There were significant differences between the expected and the actual performances of science teachers in relation to
performances in all aspects. The performances in which difference between the discrepancy of male and female science teachers was observed were, mainly in the dimensions of class-room teaching, demonstration and laboratory organization. The dimensions of laboratory organization, co-curricular activities and science library revealed performance discrepancies between urban and rural science teachers. The discrepancy in all these dimensions was more prominent among rural teachers than their urban counterparts. An inverse relationship between the performance discrepancy of science teachers and the achievement of science students was identified. The main cause of performance discrepancy were in the area of awareness of the performances, lack of time to organise the performances and over crowding e.g. lack of science material, lack of money, non-cooperative attitude of school authorities and improper and inadequate teacher training were equally responsible to make the science teachers more non-performers. As the curriculum in science was dominated fully by external examination system, the entire performance of science teachers was identified to be dominated by examination syndrome. The heads showed least interest in conducting co-curricular activities, investigatory projects and the involvement of students in teaching learning process. Marlow (1987) observed that objectives achievement in mathematics in the school setting prepare a student for further success. The breadth
of these objectives emphasizes what should be taught in mathematics.

The purpose of Raju (1990) study was to obtain evidence of any possible overlap of the cognitive and effective variables of the study in terms of relevant inter correlations and shared variance. The variables, the cognitive and effective outcomes in secondary school biology were based on the Bloom's (1956) Taxonomy of educational objectives of cognitive and effective domains with six and five variables respectively. The tests used were (i) Kerala Test of Biology Achievement for Standard X (Based on Bloom's Taxonomy of the Cognitive Domain and (ii) The Kerala Test of Biology Achievement for Standard X (Based on Bloom's Taxonomy of Affective Domain). The first test measured all the major behavioural classification under the Taxonomy of Cognitive Domain. The major categories were: (i) Knowledge, (ii) Comprehension, (iii) Application, (iv) Analysis (v) Synthesis (vi) Evaluation. The second test measured all the major behavioural classification under the Taxonomy of Affective Domain. The major categories were (i) Receiving (ii) Responding (iii) Valuing (iv) Organisation (v) Characterization by a value or value complex.

The results obtained were that the different indices indicated that there was substantial overlap among the different cognitive and affective variables.

From the above review of literature on the problem of objectives, syllabus, examination system, teaching methods,
textbooks, facilities available in institution etc., it may be inferred that there are wide variations in the results of above studies when different subjects are taken into account.

To see the critical analysis of only one subject i.e. mathematics, a brief review is presented below:

2.2 STUDIES RELATED TO OBJECTIVES, CURRICULUM, METHODS OF TEACHING & EVALUATION TECHNIQUE WHEN THE SUBJECT OF MATHEMATICS IS TAKEN INTO ACCOUNT:

A critical examination of various practices of teaching mathematics in secondary schools of Bombay was made by Samant (1944). The study revealed that: (i) the analysis of the matriculation results showed that the percentage of failures in mathematics was very high; (ii) nearly 85 per cent at matriculation level and 90 to 95 per cent at the annual examination level in schools invariably failed in more than one subject; (iii) the percentage of cases who failed in mathematics alone and mathematics plus other subject(s) was quite high; (iv) detention of the students in various classes did not help improving them in mathematics; (v) liberal promotions helped to get better results in matriculation; (vi) students dislike for mathematics was found to be one of the main causes for their failure in that subject; (vii) the dislike for the subject was more noticed in higher classes than in the lower classes; (viii) the subject-matter as presented, weakness in English (the medium of instruction) and poor teaching were found to be the main causes for disliking the
subject; (ix) the homework in mathematics was poorly planned; (x) private tuition did more harm than good. (xi) Confusion in method and application of the formulae, teachers speed, the way of each step and lengthy calculations were some of the causes of poor performance in mathematics; (xii) nearly 46 per cent of the teachers were found to be unqualified to teach mathematics, and (xiii) the analysis of the instructional material revealed that there was a need for rearranging the topics with definite aims.

