CHAPTER II

REVIEW OF RELATED LITERATURE
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### REVIEW OF RELATED LITERATURE

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CHAPTER II

REVIEW OF RELATED LITERATURE

2:1 PRELUDE

Review of research studies pertaining to the problem under investigation is of fundamental importance to provide insight into the problem, broaden the general concepts and principles and sharpen the understanding. Besides keeping abreast of the work being done in this field, the reviewer also gets corroborative evidences. The present chapter summarises research studies related to the problem "Learning Styles, Intelligence and Learning Environment in Mathematics as determinants of Achievement in Mathematics.

The review examines first different learning styles and their dimensions and then the variables that are related to achievement in Mathematics. Different studies showing the relationship between intelligence and achievement in Mathematics are reviewed. Various studies showing the relationship between learning environment and achievement in Mathematics are also reviewed. A final discussion on the studies reviewed reiterates the need for the present study.

2:2 STUDIES RELATED TO LEARNING STYLES

2:2:01 Foreign Studies

Piscopo, Phillip John (1989) made an attempt to determine the effect of learning style preference on course performance of non traditional students enrolled in an undergraduate Computer Science program. The results indicated
the difference in course grades was significant based on the course type, learning style preference.

The investigation made by Mertesdorf and Jane, C., (1990) revealed that students with dominant learning modes would have more difficulty in coping with and adapting to the learning environment than would students with balanced learning modes.

Washington, Sandra Beatrice (1990) made an empirical study of the career development of gifted underachieving students in a magnet high school. He concluded that the principle learning style of the under achieving gifted and talented students was found to be divergent.

The studies of Cooper and Therese Jeanne Dupont (1991) have shown that the differences in patterns of learning styles are related to school environment.

On examining the relationship between a prescribed homework programme considering the learning style preference and Mathematics achievement of the eighth grade students, Monsour and Susan Elizabeth Muse (1991) observed no significant difference between students’ computation, problem solving or composite Mathematics achievement scores, when completing Math assignments through normal home work procedure or when those same set of students completed math assignments through a prescribed homework programme.
Avinor, Eleanor, R., (1993) found evidence to suggest that there was no significant interaction effect of language proficiency and learning style on analogy solving ability. The age at which a person acquired the second language, however, was not linked with learning mode or style.

Investigating the relationship of learning style and academic discipline to corresponding course attrition, Beaty, Vivian Cordilla (1994) found no statistically significant correlation between learning style and academic discipline.

Shelton, Whitsitt Myles (1994) attempted to determine the effects of an integrated learning system on students enrolled in college Algebra in a community college. This study used a pre and post test quasi experimental design to find the relationship between learning style, the method of instruction and student achievement. It was found that students who were enrolled in college algebra where an integrated learning system was used as a method of instruction did not demonstrate a significant gain in Mathematics when compared to the students who were taught college algebra without the use of an integrated learning system.

The investigation made by Bryant and Joyce Westguard (1988) revealed that all low and medium achievement group in Mathematics have positive attitude growth for all learning styles and high mathematical achievement group revealed positive attitude growth only for the abstract random learning style.
Vondrell, James Henry (1988) made an attempt to determine, if the identification of learning styles would assist in predicting the success (both academic and satisfaction level outcomes) of adult students participating in an independent study program. It was reported that assimilators and convergers tended to be successful. Accommodators, although hesitant to participate, actually performed the best. Divergers tended to do worse.

Attempts have been made by Fratzke, Betty Jane (1988) to study the relationship between preferred learning style and personality type among traditional age college students and adult learners. The study indicated a high correlation between learning style preference and personality type among adult learners. The accommodator learning style was significantly more predominant among adult learners; the divergent learning style was slightly more predominant among traditional students. It was suggested that learners should be given opportunities to expand their learning style range, to move through all four stages of Kolb’s learning cycle.

On studying learning style as a correlate to course grade for a sample of students enrolled in community college tele courses, Harland - White, Faith Ann (1993) found that no correlation existed between the four learning modes (abstract conceptualization, concrete experience, active experimentation, reflective observation) and academic success. However, indications of a correlation between concrete experience and reflective observation learning modes and a very high level of academic success was discovered.
The results of the study of Krawczak, June (1995) who studied the relationship between preferred learning style and continuing professional learning among registered nurses revealed that no significant relationships were found between the four learning styles (accommodator, assimilator, converger, diverger) and the four modes of learning (self instruction, group instruction, inquiry and performance).

Ryu, Youngate (1997) studied the effects of learning style and presentation methods on knowledge acquisition on 156 subjects drawn from the University of North Texas. He analysed the achievement level of students with the four types of learning styles (accommodator, assimilator, converger and diverger), when taught through the traditional lecture method and the computer assisted instruction. The 2×4 factorial analysis with interaction showed that presentation methods (traditional and computer-based), learning style and their interaction had significant effects on knowledge acquisition. Students identified as accommodator and converger had significantly different performance levels on knowledge acquisition between computer-based presentation and traditional presentation.

