CHAPTER II

REVIEW OF RELATED STUDIES AND THE HYPOTHESES
Efforts have been made to present a review of related studies in this chapter. It was thought that such an attempt would be of help in gaining insight into the problem as also in providing a basis for having a conceptual framework of the formulation of hypotheses. Consequently, out of a large number of cognitive and non-cognitive variables only those which seem to have a direct relevance with the present investigation have been taken into account.

EDUCATIONAL ENVIRONMENT

The question of the effect of educational environment on the individual in the field of education has been the subject of much discussion and investigation for many years. The total environment which surrounds an individual may be defined as being composed of a complex network of forces (Bloom, 1964). At the psychological level, the concern has been to understand why certain instructional materials are more effective with some type of pupils than with others. According to Michael, Barbara, Fresko (1978), on the sociological plan, researches have been interested in the effect which differential types of schools have on the achievement, aspirations, creativity, motivation of the
students, possessing differing initial ability and deriving from various home background. Watts and Barnett (1973) were not in favour of customary definition of 'environment' which refers to socio-economic status, culture, family structure or life style. They defined environment somewhat unconventionally as "a set of human and non-human elements in the external world that are directly and observably connected the child's experience and that may affect his development of competence either through participating in a developmentally pertinent experience or by making such an experience more or less likely to occur or more or less pleasurable for the child". Thus from above, we can say that educational environment is a part of the total environment in which the child as a living organism is continuously affecting and in turn is effected by the various forces impinging upon him.

Educational Environment according to Dave (1963) relates to "the conditions, processes and psychological stimuli of the total environment, which affect child's academic achievement". Samuel, Soto and Parks (1976); Hildebrand and Patricia (1978) found that variables of environment have a considerable impact on the I.Q. of the children and concluded that higher the child's score in mathematics the better the family environment. Vernon (1979) concluded that both genes and environment have very substantial effects on the measured intelligence of children. Dave (1963) and Wolf (1964) found that the measure of environment accounted for approximately 50 per cent of the
variance in global intelligence test scores. Dyer (1967) who examined fifth grade West Indian children found that the environment scores accounted for 46 per cent of the variance in global intelligence test scores. Marjoribanks (1972) found that 52 per cent of the variance in a global intelligence test score could be attributed to the measured environmental forces. Reddy (1973) in his study observed that home environment appeared to be more prominent as potential predictor of academic achievement after intelligence. Both the Plowden Report (1967) and Bullock Report (1975) discussed cooperation between parents and teachers and made constructive suggestions as to how this could be improved. From the research conducted so far, it can be concluded that educational environment is affected by the variables of students, home, teachers and the structure of school. These forces are differential functions of each child as also of each family. As a result of this, each child lives in a unique educational environment resulting into differential academic achievement and acquisition of mathematical concepts.

STUDENT VARIABLES

A. INTELLIGENCE AND ACADEMIC ACHIEVEMENT:

Intelligence has been extensively used as a major factor in a variety of experimental studies on learning or acquisition of concepts. Analyzing various definitions of intelligence (Terman, 1921; Freeman, 1926; Wechsler, 1943; Stoddard, 1943), one is convinced to believe and accept that intelligence may be
considered in terms of ability to adjust, ability to learn and ability to carry on abstract thinking. Intellectually superior subjects will be having more reasoning ability, superior problem solving ability, more independent thinking, desirable behaviour and superior academic achievement. It is commonly believed and has been supported by numerous studies that intelligence plays a significant role in the acquisition of concepts.

Evidence in support of the above-mentioned argument has been presented by numerous researchers working in this field. For example, Skemp (1961) finds the difference between sensory motor intelligence and reflective intelligence and concluded that while the former helps in the mastery of skills and operations involved in arithmetic problems, the latter is needed for the development and formation of concepts. Jacobson, Dickinson and Fleishman (1969) reported that subjects of high intelligence learned concepts in fewer trials and made fewer errors than subjects of low intelligence. The studies conducted by Strang (1937), Wedemeyer (1959), Gowan (1955), Hammond and Cox (1967), Briggs (1962), Keller and Rowley (1964), Rao (1965), Singh (1965), Sheffield (1966), Vernon (1970), Rao (1970), Dhaliwal (1971), Singh (1973), Charles (1975), Hansen and Thyge (1976), Gordon and Will (1978), Zalewski and Jean (1978), Roach (1979) and Maqsud (1980) have established the superiority of intelligence as a major factor influencing academic achievement.
Lalithamma (1975) conducted a study on 732 pupils of standard IX, selected on a stratified random basis. The study revealed that the achievement in mathematics was positively related to intelligence. Seetha (1975) while inquiring into the psychological and social factors affecting academic achievement found that high achievers possessed superior intelligence when compared with low and non-achievers. Dave and Dave (1971) also found that the non-verbal intelligence of the rank students was superior to that of the failed students. Thakur (1972) also established that scholastic achievement and intelligence were significantly associated with each other.