The objectives of Dave and Saxena's (1965) study were (i) to study the existing curricula, text books and teaching methods in mathematics in higher secondary schools of various states and (ii) to develop a new curriculum in mathematics in the light of the experimental curriculum by adopting suitable techniques of teaching and learning. The analysis of syllabi and text book was extended to all states but the study of teaching learning situation was confined to only four states viz. Bihar, Gujarat, Mysore and Punjab, and the Union Territory of Delhi. Major findings of the study were: (i) most syllabi did not specifically mention any objective of teaching mathematics; (ii) even where these were recorded, consideration was given to computational skills and abilities including knowledge to solve everyday problems, select the relevant facts, reject the irrelevant ones, etc.; (iii) in listing the content, all syllabi had followed the logical sequence of different mathematical processes; (iv) the content
was arranged under topics, further divided into sub-topics; (v) basic concepts underlying the topics or subtopics had nowhere been indicated; (vi) most syllabi did not define clearly the scope of a topic; (vii) eleven per cent of the authors had a doctoral degree and thirty seven per cent master's degree in the subject; (viii) majority of the books were written in the regional languages; (ix) in about twenty five per cent books, solved examples did not clarify the concepts; (x) in all books problems were provided but no book encouraged problem solving as a method of learning mathematics; (xi) of the forty teachers observed during classroom teaching only fourteen usually linked a lesson with the premises, (xii) in introducing a new topic, about ninety per cent of the teachers talked about the subject and did not encourage pupils participation; (xiii) not even fifty per cent of the teachers ensured that the new concept had been learnt properly; (xiv) to a great extent the teachers depended on the text work for selection of problems; (xv) about fifty per cent of the teachers did analyse the problems on the day of observation; and (xvi) only about twenty six per cent of the teachers corrected the home assignment with or without suggestions for improvement and majority of the teachers just signed the note books.

The objectives of Lull's (1966) study were (i) to know the factors in the schools which lead to the low achievement of pupils in mathematics; (ii) to know the causes leading to low achievement of the pupils in the subject as viewed by the teachers.
and headmasters of the elementary schools of Gujarat;
(iii) to have an idea of the position of teaching mathematics;
(iv) to collect suggestions to improve the teaching of mathematics;
from teachers and headmasters of these schools; (v) to explore
the possibilities of preparing remedial programme or material
for such low achievers in mathematics and (vi) to recommend
measures of improvement in courses, textbooks, teaching methods,
evaluation scheme and school administration with a view to
helping low achievers in the subject. Some of the findings were
(i) the syllabus was out of date, lop-sided, impractical and
far away from the realities; (ii) some content in the syllabus
was difficult to teach; (iii) the textbooks made use of both
the old and new measures; (iv) limited scope for oral work
weakened the skill of calculation in the pupils; (v) self
explanatory illustrations were found quite inadequate; (vi) for
first three grades, there were no prescribed text books;
(vii) teachers failed to understand four fundamental methods
to be followed; (viii) majority of the schools had no reference
books; (ix) sometimes pupils were admitted at a premature age;
(x) time table was not rigidly followed; (xi) there was no
provision for effective and useful teaching aids; and (xii) over
crowded classes, frequent transfer of the teachers, irregularity
of attendance contributed a lot of the low achievement of the
pupils. The aim of the Kulkarni's (1970) study was to make
a scientific study of the standards of learning in mathematics.
at the end of primary, middle and high school education. Results of the survey reported in terms of geographical factors, school, student and other related variables indicated that only the public schools got more than 35 per cent marks in achievement at all the three levels of education. Levelwise, most of the states secured more than 35 per cent at the primary level. It may be stated that in all the states, the percentage performance was higher at the primary level than at the middle or high school levels.

