CHAPTER - I

*** INTRODUCTION
CHAPTER - I

**** INTRODUCTION

The present study entitled "Identification of Variables of Educational Environment as Related to the Acquisition of Mathematical Concepts at the Junior Secondary Stage", was found worth investigation in view of the tremendous significance that mathematics occupies in all walks of human life. To build a sound base for scientific and technological advancements, it is imperative to improve the quality of mathematics teaching right from the school stage onwards. Identification of variables of educational environment as related to the understanding of mathematical concepts at the junior secondary stage, it was thought, would provide valuable suggestions for improving the teaching of mathematics at that stage.

Mathematics helps to develop the power for deliberate thought, and intellectual habits, such as accuracy, training for simplicity, certainty, verification of results, persistence, patience, neglect of necessary discomfort and intellectual justice or openmindedness, originality and reasoning. It helps the child to develop mathematical skills and attitudes to meet the demands of daily life, future mathematical work, work in related fields of knowledge and to solve the quantitative problems faced by the child in his/her immediate and anticipated environments. It is useful to the common man besides
those who pursue it as a profession in the sense that in
the modern industrial age- the people must be able to under-
stand what is happening around them and how and why it is
happening so. Mathematics also acts as a key to the development
of all sciences and its use has been extended on account of
practical, scientific, aesthetic and philosophical interests
of man. Its nature led many a people to believe that the entire
world phenomena can be interpreted mathematically. Certainly,
many of the laws of economic dependency, facts of growth versus
social conditions, composition of soil in agriculture, mineral,
time and rate in interest, cost price relation in commercial
work, industrial product, means of transport, import and exports,
population, rate of growth of income and expenditure and even
the growth and down fall of empires and prevalence of wars and
famines, all these could make use of the mathematical principles.

The new scientific industrial revolution in our country
makes it all the more imperative to devote special attention
to the study of mathematics as it plays a vital part in tech-
nical professions and atomic energy researches. It is
considered to be the universal tool which helps mankind in
building up civilizations, in interpreting physical and
biological sciences, and bringing out the advantages of
science and technology within the reach of common man. All the
useful occupations now depend upon the knowledge of mathematics
and science. If you shut out mathematics from pupil's school
course, the door of almost every form of useful occupation
and of almost every form of higher studies is closed for him.
Education for him becomes very narrow indeed. Therefore, if
education has to be treated as a powerful tool of modernity, if
India has to acquire self-sufficiency in food, ensure economic growth and full employment, seek for social and national integration, develop its political stability, then science will have to be made as a basic component of education and culture. It implies strengthening the mathematical programme so as to work hand in hand with the recent trends in the contemporary world of scientific thinking. Seeing the fact, the effects mathematics produces on society in general, it can be maintained that mathematics has an important place in school curriculum and as an instrument of science and technology it can become effective if its sound foundation is laid at the school stage.

In view of the discussion submitted in the preceding paragraphs, the utilitarian aspect of mathematics would emphasize understanding and concept learning much more than merely learning of mathematical skill, because in the latter case, the idea of teaching mathematics is to train the faculties of mind and so naturally there is plenty of stress on mechanical work and drilling of computational processes. Here emphasis is on the successful drilling of various mechanical computations, which according to Piaget (1961) involves merely sensory, motor intelligence. He refers to a situation where the child knows to count a set of objects without actually understanding the concept of number. In the former case, since the utilitarian aspect would involve application of learnt principles to practical situations,
appreciation of the part that mathematics plays in his environment, in his community and in human progress, enables the pupils to learn the techniques of problem solving by way of developing the power of reasoning, organising, analysing, interpreting and verifying. Therefore, understanding occupies an important position and concept learning becomes of prime concern. Thus, in the modern world of science and technology, there is a need that the mathematical programme at the school stage should concentrate on acquisition of conceptual understanding involved in the mathematical principles and operations.

In the process of teaching and learning, concepts play an important role, as learning is a developmental process involving change in behaviour from perceptual motor skills to the formation of concepts. Child’s mental as well as his social development is very much influenced and controlled by the adequacy and non-adequacy of his concepts about things, persons, events or phenomena. His concepts bring economy to his thinking reasoning and problem solving behaviour and help him much in acquiring the knowledge and skill with ease.

According to Rohwar (1970) individual differences in performance may be due to individual differences in learning and storage proficiency. Efficient successful learning necessarily involves conceptual processing of information, in contrast to rate processing. In general, concepts are a vehicle of our symbolic behaviour. What we think, understand, reason and judge, to a great extent are controlled by our
concepts. Thus, concepts become the most important tool of our thought and expression of our language. Concept is a generalized idea about the things persons or events. It is a common name given on the basis of similarities or commonness found in different objects, persons or events.

For Piaget (1957) a 'concept, is a explanatory rule, or law, by which a relation between two or more events may be described e.g., the concept of causation. According to Russell (1960) concepts are learning that permeate thinking and they are marked by consistency of differential generalized symbolic response. Vygotsky (1962) takes a concept, as an active part of the intellectual process, constantly engaged in serving communications, understanding and problem solving. Piaget (cited by Flavell,1963) accounts for concepts formation as a change over from sensory motor intelligence to reflective intelligence, involving formation of hypothesis or hypotheses, collection of data, analysis of data and verification of results. Thus, systematization of working leads to concepts formation.