Freeman (1942), on the basis of a large number of research studies, reached the conclusion that correlation between IQ and academic achievement ranged from .40 to .60, with the mean value of .51. Crawford and Burnham (1946), reported correlations within the range of .60 and .65. Rattan and Macarthur (1968), reported a highly significant 'r', between achievement and scores on 'progressive matrices'. Sinha (1967) while investigating into the relationship of intelligence with the academic achievement of students by taking a sample of 200 high achievers and 200 low achievers found that the two groups significantly discriminated (beyond .01 level) on the variable of intelligence. Diwan (1970) obtained the value of 'r' as .51 between Jalota's test of verbal mental ability and annual marks of the 9th grades. Bruce (1977) studied intelligence and mathematical concept formation and
concluded that those students scoring in the intellectual range of IQ's above 109 attained significantly higher mean scores than those students functioning in the low range of intelligence (80-99) in the attainment of mathematical concept. Coleman (1977) concluded that intellectually superior subjects performed more successfully than normal subjects under both successive and simultaneous presentation of the stories.

No doubt, the studies cited above show a positive and significant relationship between measures of intelligence and academic achievement, but at the same time a wide range of variation is reported in these studies. Super (1949) on the basis of various studies reviewed by him concluded that 'r', between intelligence and academic achievement ranged between .30 and .80 at the school level, whereas, at the college level it varied from .27 to .70. Rao (1963) reported even greater variations in the values of 'r' ranging from .10 to .90.

Several studies have reported evidence of insignificant correlation between intelligence and achievement in school situation. Green and Farquhar (1964) obtained exceptionally low, insignificant and negative 'r', of .01 between verbal intelligence and achievement of negro students. Bansal (1977), Dave and Amad (1971) concluded that there was no significant difference in the pupils except in affiliation and aggression when averaged over the different levels of general intelligence.
Dhamiwal and Parkash (1976), in one of the recent studies reported an insignificant 'r' of .26 between intelligence measures and achievement in Mathematics. Srivastava (1972) conducted a study to investigating the effects of the factors of intelligence, task complexity and instruction on the process and performance in verbal concept learning, concluded that the response generating period in verbal concept learning was not a function of intelligence but of task complexity. Pelechano (1972) too, had pointed out, that intelligence was not systematically related to academic performance. Thorndike (1963), also cautioned the research workers that there was not a priori justification for expecting one to one correspondence between academic achievement and scholastic aptitude measures. Intelligence, therefore, is just a promise, which shows possible prospectus of success in an academic field, but it is not the actual achievement. However, even when the influence of intelligence is partialled out at one or more levels, there still remain wide variations in academic achievements. The failure of research workers to explain variations in academic achievement on the basis of intelligence test, offers a strong evidence for the existence of variables other than intelligence.

All research material available in the field of intelligence and learning leads one to infer that ordinarily higher intelligence accounts for better learning whatever the type of learning; may be the acquisition of concepts. Yet the wide variations reported in the value of 'r' are indicative of the fact that intelligence alone cannot explain the total phenomenon of
individuals falling within the same range of mental ability and yet showing wide range of variation in academic achievement, has led the research workers to admit the existence of factors other than intelligence.

**B. TIME DEVOTED TO THE STUDY OF MATHEMATICS, ADDITIONAL HELP TAKEN AT HOME AND ACADEMIC ACHIEVEMENT:**

Generally, it is considered that time devoted to the study of mathematics and availability of help at home result into better performance. Hewison and Tizard (1980) concluded that when amount of coaching which the children had received was related to reading test score, a highly significant positive association was found. But the findings of Bell (1931), Ecbert (1935) and McCormick (1932) contradict the above conclusion. These findings have reported a moderate 'r' between time spent on the study and grade achieved. Singh (1977) also concluded that both these variables revealed insignificant 'r' of the order of -.0018 and .06 respectively with the geometric concept test.

**C. INTEREST AND ACADEMIC ACHIEVEMENT:**

It is commonly assumed that success at a task increases one's interest, it is also assumed that interest in a task improves one's performance. The "success-brews-interest" and "interest-brews-success" assumptions are evidenced in many educational policies and programmes. It has been demonstrated
by experimenters that significant correlation exists between the interest and student's success (Cattell, 1961; Gorden and Alf, 1962). Srivastava (1974) and Lalithama (1975) conducted studies and revealed that achievement in mathematics was positively related to interest in mathematics. Further the coefficient of correlation between intelligence and interest was .58 for boys and .35 for girls. Similarly, correlation between interest of boys and girls and their achievement in different school subjects was very high viz., .75 and .78 for boys and girls respectively. Pande (1978) found the existence of a positive relationship between interest and problem solving ability, when problem are set in the area of interest among secondary school students.

However, this "interest-success phenomenon" becomes further complicated when we are confronted with insignificant correlation between interest and performance. Several studies have shown that high performers do not necessarily express greater interest than lower performers (Clifford, 1972; Clifford et al., 1972; Smith and Dunbar, 1951). Traver's (1967) review of literature led to the conclusion that 'data generally' demonstrated a very small relationship between interest measures of learning and these relationship tend to be too small to be of practical significance. Seetha (1975) conducted a study with the aims to examine the psychological and social factors affecting academic achievement and concluded that no significant relationship existed between interest and academic achievement.
D. SEX DIFFERENCE AND ACADEMIC ACHIEVEMENT

The effect of sex difference on the concept learning has been demonstrated by number of studies. Three trends have been observed in research literature with regard to the relationship of sex difference and learning of concepts.