To investigate the level of satisfaction of the teachers and to know their choice for teaching profession and the workload of the teachers working in the higher secondary schools in Uttar Pradesh a study was conducted by Pal and Gosh (1967). The workload of an individual teacher was defined in terms of curricular and co-curricular work, office and other academic work which the teacher is expected to perform either in the school or at home. The investigation revealed that (i) the teachers entered the profession with favourable attitude towards teaching but later on the circumstances, the service conditions and the other factors contributed to their frustration and dissatisfaction; (ii) the teacher suffered on account of low socio-economic status; (iii) the unwholesome service conditions had great impact on the physical and mental life of the teachers; (iv) a vast difference existed between the service conditions of government and private school teachers;
(v) teacher training did not help in minimising the workload of teachers; (vi) workload was more for the private school teachers than for the government school teachers due to the teacher-pupil ratio and job insecurity; (vii) methods of teaching, number of the school subjects taught, and the heterogeneity of the classes contributed to the load of work; (viii) supervision of extra-curricular activities after school hours and during holidays encroached upon the free time of the teachers; and (ix) all the teachers were expected to attend office work of one kind or the other.

Pillai (1963) in his investigation revealed that at school level, standard of mathematics has been falling and its syllabus needs immediate revision to make it keep pace with the time. Practical bias and fusion programme are noteworthy features in general science. A survey was conducted on the teaching of mathematics in secondary schools in Kerala by Pillai (1970) to study how far the syllabus in mathematics reflected the objectives sought and to study the methods and techniques followed in teaching mathematics. The findings of the study revealed that (i) no syllabus published since 1932 gave any objectives of teaching mathematics but syllabi published in 1962 and 1964 gave the objectives of teaching mathematics in secondary schools; (ii) the syllabus framed reflected the objectives of teaching mathematics to a large extent though improvements are needed in certain areas; (iii) the mathematics syllabus followed in secondary schools
of Kerala is superior in certain respects when compared with the syllabus followed in Tamil Nadu and Andhra Pradesh but it is far below the level of the syllabus suggested by the NCERT; (iv) it is incomparable with the syllabus followed in U.S.A. and U.K. the standards of the content is superior in these countries; (v) the content of the mathematics textbooks reveals that algebra does not imply functional value of the subject and both analytic and synthetic methods of teaching mathematics are poorly expounded; (vi) many schools do not have facilities to teach graph, lack in instrument boxes and other mathematical models; (vii) reference books in mathematics are rarely found in libraries of the schools; (viii) about ninety seven per cent of the teachers handling classes in mathematics are having degree in mathematics and are trained in the methods of teaching mathematics; (ix) many teachers lack knowledge of modern trends in teaching mathematics and are not familiar with modern mathematics books and literature; (x) home assignments are given in mathematics, but only thirty seven per cent of the teachers correct them; (xi) teachers complain that they do not have adequate time for handling all aspects of teaching; and (xii) seventy four per cent of the teachers report that the curriculum is heavy in mathematics while fifty eight per cent feel that the methods followed do not inculcate the necessary enthusiasm and interest in the pupils.

A study was designed by MSBTPCR (1974) to know the qualification and opinion of teachers regarding mathematics.
and science syllabi. The study concluded that: (i) seven per cent teachers who taught mathematics were B.Sc., 6 per cent were B.A., 72 per cent had S.S.C. certificate, 12 per cent had passed the primary school certificate examination and 3 per cent were either F.Y.B.Sc. or F.Y.B.A. (ii) Among the mathematics teachers of classes V, VI, VII, 87 per cent were trained, 72 per cent had more than five years teaching experience and 47 per cent had undergone an orientation course in mathematics. (iii) Ten per cent of the mathematics teachers felt the modern mathematics portion of the syllabus was very difficult for pupils, 63 per cent felt that it was somewhat difficult and 27 per cent felt it was easy. (iv) Seventy four per cent teachers thought that modern mathematics should not be kept optional but made compulsory. (v) Some teachers felt that to do justice to modern mathematics, orientation courses of long duration should be organized for teachers, the mathematics periods should be increased and new teaching aids should be developed.

On the survey of audio-visual aids Aggarwal (1974) observed that important audio-visual aids like chalk, boards were not available with 18.2 per cent of institutions. The audio-visual aids were not adequately stirred and were not easily available for reference. Physical facilities were not existent at most of the institutions.