Bottroff - Hawes, Sally, J., (1991) investigated the preferential learning strategies, modality preferences and academic performance among eighth grade students. Two self reporting assessment instruments were administered to 200 eighth graders to determine learning style and modality preferences: abstract-sequential (AS); concrete-sequential (CS); abstract-random (AR); concrete-random (CR); auditory (A); visual (V); kinesthetic-Tactual (KT). It has been reported that the mean score achievement pattern ranged from
highest to lowest; learning styles (AS, AR, CS, CR); modalities (A,V,KT). Females preferred left - brain dominant / sequential learning styles (AS, CS), while the males preferred right - brain dominant / random styles (CR, AR). Females preferred abstract learning styles (AS, AR) to concrete ones. Males preferred concrete styles (CR, CS) to abstract ones. Females preferred auditory modality, while males preferred visual.

According to Allen, Ronald Floyd (1988) who investigated the relationships between secondary teachers' learning and teaching styles, the relationships between learning style inventory and teaching style inventory companion subscales were found to be significant in auditory, visual, kinesthetic, written expression and independent learning. In the subscales of auditory language and group learning, the teachers showed a preference to teaching rather than learning.

Draper, David, O., (1988) found that the majority of the athletic trainees were individual learners and preferred an auditory - visual - kinesthetic combination learning mode.

Eitington, Norma Jo (1989) made an attempt to compare learning styles of college freshmen with high and low reading achievement who were enrolled in a special purpose program. The findings indicated that there were significant differences in the learning style of subjects with high and low reading achievement with regard to seven learning style variables: preference for visual learning, learning in a variety of ways, authority orientation, need for structure, auditory, tactile and kinesthetic learning. It was found that
subjects with high reading achievement tended to prefer learning in a variety of ways and subjects with low reading achievement were more likely to prefer visual learning.

In an attempt to study perceptual learning style preferences and their relationship to language learning strategies in adult students of English as a second language, Rossi-Le, Laura Ann (1989) found that the dominant learning style preferences for the sample were tactile and kinesthetic. The strongest correlation existed between visual learning style and visualization strategies.

An experimental investigation of Ingham, Joanne (1989) to find the relationships among learning style perceptual strength, instructional strategies, training achievement and attitudes of corporate employees indicated the effectiveness of matching individual employees' perceptual preferences with complementary instructional strategies to increase training achievement and promote more positive attitudes towards company sponsored training programmes.

From the studies of Crampton, Nancy Ann Stoufer (1990), it was found that students who preferred to learn through tactile methods also liked to learn through kinesthetic experiences. Students in alternative schools preferred not to learn through visual modality.

Bauer, Elizabeth (1991) investigated the relationships among learning style perceptual preferences, instructional strategies, Mathematics achievement and attitudes toward Mathematics of learning disabled and
emotionally handicapped students in a suburban junior high school. It was reported that instruction through a single preferred modality was not sufficiently effective, when learning Mathematics. Furthermore, when a tactual/visual or multi sensory approach was utilized, students achieved significantly better.

An experimental investigation undertaken by Ogato, Beyene, G. (1991) to determine whether the visual, auditory, tactual and kinesthetic scores of students in grades six, seven and eight from four middle schools were significantly related to academic achievement in mathematical concepts and reading comprehension. It was found that achievement and learning modality were not related. There were no relationships among gender, grade and school with learning modality.

Research done by Garrett, Sandra Lee (1992) to study the effects of perceptual preference, motivation and academic achievement on short and long term vocabulary and attitude scores of ninth, tenth, eleventh and twelfth grade students revealed that grouping students according to perception auditory / visual or tactual / kinesthetic without matching to complementary instructional approaches had no impact on short or long term vocabulary learning. Attitude toward the learning task correlated positively with matched conditions.

Marsh, Joan Czaja (1992) examined the learning style preferences to look for visual, auditory and kinesthetic patterns in learning that differentially prepared students used while studying Algebra. The study showed that successful visual, auditory, mixed modality students had high correlation
between their identified modality strengths and matching study strategies in class and in private study. However, successful kinesthetic students were not correlated and did not use study strategies that matched their identified modality strength in class or in private study.

An attempt made by Adams, Kenneth Mark (1994) to investigate the relationship between learning style perceptual preferences of fourth grade urban students and the attainment of selected physical science concepts as taught using learning cycle methodology. The study revealed the learning cycle instruction did not appear to be sensitive to different perceptual preferences. Students with different preferences for auditory, visual and tactile modalities, when learning, seemed to benefit equally from learning cycle exposure.

Curry, Ellen Rose (1994) investigated the relationship between the learning style perceptual preferences of eleventh grade young women and their attitude and achievement in chemistry. The research data indicated that the interaction between an individual student's learning style perceptual preference and instructional method was not significant for attitude or for achievement in Chemistry. Auditory and visual learners had their highest achievement in the matching instructional method.