Crandall (1969), Dave and Dave (1971), Shahi (1973), Horner (1974), Veroff (1969), Gupta (1972), Reddy (1971), Thakur (1972), Gorden and Will (1978), Nelson and Emery (1979), Jolly and Donald (1978), Jahode (1979) and Julia (1980) found positive significant sex differences in respect of achievement and concluded that males are higher achievers than the females. Furthermore, the experiment of Lalithamma (1975) on 732 pupils of Class IX has shown that there was significant difference in the performance of boys and girls in mathematics, the difference being in favour of boys. Joshi (1969) conducted a study to know the development of algebraic concepts in the pupils at the junior secondary stage. The results showed that the contribution to variance due to sex was found to be significant at .01 level in the three-way and four-way classifications of analysis of variance which indicates significant sex differences in the understanding of algebraic concepts. Girls and boys differed significantly at each grade level as also in the total sample with regard to the total algebraic concepts score and in each case the mean scores of boys was higher than that of girls in the corresponding group. From these findings, it can be safely
inferred that the boys had a tendency to excel girls in the understanding of concepts.

The second group of evidence is opposed to the first one. Roach (1979) found that mathematics achievement had significant positive correlation with intelligence and girls had higher mathematics achievement than boys. Sharma (1976), Betty and Roger (1980) in their study stated that girls were found to be significantly superior to boys both in general science and mathematics. Wilson and Linford (1979) made investigation of sex effects in the comparison of learning abilities between rural and urban children and indicated that rural female were superior to all other groups but it is suggested this was due to sampling bias.

The last group of studies have failed to find any relationship between sex and achievement. According to Sears and Feldman (1966), Vroegh (1976), Long and Resh (1976), Pitts (1980) achievement tests usually reveal no sex differences in academic skill. There is no significant differences between the girls and boys in their ability in the level of abstract achievement. The results of studies by Anastasi (1958), Dwyer (1973), Maccoby (1966) reported that, in general female have been found to excel in reading and male in arithmetic, but the differences have varied with age, SES, IQ and the specific sub-skill to be measured. Sharma (1977) observed no significant differences in the achievement of boys and girls in arithmetic but in reading test the girls achieved significantly higher scores, the significance being at .02 level.
It is well documented that the low socio-economic status (SES) children perform less successfully than middle-SES children in many kinds of academic and experimental situations (e.g., Curry, 1962; Karp and Sigel, 1965; Wiseman, 1967).

Turner (1975) conducted a study to examine the differential effect of SES on the performance of the students. A matrices training task was administered to 120 white male subjects representing grade I and III and low and high SES level. He concluded that high SES group demonstrated improved performance than the low SES group. Siller (1957), in one of the studies with sixth grade white children, observed that children belonging to high SES did better than children belonging to low SES on all tests of conceptual ability. Vane (1967), found a fairly high positive correlation between achievement and SES of 272 negro and white children. Chopra (1967) studied matched pairs of achieving and under achieving students of high intellectual ability and concluded that parents of the achiever had better SES level. Wendt (1967) is of the view that high percentage of low achievers were from the families, in which the father's occupation was ranked low. Montage (1964) concluded that children belonging to high SES performed better than children belonging to low SES on arithmetic concept test.

Pointing to the importance of SES, Lalithamma (1975) observed that the achievement in mathematics was positively
related to socio-economic status of the children. Attempt was made by Anand (1973) to investigate the affect of socio-economic status on academic achievement of the child on a sample of 1897 pupils of standard VIII, IX and X chosen randomly from eighteen high schools. The analysis revealed that three SES groups differed significantly from one another in their non-verbal and verbal intelligence; high SES group achieved higher mean score than pupils in both low SES group and middle SES group. Patel (1977) found that the mean achievement scores of high, middle and low SES groups were 8.0, 6.9 and 6.7 respectively. Dave and Dave (1971), Thakur (1972), Jachuck and Mohanty (1974), Seth (1975) and Tandon (1978) have also expressed similar views. Vijaya Lakshmi (1980) have also showed a positive relationship between creative ability and academic achievement. She found that high creatives were found from high socio-economic status group.

Socio-economic class differences in the free call of categorised items were studied by Glasman (1968). She demonstrated that middle class children scored about one standard deviation (S.D.) above than the lower class children on this task. Rusten (1967) summarizing the findings of international study of achievement in mathematics, concluded that there was a consistent positive 'r' between achievement in mathematics and SES. Burt (1937), Davis (1947), Furneaux (1954) and Dougles (1964), with their research literature concluded that the educational achievement of children from middle class homes
is better than children belonging to the manual working class families. Burt (1937) also showed that poverty, family size, poor health, inadequate general knowledge were the aspects of low social class which seem to prevent children from taking full advantage of educational opportunities. Mcarthur (1980) determined that there was a significant relationship between student achievement and professional level of parents.

Miller (1970) concluded that factors associated with achievement of the children are generally less associated with social class. Besides, the findings of Reddy (1973) revealed that SES was not significantly related to achievement in any subject or group of subjects. The evidence in support of this argument has been presented by numerous researchers e.g., Swift (1967), Gordon (1970), Entwistle (1968), Henry, Roberts and Grady (1975), Dibble (1967), Reddy (1971) and Bansal (1977).

For the underlying cause of such differences in ability, Jensen (1974) has offered a two-level theory of mental ability. The theory involves two types of mental abilities: level I and level II and their interaction with population (SES) differences. Level I ability consists of rote learning, primary memory and characterized essentially by relative lack of transformation, conceptual coding. Level II ability in contrast is characterized by conceptualization, reasoning, solving and general intelligence 'g' factor. Level II and SES are positively correlated, since most intelligence and achievement tests require
Level II ability and thus middle SES children consistently outperform low SES children. Jensen's (1961, 1965, 1969b) research findings indicate that the performance of low SES children with low IQ's (60-80) on tests of associative learning, designated as level I ability was generally superior to middle SES, with similar IQ's. However, low SES children with low IQ's who did very well on associative tests, did not do as well on tasks on conceptual learning designated as level II ability. Green and Rohwar (1971) while investigating SES differences, found substantial SES differences on a level I and level II task.