Sinha (1976) in his study on the evaluation of curricular material in new mathematics showed that material in new
mathematics did not reflect necessarily the spirit of the so-called new mathematics, it had often been mixed up with a ritual, in the shape of rote learning of techniques.

In a critical analysis of the new mathematics, syllabus and textbooks used in the upper primary classes in Kerala, Gopal Krishan (1977) observed that (i) Predetermined percentage of promotion, over-crowding in classroom, low socio-economic status of the parents, frequent strikes and agitations, poor academic background of students, lack of adequate foundation in mathematics, lack of parental interest, lack of interest on the part of the students and lack of textbooks dominated among the causes that adversely affected the introduction of new mathematics. (ii) The structure and rigour of the mathematics textbooks were appropriate. The rate of introduction of new terms was uneven. Typographical errors, errors due to carelessness and real errors were found here and there in the textbooks. Almost all topics needed gradation. The revision exercises, diagnostic tests and general exercises were, in general, appropriate. The inclusion of enrichment programmes were a good feature of the textbooks but the diagrams were not satisfactory. There was some disagreement between the syllabus and the textbooks due to omission of certain topics and sub-units. (iii) The syllabus of 1970-75 was better than that of the immediately preceding years. (iv) The coverage of content of textbooks of Kerala was not at par with that of NCERT syllabus. (v) The addition to the syllabus suggested
by the respondents were: more exercises suitable for homework, problems related to life, English equivalents of new terms and life history and important events of mathematicians. The deletions suggested included discovering patterns, enrichment programmes, difficult problems and fundamental laws.

Paranjape (1977) found that the mathematics syllabus had been revised several times during this period, namely in 1901, 1913, 1928, 1940, 1947-49, 1955 and 1966 but there was no statement of objectives in several of the past syllabi.

Sharma (1978) found that factors responsible for low achievement in mathematics were the imparting of limited knowledge, blind use of rules, heavy syllabus, defective textbooks, lack of the natural urge among pupils to learn mathematics, insufficient drill work at the primary stage and absence of approach of the classroom teaching.

Attempt was made by Godgil (1979) to study the causes of large failures in mathematics at the S.S.C. examination. The study revealed that even though the percentage of trained graduate teachers in the twenty-nine schools included in the sample was satisfactory, only two teachers had taken some orientation courses in mathematics which could be considered satisfactory. Reasons for failure in mathematics were inadequate coverage of the syllabus, inadequate attention paid to some difficult topics, inadequate motivation for study and inadequate guidance provided to pupils for study.
Marlow (1987) in his study revealed that a good mathematics curriculum must emphasise careful consideration of the concepts, scope and sequence. The mathematics curriculum must be vital in subject matter, as well as sequential to assist optimal learner attainment.

Sivadasan (1987) conducted a study by taking a sample of 40 boys each from ninth grade of a high school in Trivandrum, found that the study does not conclusively indicate the superiority of a particular classroom situation for attaining objectives. Nevertheless the results of the experiment show that the traditional teacher oriented situation is not so effective as pupil-oriented and group-oriented learning situations for the realisation of many categories of objectives. The group-oriented learning situation is generally more effective than non-group situations. The implications of this finding is that the group-situation in which group activities are given prominence can be practised in schools for a higher extent of attainment of certain categories of objectives. The teachers, however, must be able to decide which situation is the best for the realisation of a particular objective. There may be occasion when one particular situation is more appropriate than the other because of the nature of the learning behaviour of pupils in classroom groups. So teachers need not rely upon a single classroom situation always. The result that the relative effectiveness of different classroom situations upon the attainment of most of the objectives is
independence of pupils intelligence and SES leads to suggest that there is no harm in setting the same learning situation for an intact classroom group which is generally heterogeneous in nature.