Hunt (1966) defined concept learning as 'acquisition or utilization or both,of a common response to dissimilar stimuli'.Thus for him concept is a mental image of a thing formed by a generalization from particular, also an idea of what a thing in general is to be.

The foregoing discussion leads to conclude that concept formation is basic to the understanding of mathematics. At the school stage mathematical concepts may be classified as arithmetic
concepts, algebraic concepts and geometric concepts. The development of mathematical concepts takes place in the same fashion as in the case of general concepts, in any learning activity. According to Piaget (1950) from 0-2 years age child reacts only to concrete objects, from 2 to 7 years the child can respond to the intersection of two classes. At the age of 8 years, subtraction of sets comes within the child's capacity. Some what later in a second sub-stage, the idea of union of sets as a set occurs. Only at this stage acquisition of concepts take place. According to Skemp (1961) repeated sensory-motor experiences affect the development of mathematical concepts. Engen (1953), says that concept development is earlier in intelligent persons than in average or below average person. Lowell (1961) concludes his book on Concept-Development by showing that mathematical concepts develop slowly. Gradually concepts grow in width and in depth, with maturation and experience. He believes that process of concept formation has three important phases as perception, abstraction and generalization. The rate of development depends upon the quality of brain mechanism of the child, upon his motivation and upon the cultural milieu. The two most important factors likely to effect the development of concepts are: the mathematical understanding of the teacher and the climate of opinion in which the child is reared.

Prewitt and James (1976) found that there is relationship between the development of mathematical concepts and the development of a wide range of concepts when chrononological
age is statistically controlled. Russell (1960) concluded that the nature of the problem presented, the goal, personality, age and intelligence of the learner, material used as examples, the manner and order of presentation, and use of the concepts help in building up the conceptual understanding. Lundberg and Tormeus (1978) confirmed that the concepts are highly abstract and children efforts to understand them may be added by providing them the concrete experiences of their correct meaning. Therefore, it would be worthwhile to include only those concepts in the syllabus which have a definite relationship with the particular stage of the pupil's development. The ultimate objective should be the conceptual understanding rather than simple drilling of computations.

Conceptual understanding of mathematics at each developmental stage is likely to be influenced by the multiplicity of factors. Variables of educational environment such as student's intelligence, interest in mathematics, his home conditions, the socio-economic status of the family, size of the family, education of the parents, qualification and experience of the teachers, feedback given by the teachers, structure of the school, i.e., teacher-pupil ratio, availability of equipment in the school etc. may influence the acquisition of mathematical concepts. Soto and Parks (1976), Hildebrand and Patricia (1978) have shown positive relationship between family environment and child's performance in mathematics.
Similarly, Skemp (1961), Fleishman (1969), Bruce (1977) found that achievement in arithmetic and mathematics was positively related to intelligence. On the other hand, Dhalival and Parkash (1976), reported an insignificant 'r' of .26 between intelligence measures and achievement in mathematics.

Bell (1931) and Ecbert (1935) found a moderate 'r' between time spent on the study and grade achieved, while Singh (1977) revealed that time devoted to study geometry and availability of help at home to study geometry have significant 'r' with the Geometric Concept Test.

Efforts have been made in the direction of finding relationship between the interest of the child and achievement in mathematics by Hart and Marry (1977), Srivastava (1977) and Lalithamma (1975) who found that achievement in mathematics was positively related to interest in mathematics.

The research evidence pertaining to sex differences and achievement in mathematics is also equally inconclusive. Joshi (1969) and Lalithamma (1975) concluded that boys secured higher than girls in algebra and mathematics. In contrast to these studies, Sharma (1976) and Roach (1979) reported the superiority of girls over boys in the learning of mathematical concepts. Sharma (1977) found no difference in mathematical achievement due to sex difference.
There are also considerable fluctuations regarding the differential effect of socio-economic status of the child and achievement in mathematics. Montage (1964) and Husten (1967) observed that achievement in arithmetic and mathematics was positively related to SES of the children. Contrary to it Reddy (1973) observed that SES was not significantly related to achievement in mathematics.

Research evidence also does not present a consistent view about father's absence or presence and achievement in mathematics. Lynn (1974) and Markus (1975) showed that children whose fathers were absent performed less as compared to children whose fathers were present on achievement test. Whereas Fowler and Richards (1978) demonstrated no significant effects on the achievement in mathematics and father's absence or presence.

Experimental evidence regarding the effects of size of the family, ordinal position of the child, income of the father and education of the parents on the achievement of the child in mathematics are, also conflicting. Husten (1967) reported negative 'r' between size of the family and achievement in mathematics. Lalithamma (1975) found achievement in mathematics of first borns was better, than that of the last borns. Dibble (1967), Dave and Dave (1971) observed that income of the father is related with student's achievement in mathematics. Similarly Husten (1967) reported a moderate 'r' ranging between .07 to .33 between parent's education and achievement of the child in mathematics and science. Thus some
of the findings indicate positive effect whereas others indicate negative effect. There is also a third group of studies which failed to get any significant effect of these variables on the understanding of mathematical concepts by the children.