B. FATHER'S ABSENCE OR PRESENCE AND ACADEMIC ACHIEVEMENT:

The adverse effects of early father absence on educational achievement has been documented by a number of investigators (e.g., Baughman and Dahlstrom, 1968; Belmont and Moralla, 1973; Carlsmith, 1964; Lynn, 1974). According to Zajonc (1976) and Zajonc and Markus (1975), when a father is chronically absent, there would necessarily be a decrease in the quality of the intellectual environment, since one member of high mental age has been removed from the family configuration. Children from household with a long absence of father are educationally less well prepared for school, and perform poorer on early achievement tests.

However, Fowler and Richards (1978) investigated a study in which equal number of father-present and father-absent
(60 of each sex) were assessed on twelve educational preparedness measures. Two years later, they were tested for reading mathematics and language arts achievement. A analysis of covariance of preparedness factor scores revealed no significant effects in the achievement of the children. These results are also consistent with other reported researches e.g., Hess, Shipman, Brophy and Bear (1968).

Research evidences given above, thus, does not present a clearcut and consistent view about father absence and father presence and therefore further research is needed in this direction.

C. SIZE OF THE FAMILY AND ACADEMIC ACHIEVEMENT:

Many research studies emphasize the negative correlation between family size and achievement of the children. Fraser (1959) found a relationship of -.4 between family size and achievement of the pupils, while Nisbet (1953) found a relationship of -.19 and -.33 between family size and non-verbal test and verbal test. Deutsch, Katz and Jensen (1968) observed a negative 'r' of value .24 between intelligence and family size. Husten (1967) also reported a negative 'r' of value .20 between size of the family and achievement in mathematics. According to Lovell (1969) investigations have shown that there is a negative correlation of about .20 to .30 between pupils intelligence test scores and family size. Solomon, Hirsch, Scheinfeld and Jackson (1972), Nisbet, Entwistle (1967) and Prosser (1973) found high negative correlation between family size and student achievement.
Baughman, Dahlstrom (1968), Lynn (1974) and Richardson (1977) reported adverse effects of increased family size on educational achievement. Tandon (1978) found that the parents of under-achievers had large families. According to Griffitts (1926) average grades of children in small families were higher than the average grade of children coming from large families. Jenkinis and Randall (1948) in their study concluded that children of superior ability were drawn from comparatively small families. Chopra (1967) concluded that the fathers of the achievers had a smaller families.

Marjoribanks (1972) found a moderate relationship between family size and intelligence test performance. Asbury and Charles (1976); Dave and Dave (1971) observed no significant correlation between size of the family and achievement of the children.

D. ORDINAL POSITION OF THE CHILD AND ACADEMIC ACHIEVEMENT:

It is generally considered that the ordinal position of the child effects the learning. If the child is elder in the family then he has to utilize his energies in looking after the education of the youngers and in this way youngers get the benefit whereas his own study suffers. On the other way being eldest he becomes responsible and excels in learning while youngers become dependent on others. But study conducted by Fraser (1959), Nisbet (1953), Deutsch et al. (1968) and Marjoribanks (1972) found no relationship with verbal educational ability score and ordinal position of the child in the family.
Lalithamma (1975) in a study on 732 pupils of standard IX found that achievement of first borns was better than that of the last borns. At another place, Desai (1963) after taking a sample of 2699 children of first through tenth birth orders and studying in eighth, ninth and tenth grades in different high school of Bhavnagar city, observed that (i) boys having a brother as an elder sibling, showing a tendency for higher intelligence, did not in fact differ in intelligence from boys having sister as an elder sibling; (ii) boys having a brother as an elder sibling showing a tendency for lower intelligence did not in fact differ in intelligence from girls having a brother as an elder sibling; (iii) boys having a brother as an elder sibling, showing a tendency for lower intelligence did not in fact differ in intelligence from girls having a sister as an elder sibling; (iv) boys having a sister as an elder sibling were significantly lower in intelligence than girls having a brother as an elder sibling.

Swanson (1980) designed a study to determine the possible inter-relationship between birth order, intelligence and academic achievement. They found that birth order was not statistically related to intelligence $F(2,165) = 2.23$, $p > .05$ but it was statistically related to achievement on CTBS (Comprehensive Test of Basic Skills) $F(2,165) = 3.46$, $p < .05$.

E. INCOME OF THE FATHER AND ACADEMIC ACHIEVEMENT:

Father's income is considered very important factor for the child to get various facilities in the student life. Many
studies have been conducted to find out the relationship between scholastic achievement and father's income.

A number of studies showed a positive relationship between performance and father's income. Fraser (1959), in her study with 427 sixth grader primary school children obtained an 'r' of the value of .44 between income of the father and achievement of the child. Chopra (1967), studied matched pairs of achieving and under achieving students of high intellectual ability and found that fathers of the achievers had comparatively greater income. These results are consistent with the results of Joshi and Sharma (1969) who studied one hundred ninth grade under achievers and concluded that poor income of the father was a significant factor of under achievement. Similar results were also obtained by Dibble (1967), Dave and Dave (1971), Gordon and Will (1978) while finding the relationship between intelligence, sex and income of the father observed that income of the father is related with the student's achievement in mathematics.