According to Sundararajan and Srinivasa (1990) educationists teachers and public are voicing concern over the teaching of mathematics in our schools. There is complete agreement among different sections of society about the importance of effective teaching and every one is convinced that the present classroom teaching is highly defective. He has remarked that educators had made progress towards solving the problem of teaching better mathematics, but not of teaching mathematics better. In the same study it was found that some of the reasons for the lack of interest in mathematics are lack of facilities, ill prepared teachers, content overload and poor teaching. Though it is not possible to find a single remedy to all these evils, it can be said that effective teaching solves many of the problems faced by the students.

Budhdev (1990) conducted a study on a sample of 737 students of senior secondary schools with the aim to study the influence of cognitive variables on achievement in mathematics. He concluded that attitude towards mathematics had significant influence on the achievement in mathematics. Students of favourable attitude group had higher achievement than students of unfavourable attitude group. Intelligence had significant influence on the achievement in mathematics.
Mathematical aptitude significantly affects the achievement in mathematics. Sundararajan and Srinivasan (1990) also concluded that there is significant positive correlation between attitude of the students towards mathematics and their achievement in it.

Kaile and Sharma (1990) designed a study to find out whether verbal and non-verbal intelligence are significant correlates of achievement in Mathematics. Whether the conjoint prediction of verbal and non-verbal intelligence for achievement in mathematics is significantly higher than their separate predictions. The conclusions of their study were verbal and non-verbal intelligence are significantly positively correlated with achievement in mathematics at .01 level. The prediction of achievement in mathematics on the basis of conjoint effect of verbal and non-verbal intelligence is significantly greater than the prediction on the basis of either verbal intelligence or non-verbal intelligence.

Hence, a critical review of the research studies related to mathematical education revealed that the research on the objective, curriculum, methods and evaluation techniques in the field of mathematics education are scarce, scattered and very few. Specially we do not find any study in the field of mathematics education at the senior secondary stage. The trends also, which come forth out of these researches cannot presently be called conclusive, and thereby living scope for further research in this field.
2.3 HYPOTHESES

Hypotheses are temporary guesses or assumptions based on knowledge and theory which enable a researcher to investigate some facts and theory that are yet unknown. They are the central core of the study that indicate the type of data to be collected, design to be followed, statistical analysis to be done and conclusions to be drawn from the study. Directed towards the objectives of the study and guided from the review of research given in the preceding paragraphs, the following hypotheses have been formulated:

1(a) Present curriculum in mathematics, methods of teaching and evaluation techniques are not relevant to the attainment of objectives (in the cognitive domain) of teaching mathematics at elementary stage.

1(b) Present curriculum in mathematics, methods of teaching and evaluation techniques at the elementary stage are not relevant to the attainment of objectives (in the affective domain) of teaching mathematics at the elementary stage.

1(c) Present curriculum in mathematics, methods of teaching and evaluation techniques are not relevant to the attainment of objectives (in the psycho-motor domain) of teaching mathematics at the elementary stage.

2(a) Present curriculum in mathematics, methods of teaching and evaluation techniques are not relevant to the
attainment of objectives (in the cognitive domain) of teaching mathematics at the secondary stage?

2(b) Present curriculum in mathematics, methods of teaching and evaluation techniques are not relevant to the attainment of objectives (in the affective domain) of teaching mathematics at the secondary stage.

2(c) Present curriculum in mathematics, methods of teaching and evaluation techniques are not relevant to the attainment of objectives (in the psycho-motor domain) of teaching mathematics at the secondary stage.

3(a) Present curriculum in mathematics, methods of teaching and evaluation techniques are not relevant to the attainment of objectives (in the cognitive domain) of teaching mathematics at the senior secondary stage.

3(b) Present curriculum in mathematics, methods of teaching and evaluation techniques are not relevant to the attainment of objectives (in the affective domain) of teaching mathematics at the senior secondary stage.

3(c) Present curriculum in mathematics, methods of teaching, evaluation techniques are not relevant to the attainment of objectives (in the psychomotor domain) of teaching mathematics at senior secondary stage.