Considerable research efforts have also been directed to find out the effect of teacher variables such as qualification, experience, amount of homework given by the teacher, in-service training received by the teacher and feedback given to the teacher on the understanding of mathematical concepts by the pupils. Smith (1964) and Rouse (1967) found that success in school mathematics will not be found in variables of qualification and experience of the teacher. Similarly Anthony and Preston (1977) concluded that students who did less homework problems in algebra tended to achieve more than the students who did more homework problems. Azzi (1977) reported the effectiveness of in-service programme to the teaching of mathematics, Joshi and Bakhtar (1977) demonstrated that performance of feedback condition is significantly superior on the acquisition of algebraic concepts as compared to the performance under no feedback conditions. As the above results are not very conclusive, so they bring out certain questions for further research.

Two trends have also been observed in research literature with regard to the relationship of size of the
school, type of the school and understanding of mathematical concepts. Wilson and Karen (1975) found that performance of students in mathematics, belonging to large schools, are better than their counterparts in smaller schools. The second group of evidence failed to find any relation between size of the school and performance of the students in mathematics (Garrett, 1949; Wiseman, 1964). Sharma (1977) investigated the effect of type of school on performance of the child in arithmetic and found that performance of the children of recognised private schools was higher than children of corporation schools.

Since the available data based upon the effect of different variables of student, home, teacher, and school structure lead to conflicting conclusions, the present study was undertaken to identify the factors which go with the acquisition of mathematical concepts among students at the junior secondary stage.

Further, the child is a complex organism and lives in several environments generated by the conjoint interplay of diverse forces present within the child, in the home, in the teacher and in the school. This is more likely to be so in Indian society where the physical and social-cultural environment of different groups show very wide contrasts. Therefore, for studying the total effect of educational environment as related to the acquisition of mathematical concepts, the use of single variable approach was avoided, because it not only gives a distorted picture of the
relationship of these variables, but also leads to erroneous conclusions. For this reason a multivariate approach was preferred in the present study.

Finally, variables of educational environment as related to the acquisition of mathematical concepts need to be identified due to the increasing awareness of the need for co-operation between home and school and the significant part that a child's home and school environment play in determining his educational progress. It will also lead to the clear understanding of the influence of home, teacher and school to utilize more concretely the ways through which these influences could suitably be manipulated for developing curricula and designing educational programmes to suit the needs of pupils with varied background. And lastly as India has adopted equality of opportunity as its national goal, the study of the identification of variables of educational environment behind the academic performance of the child and that too especially in mathematics becomes very important.

The following basic issues emanate out of the above discussion which need further probing:

(a) Whether student variables such as intelligence, time devoted at home for the study of mathematics, additional participation in co-curricular activities, interest in mathematics, and sex differences are related with the acquisition of mathematical concepts.
(b) Whether home variables such as socio-economic status of the parents, parents alive or not, size of the family, place in the family, father's income, mother in-service or not, encouragement given by parents, and education of the parents are related with the acquisition of mathematical concepts.

(c) Whether the variables of teacher such as qualification, professional qualification, size of the class, amount of homework given by the teacher, teaching experience, in-service training, encouragement given by the head of the institution, use of aids, nature of the test, feedback given by the teacher, total index of above variables of teacher, and teacher's attitude are related with the acquisition of mathematical concepts.

(d) Whether school structure variables such as enrolment, teacher pupils ratio, mathematics teacher pupils ratio, expenditure on salary, non-recurring expenditure and non-recurring expenditure per student, type of the school, total index of the above school variables, are related with the acquisition of mathematical concepts.

(e) Whether the variables of school characteristics as identified by curriculum press (Category I), press of teaching method (C2), press of school rules and regulation (C3), press of curricular activities (C4), and press of school tradition (C5) are related with the acquisition of mathematical concepts.
Whether the variables of educational environment such as student, home, teacher and school conjointly are related with the acquisition of mathematical concepts.

The present investigation entitled "Identification of Variables of Educational Environment as Related to the Acquisition of Mathematical Concepts at the Junior Secondary Stage" has been addressed to the issues raised above.

ORGANIZATION OF RESEARCH REPORT

After having presented the introductory remarks in Chapter one, the second chapter has been devoted for the review of related studies and hypotheses on which the present study has been advanced. The third chapter deals with the method and procedure. In the fourth chapter detailed account of the research tools developed and used in the present study has been given, while the fifth chapter studies the nature of score distributions. The sixth chapter gives details of analyses of data alongwith discussion of results, while the seventh chapter deals with the summary and conclusion of the research study. Each type of analysis of data in this study is followed by the discussion and interpretation of results in the same chapter. Analysis of data was done by using the IBM-1620 Computer and DEC-2050 Computer.

The bibliography and appendices have been given at the end of the research report as usual.