However, Long and Resh (1976) in a study to determine the effectiveness of a technique employing an ambiguous stimulus for assessing a child's level of skill and concept development in the area of addition and subtraction found no significant differences between father's income and child's level of abstract achievement.
Seth (1975) studied one hundred and eight infants of working and non-working mothers to examine the hypothesis that the children of working mothers would tend to have smaller vocabulary in comparison to the non-working mothers. But the hypothesis was rejected with the findings that the difference in the vocabulary size was not found to be significant amongst children of working or non-working mothers.

Singh and Sharma (1975) conducted a study on 892 working and non-working women from the city of Patna in Bihar. Working women were teachers of primary schools, high schools and colleges. Non-working women were from the neighbourhoods of all the three categories of teachers and they fully matched with their counterparts in respect of education. The findings of the study suggested that more educated working and non-working women display higher degree of acceptance, independence and reward in their child, less educated working and non-working women expressed more degree of dependence and punishment in their attitude towards child, working and non-working women differ significantly on 'reward-punishment' dimension. Similar effects of parental employment on the child have been studied by Breecher (1955) and Gram (1963).

Significant attempts to study the encouragement given by parents related to the achievement of the child were initiated by Dave and Dave (1971) and Reddy (1973) who
concluded that the variable of parented encouragement was found significantly associated with achievement in one subject or the other. Further, parents of the rank students showed more academic concern about their ward and gave more encouragement than those of the low achiever or failed students.

G. EDUCATION OF THE PARENTS AND ACADEMIC ACHIEVEMENT:

It has been concluded by many research studies that the educational attainments of the parents had a greater effect on the scholastic achievement of their children. Joshi and Sharma (1969) studied one hundred ninth grade under-achievers and found that the poor achievement was due to the low educational standard of their parents. Stevenson et al. (1976) found that educational level of parents influence more their sons than their daughters on the achievement tests.

Husten (1967 ed), in the international study on achievement in mathematics and science reported an 'r' ranging from .07 to .33 between father's education and the achievement of the child, while this range vary from .06 to .32 in case of mother's education and achievement of the child. Kevin (1972) calculated 'rs' for verbal ability, numerical ability, spatial ability and reasoning ability of the magnitude of .29, .27, .26 and .22 respectively for the level of father's education while in case of mother's education, the value of 'rs' were .39, .33, .21 and .16 respectively for the same abilities.
Charles (1975) obtained an 'r' of the value of .32 between father's education and GPA of the child but did not find any relationship between mother's education and achievement of the child. Dibble (1977) also emphasised that mother's education contributed very little to variance in the achievement of the child.

Dave and Dave (1971), Reddy (1971, 1973) in their studies revealed that a higher percentage of rank students belonged to homes having higher parental education whereas a higher percentage of failed students belonged to homes having lower parental education. Nagpal and Wig (1975) while studying the non-intellectual factors associated with academic achievement concluded that the pass group students had more often parents who were better educated than the fail group students. Study conducted by Jachuck and Mohanty (1974), Tandon (1978) also supported the positive and significant relationship between parents education and pupil's achievement.

TEACHER VARIABLES

A. ACADEMIC AND PROFESSIONAL QUALIFICATION AND EXPERIENCE OF TEACHER AND ACADEMIC ACHIEVEMENT

Several recent books and articles have concluded that only the quality of the student body and not the school or its teaching staff 'makes a difference' on measures of student learning (Coleman et al., 1966; Heil et al., 1960). These studies however have used school rather than teachers as the unit of analysis.
The study conducted by Veldaan and Brophy (1974) using a sample of 115 second and third grade teachers with five or more consecutive years of teaching experience of their respective grade level, showed that better qualified and trained teachers do affect student learning to a degree that is both statistically and practically significant. Sparks (1960) found that school with the greatest gains were characterized by teacher better qualified and teacher with longer tenures of service. Sherman and Blackburn (1975) collected a data from 1500 students judgement on 108 male and female teachers and their results showed that highly intellectually competent teachers received statistically significant higher teaching competence rating than did teacher tending towards the opposite of this trait.

Malhotra (1976) conducted a study on 1724 students and 250 teachers. He found that the teachers with bachelors degree were more indirect in their class-room behaviour than teachers with masters degree. Mehta (1976) examined 36 males and 14 female teachers of secondary schools of greater Bombay and revealed that significant relationship was observed between the qualification of teachers and teachers communication pattern.

Study conducted by Cantrell, Stenner and Katzenmeyer (1977) support a positive relationship between teacher's qualification, professional qualification and pupil gain by assuming that the teacher's qualification are correlated with that of teacher's classroom teaching process, which in turn effects changes in
student behaviour and/or achievement. Wilson (1959), Spady (1973), Coleman (1975), Bidwell and Kasarda (1975), Crouse and James (1977) also established a positive correlation between teacher's qualification, experience and achievement of students.

Studies conducted by Smith (1964), Lampela (1966), Rouse (1967), Hawkins (1966) concluded that mere spending more years in teaching profession does not automatically lead to professional effectiveness of the teacher and that predictors of elementary school. Mathematics teaching success will not be found in the obvious variables of experience and qualifications. Minnesota National Laboratory conducted a study on 127 teachers in 1959-60 in grades 7 to 12; this study failed to reveal any significant 'r' between student achievement, experience and college grades.