4(a) There is significant positive correlation in the attainment of objectives of teaching mathematics (in all the three domains) through curriculum and methods
of teaching at the elementary stage.

4(b) There is significant positive correlation in the attainment of objectives of teaching mathematics (in all the three domains) through methods of teaching and evaluation techniques at elementary stage.

4(c) There is significant positive correlation in the attainment of objectives of teaching mathematics (in all the three domains) through curriculum and evaluation technique at the elementary stage.

5(a) There is significant positive correlation in the attainment of objectives of teaching mathematics (in all the three domains) through curriculum and methods of teaching at the secondary stage.

5(b) There is significant positive correlation in the attainment of objectives of teaching mathematics (in all the three domains) through methods of teaching and evaluation technique at the secondary stage.

5(c) There is significant positive correlation in the attainment of objectives of teaching mathematics (in all the three domains) through curriculum and evaluation technique at the secondary stage.

6(a) There is significant positive correlation in the attainment of objectives of teaching mathematics (in all the three domains) through curriculum and methods of teaching at the senior secondary stage.
6(b) There is significant positive correlation in the attainment of objectives of teaching mathematics (in all the three domains) through methods of teaching and evaluation technique at the senior secondary stage.

6(c) There is significant positive correlation in the attainment of objectives of teaching mathematics (in all the three domains) through curriculum and evaluation technique at the senior secondary stage.

7(a) There are significant differences in the attainment of objectives of teaching mathematics (related to cognitive domain) through curriculum, methods of teaching and evaluation technique at elementary school stage.

7(b) There are significant differences in the attainment of objectives of teaching mathematics (related to affective domain) through curriculum, methods of teaching and evaluation technique at elementary school stage.

7(c) There are significant differences in the attainment of objectives of teaching mathematics (related to psychomotor domain) through curriculum, methods of teaching and evaluation technique at elementary school stage.

7(d) There are significant differences in the attainment of objectives of teaching mathematics (in terms of cognitive, affective and psychomotor domain taken conjointly) through curriculum methods of teaching
and evaluation technique at the elementary school stage.

7(e) There are significant differences in the attainment of objectives of teaching mathematics at three levels of domain i.e. cognitive, affective and psychomotor at elementary school stage.

8(a) There are significant differences in the attainment of objectives of teaching mathematics (related to cognitive domain) through curriculum, methods of teaching and evaluation technique at the secondary school stage.

3(b) There are significant differences in the attainment of objectives of teaching mathematics (related to affective domain) through curriculum, methods of teaching and evaluation technique at secondary school stage.

8(c) There are significant differences in the attainment of objectives of teaching mathematics (related to psychomotor domain) through curriculum, methods of teaching and evaluation technique at secondary school stage.

8(d) There are significant differences in the attainment of objectives of teaching mathematics (in terms of cognitive, affective and psychomotor domain taken conjointly) through curriculum, methods of teaching and evaluation technique at secondary school stage.
There are significant differences in the attainment of objectives of teaching mathematics at three levels of domain i.e. cognitive, affective and psychomotor domain at the secondary school stage.

There are significant differences in the attainment of objectives of teaching mathematics (related to cognitive domain) through curriculum methods of teaching and evaluation technique at senior secondary stage.

There are significant differences in the attainment of objectives of teaching mathematics (related to affective domain) through curriculum, methods of teaching and evaluation technique at senior secondary stage.

There are significant differences in the attainment of objectives of teaching mathematics (related to psychomotor domain) through curriculum, methods of teaching and evaluation technique at senior secondary stage.

There are significant differences in the attainment of objectives of teaching mathematics (in terms of cognitive, affective and psychomotor domain) through curriculum, methods of teaching and evaluation technique at senior secondary stage.

There are significant differences in the attainment of objectives of teaching mathematics at three levels of domain i.e. cognitive, affective and psychomotor domain at senior secondary stage.
10. There are significant differences among elementary, secondary and senior secondary stages in respect of relevance of curriculum, methods of teaching and evaluation techniques to the attainment of objectives of teaching mathematics.