But the study conducted by Newman (1980) investigated the impact of years of teaching experience of class-room teachers on the achievement of third grade students in Inner-City Title I Schools. Analysis of the data indicated that teachers having more years of experience in Title I Schools appeared to have a greater increase in the reading and mathematics scores of students.

B. SIZE OF THE CLASS AND ACADEMIC ACHIEVEMENT:

Investigators have found that it becomes difficult for the teacher to establish close contacts with the students in the large classes. The teacher can not easily judge the
capacities of the individuals and no individual attention can be paid (Mekenna, 1957). According to the findings of Wilson (1959), Spady (1973), Bidwell and Ksarda (1975), Coleman (1975), Chang and Ping-Tung (1978) there exist significant main effect of small group instructional procedures on achievement of the students. Achievement in small class is greater than the big class.

George (1975), however, obtained a negative 'r', between reading achievement and class-size. Marklund (1963), made 291 comparison and found that 37 comparisons favoured large classes, 22 favoured small classes, whereas 222 showed no significant differences. Newman (1980) also concluded that students in large classes appeared to show greater gains than students in smaller classes in reading and mathematics.

C. EFFECT OF HOME WORK AND ACADEMIC ACHIEVEMENT:

Some educationists are of the view that homework establishes the habit of working hard and that too regularly. It supplements and confirms classroom work and is a practical means to cover comfortably the lengthy and heavy syllabi and thus mathematical concepts are understood in a better way by utilizing the leisure time.

However, it was revealed by Friesen and Donovan (1976) that there exist no significant differences in the responses of
two groups - one given the home work and the other not.

Anthony and Preston (1977) in one of the experimental study of the effects of different amount of home work upon student achievement in Algebra, concluded that, student who did upto five home work problems tended to achieve more than the students who did three times as much home work. But they cautioned that these results should not be interpreted as implying that the smaller the given home work assignment, the better the achievement.

D. IN-SERVICE TRAINING OF THE TEACHER AND ACADEMIC ACHIEVEMENT:

In-service programme is one of the best source for the teachers to remove their problems, to get fresh knowledge of the subject by way of discussion and listing the lectures of expert persons. Azi (1977) conducted a study to evaluate the effectiveness of the in-service programme to the teaching of mathematics in the elementary school. He found that the in-service programme, consisting of summer workshop followed by implementation stage appeared to be very effective in the modification of teacher behaviours and implementation of an activity-oriented class-room. In one of the study Giffune (1980) while assessing the effect of in-service training in teaching reading strategies to solve verbal problems in mathematics revealed that teaching of reading strategies significantly affected student ability to write correct equation, obtain correct solution on post-test at the .01 level of significance.
E. USE OF AUDIO-VISUAL AID AND ACADEMIC ACHIEVEMENT:

In fact, all teaching has always involved the communication of ideas through the senses either orally through the medium of instruction or visually by the use of written or printed material. Many people are of the opinion that in mathematics, where doing is more prominent than reading to create the necessary interest, subject demands the use of aid at every step. Seth (1975) finds that audio-visual aids were found to be more beneficial for girls of lower intelligence group as compared to the girls of higher intelligence group. Lang and Solman (1979) conducted a study in which comparison were made between three conditions: the absence of a picture, the presence of a related picture, and the presence of an unrelated picture. They concluded that pictorial information could be used with advantage, if the child was aware of the relationship between word and picture and that the use of spacing did appear to facilitate learning.

Findings obtained in studies by Spears and Edward (1976); Tilghman and Finney (1976) indicate that children use picture as the source of their answer even though they have the choice between picture and sentence and further-more, these modality preference and use of audio-visual aid stimulate interest and affect learning and achievement of the pupils. Daruwalla (1980) on the basis of their findings interpreted that newspaper as an Audio-Visual aid may serve to make concept clear to the students, to interest them in the lesson taught and to increase their achievement in mathematics.
Providing students with feedback concerning their performance in periodic tests has been advocated as an instructional aid on the grounds that feedback (knowledge of results) facilitates learning (e.g., Beard, 1967; Ellis, 1967). Although in the past, psychologists explained the facilitating effect of knowledge of results on learning in terms of reinforcement (e.g., Angell, 1949), today it is widely accepted that this effect is due primarily to the provision of information (Annett, 1969). Several investigators have found that a particularly effective method of giving feedback of examination results is discussion between the teacher and students (Gilbert, 1956). Sassenrath and Garverick (1965) compared three methods of giving students feedback of mild semester examinations: discussion with an instructor (active feedback), letting them check their answers against the correct ones written on a blackboard (passive feedback) and assigning them to text-book material related to questions which they had answered incorrectly. The discussion group performed better on post-test than the others. Mantor (1970) gave students feedback of multiple-choice test results using a device which gave an immediate indication of whether or not each response was correct. He found that group who received feedback did well in post-test as compared to other group who did not receive feedback.
The positive effects of knowledge of results on concept learning and performance are firmly established in the research literature (e.g., Ammons, 1956; Biodean and Biodean, 1961; Shaida, 1976; Vroom, 1964). When an experimental subject is informed that he has failed to surpass a standard set by experimenter, it is highly likely that he will try harder, on subsequent trials. Similarly he might be expected to relax somewhat if told that his performance had exceeded expectations. True, there is a substantial data which indicate that feedback operates primarily to correct error responses rather than 'reinforcing' correct answers (Anderson, 1970; Guthrie, 1977; Tait, Hartley and Anderson, 1973). In their study Meyer (1960; Anderson, Kulhavy, and Andre (1971); Cobb and Hops (1973); Surber and Anderson (1975); Walker and Hops (1976); Raymond, Kulhavy and Yekovich (1976); and Peeck (1979) concluded that the active feedback group did slightly better than passive feedback group which in turn did slightly better than the no feedback group.

G. ATTITUDE OF THE TEACHER AND ACADEMIC ACHIEVEMENT:

It can not be denied that attitudes are important indication of teacher's educational, vocational, personal, social and interpersonal adjustment. How the attitude of the teacher affect the achievement of pupils, have become important issues in educational research. The teacher's personal attitude towards the educational work or teaching is a great factor in determining his effectiveness in teaching. For example, if a teacher is genuinely interested
in his teaching for its own sake and also in the children, his altruistic behaviour will go a long way to evoke an enthusiastic response from the students in the classroom, while the student individually emerge distinctively for the teacher and the teachers own personality remains clearly defined for every student. The positive attitude may evoke brilliant results while negative attitude may evince diametrically the opposite. Malhotra (1976) also emphasises that teacher with positive attitude were more indirect in their class-room behaviour than teachers with negative attitudes.

Several studies have shown that teachers attitude did indeed affect their teaching performance. Beez (1968) found that teachers taught more to students randomly labeled high ability, than to those labeled 'Low ability'. Studies conducted by Brandt and Hayden (1974), Brophy and Good (1972) explained that some teachers may be more efficient in controlling their behaviour towards students in such a way as to minimize or eliminate the influence of ascriptions. Good, Sikes and Brophy (1973) found differences in the attitude of male and female teachers while interacting with their students. Cantrell, Stenner and Katzennmeyer (1977) also supported a positive relationship between teacher's attitude and pupils achievements. Quraishi (1973) studied the relationship between teachers personality variables and their class room behaviour using Flanders Interaction Analysis Category System. He found only teacher attitude to be associated with class-room behaviour of teacher.
Buch (1959) surveyed the attitude of teachers towards the profession. The results indicate that, in general, training has a favourable effect on the attitude of teachers towards their jobs, except when experience exceeds five years after training. Aggarwal (1966) has made a similar study, that factors like designation, age, sex, and experience do not influence the attitudes. Gupta (1977) observed that the success in teaching was significantly related to professional attitude of the teacher. Leonhardt and Albert (1962) studied 45 schools of three categories of enrolment in order to ascertain difference existing between those achieving high, and those achieving low on co-operative general mathematics test for high classes and found that the attitude of the teachers toward professional organisation was responsible for the difference in achievement of the pupils.

Popham and Standlee (1958) explored the relationship between teachers favoured out of school activities and their professional growth as measured by principal's rating and teacher's attitude towards pupils as reflected by Minnesota Teacher Attitude Inventory (MTAI). They found that there is significant positive relationship between attendance of professional meeting and MTAI score, the number of professional books read and both MTAI scores and principal's ratings, the extent of participation in leisure organization (dramatic, club etc.) and principal's ratings and extent of participation in religious organization and principal's ratings. Lynch (1980)
found that teacher-pupil interaction and student's performance has a significant positive correlation.

Manske (1936) found that teacher's attitude may still exert an important effect on the pupils and that the attitudes of some classes were more affected in this way than those of others, irrespective of the age intelligence, or socio-economic status of the pupils. Studies by Lippitt and White (1947) and by Anderson and his colleagues (1945, 1946) made it clear that the attitude of the teachers towards pupils has a considerable effect on classroom relations. Corey and Beery (1938) concluded that teacher who has little sympathy with the pupils, and does not understand their needs, may induce a dislike for school and school work which may affect the whole of their after-lives. Symonds (1950) suggested that the teacher who is confident and secure, who is interested in children and is able to accept them as they are, is likely to be successful and affects pupils' achievement.

Torrance et al. (1966) reported that teacher effectiveness had a positive effect on student attitude towards teaching method and overall school climate.

When the teacher was autocratic or dominating, the children were likely to be aggressive or over submissive. They showed little pride in work and did not co-operate. In the classroom of a democratic teacher or socially integrative teacher, the children were relaxed and friendly, they worked
well together, and they were interested in what they were doing. Careful observations made it clear that these differences in the children were the results of the differences in the attitude towards them of their teacher.

Veldman and Kelly (1965) reported that the effective teachers were friendly, admired and exercised strict control. Positive attitude towards self, authority and reality were observed in the effective teacher group. Mallula (1979) in his study described the relationship between teacher competency, teacher attitude and student achievement. He found that the attitude of the more competent teacher was significantly greater than the attitude of the less competent teacher towards incorporating the reading skills with content. Student achievement in reading for vocabulary and for comprehension was significantly related to teacher attitude at the seventh grade level.

These attitudinal findings, after having become reliably established, should have important implications for educational programmes.

SCHOOL VARIABLES

A. SIZE OF THE SCHOOL AND ACADEMIC ACHIEVEMENT:

There are sufficient supporting evidences which indicate that large schools are better than small schools for providing the children with extra information by way of good library, by organising large number of co-curricular activities, group
projects, putting progressive methods of teaching with the help of efficient, trained and experienced staff. Generally in smaller high schools, less paid, less experienced, untrained and heavily loaded teachers are found who suffered from inferior housing problems, inadequate equipment, restricted curricular offering and less developed programme of guidance and counselling (Douglas, 1931).

Smith (1960) investigated the relationship of school size to 21 selected qualitative and quantitative factors of education relating to cost, pupil, teacher and institutions. The result showed that school with fewer than 200-400 pupils were paying a premium for an inferior programme, and a size range of 800-1200 pupils was one of which favourable factors approached the maximum value and unfavourable factors reached the minimum. Street, Powell and Hamblin (1962), conducted a study in which schools were grouped according to size. First group consisting of schools with more than 300 students, second group 100-300 students and third group less than 100 students. Tests in reading, spelling, language and arithmetic were given to seventh and eighth graders. Difference in mean scores between schools of first group and second group were significant at .01 level in all the four tests, between first and third group were significant at .01 level on all measures except for spelling scores and between second and third group school were significant at .01 level for language only. Study conducted by Wilson and Karen (1975) also favoured that the
performance of students belonging to larger schools are better than the performance of students belonging to smaller schools and he obtained 'r' of value .19 between size of the school and ten years old students performance in mathematics.

The second group of studies failed to find any relationship between size of the school and student achievement (Garrett, 1949; Lathrop, 1960 and Wiseman, 1964).

B. TYPE OF SCHOOL AND ACADEMIC ACHIEVEMENT:

Sharma (1977) made an attempt to explore achievement of children in relation to school system. The result of his study suggested that when the score of corporation and recognised private schools children were compared, highly significant differences were observed. Children of recognised private schools achieved significant higher scores in arithmetic as compared to the students of corporation schools.

HYPOTHESES

Confrontation with certain controversies as to the nature of various variables of educational environment and its relationship with the academic achievement as a result of review of related studies led to the formulation of the following hypotheses:
HYPOTHESES RELATED TO STUDENT VARIABLES:

(i) Intelligence is significantly correlated with the acquisition of mathematical concepts individually and in unique constellation with other variables.

(ii) Students who devote more time to study mathematics and have the advantage of additional help, show superior performance on the MC Tests.

(iii) Student's participation in co-curricular activities and acquisition of mathematical concepts are independent of each other.

(iv) Interest of the student in mathematics is significantly related with the acquisition of mathematical concepts.

(v) Sex difference is significantly related with achievement on the MC Tests.

HYPOTHESES RELATED TO HOME VARIABLES:

(i) Socio-economic status of the parents is significantly correlated with the acquisition of mathematical concepts.

(ii) Father's presence or absence, size of the family, ordinal position of the child in the family and acquisition of mathematical concepts are independent of each other.

(iii) Father's income is significantly related with the acquisition of mathematical concepts.
(iv) Working or non-working mother and the encouragement given by the parents are independent of the achievement on the MC Tests.

(v) Education of the parents is significantly related with the acquisition of mathematical concepts.

HYPOTHESES RELATED TO TEACHER VARIABLES:

(i) Teacher's qualification, both academic and professional and achievement on the MC Tests are significantly related with each other.

(ii) Significant relation is expected between size of the class, and achievement of the students on MC Tests.

(iii) Amount of home work given by the teacher, teaching experience and inservice training received by the teacher shows no difference in respect of the acquisition of mathematical concepts.

(iv) Encouragement given by the head of the institution to the teacher is significantly related with the acquisition of mathematical concepts.

(v) Use of A.V.aids, nature of the test and feedback given by the teacher and achievement on the MC Tests tend to go together.

(vi) The qualification, class size, teaching experience, feedback and other variables of teacher considered jointly predict significant variance in the acquisition of mathematical concepts.
(vii) Attitude of the teacher towards teaching profession, professional growth, students, teaching method, student discipline, school discipline and toward self-concept is significantly related with the acquisition of mathematical concepts.

HYPOTHESES RELATED TO SCHOOL STRUCTURE VARIABLES:

(i) A significant relation exists between the size of the school and student achievement on the MC Tests.

(ii) Acquisition of mathematical concepts in pupils depends on the teacher-pupils ratio and mathematics teacher-pupils ratio.

(iii) Significant differences in the acquisition of mathematical concepts emerge due to the different expenditure on salary of the teachers, non-recurring expenditure and non-recurring expenditure per student.

(iv) Type of school namely government (boys), private (boys), government (co-education), private (co-education), and government (girls) contributes to significant differences in relation to the acquisition of mathematical concepts among children.

(v) The size of the school, teacher pupils ratio expenditure and other variables of school structure when considered jointly account for significant differences in the acquisition of mathematical concepts.
HYPOTHESES RELATED TO SCHOOL CHARACTERISTICS:

(i) The curriculum press ($C_1$) and achievement on the MC Tests are significantly correlated with each other.

(ii) The press of teaching methods and nature of student teacher interaction in the classroom ($C_2$) share a significant correlation with the achievement scores on the MC Tests.

(iii) A significant correlation exists between press of school rules, regulations, policies ($C_3$) and student achievement on the MC Tests.

(iv) No significant correlation exists between press of curricular activities ($C_4$) and performance on the MC Tests.

(v) Press of school traditions ($C_5$) contribute to significant differences with regard to the understanding of mathematical concepts.

HYPOTHESIS RELATED TO MULTIVARIATE ANALYSIS:

In a multivariate analysis, the variables of educational environment as related to student, home, and school conjointly predict significant variance in respect of acquisition of mathematical concepts.