Braio, Ann (1995) investigated the effects of incremental implementation of learning style preferences for sound, light, temperature, design, mobility, tactual, kinesthetic, auditory and visual elements on reading, achievement and attitude toward instruction via structural analysis with special education and low achieving General Education students in grades four,
five and six. Significant gains in reading achievement for both special Education and General Education students were found, when students were taught using incremental learning styles strategies.

Hardy, Samuel Butler (1996) studied the relationship between learning style and job satisfaction for middle managers employed in the banking industry. The study revealed that the indicated learning style had an impact upon the level of employee's job satisfaction. The dominant learning style group was visual, and this group by itself did not have a degree of job satisfaction significantly different than the other three learning style groups namely auditory, kinesthetic/tactile and multisensory.

According to Miller and Wynn Arthur (1990), preference learning style and content knowledge are not influenced by co-operative learning technique.

Poppers, Audrey, E., (1991) made a comparison of the achievement of learning disabled students in a traditional resource room setting versus a collaborative consultation model. It was found that students made significant gains in reaching achievement, without regard to treatment setting. Students also made significant gains in Mathematics; However, the students in the collaborative consultation model made significantly higher Mathematics gains than students in the resource room model.

The research study of Doyle, Barbara King (1991) suggested that group presentations of interactive video physical science lessons might be as effective as individual viewing, when no additional teaching was added to the
group lesson. Achievement might be increased for all types of learners, if the teacher played an active role during the group discussions.

Attempts have been made by Hall mark, Bryan wayne (1994) to study the effects of group composition on elementary students’ achievement, self concept and interpersonal perceptions in cooperative learning groups. The findings of this study suggested that students with differing ability did not negatively or positively affect other group members’ achievement in Mathematics or Science, when working in heterogeneous or homogeneous groups. When gifted students were in a group, the other group members’ social self concept declined. In general, group composition (heterogeneous or homogeneous) had no effect on achievement.

Kummerow (1989) in his study on "the hemispheric dominance of high school students enrolled in selected alternative education programme" found no relationship between hemispheric dominance and the variables like academic success, gender, handedness etc.

Lub Singh Peir (1990) examined "the learning style, personality type and brain hemispheric performance of Teacher Education majors" and concluded that there was no predominant learning style, personality type or brain hemispheric performance among teacher education students. No difference existed among the three variables between the females and males.
According to Pandian (1983), there is significant relationship among learner characteristics, cognitive style, learning style and preference to teaching strategy. [As reported by Panda, K.C., 1991].

Research done by Siriyananda and Acharya (1989) showed that there was no significant relationship between gender and learning style preferences of Adult Basic Education students.

Studies of Verma, B.P., (1992) have shown that when appropriate instructional strategies that are congruent with students’ learning styles are implemented in the classroom situation, students achievement would increase.

Feiza and Anthony Stanley (1988) reported that there was no modifying variables in motivational preferences discriminating the four learning style groups (concrete Random, Abstract Random, concrete sequential, Abstract sequential).

Mathur, M.C., (1985) has pointed out in his research that there was a slight relationship between option of stream (Science, humanities and commerce) and the four perceptual learning styles (Visual, auditory, kinesthetic and tactile) among the students of urban and rural, Government and aided senior secondary schools.

Gangatharan, D.K.V., (2001) inferred that there was no significant association between the perceptual learning style and the subjects of study
chosen by the students. There was no significant association between the hemisphericity and the subject groups.

From the research studies reviewed so far, it could be inferred that much has been done in studying the effect of learning style on academic achievement in the western countries. But only limited studies are available in the Indian context and that too, most of them investigated the perceptual learning styles and learning styles based on social interactions. Moreover, there is hardly any study investigating the relationship between the different dimensions of learning styles.

2.3 STUDIES RELATED TO INTELLIGENCE

2.3.01 Foreign Studies

The research undertaken by Burhem, Anand and Sharma (1981) revealed that general intelligence appears to be the major factor that influences mathematics performance of high school students.

Stubbs (1983) also established the relationship between intelligence and academic achievement. This study, though it does not support the structure of intellect and training of intellectual abilities contributes to academic performance, reveals that control group scored significantly higher in Mathematics and language.

The study of Cai, Weiwei (1993) analyzed various factors influencing students' Mathematics achievement in the sixth grade and reported that sex has no significant bearing on Mathematics achievement. Also, Mathematics
achievement of students was significantly related to intelligence, achievement motivation and their socio-economic status.

This finding is in tune with the findings of Gliver, Ruth Newton (1994) based on a correlational study of children's social intelligence, social influences, academic intelligence and achievement motivation.

A cross-cultural study made by Oh-Hwang, Young Joo (1994) to know the linkages among intelligence, psycho-social maturity, parenting practices and academic achievements of adolescents. He inferred that academic achievement was positively related to students' intellectual ability, psycho-social maturity and parental education.

The research study on psycho-social correlates of academic achievement among college students with learning disabilities by Gibbs, Beverlee (1995) revealed that academic achievement was not influenced by pupil's intelligence.

Schnedeker, John Allan (1997) attempted a study on the psychological factors in school achievement and concluded that motivation and intelligence were the predictors of achievement.

Based on an exploration of the relation between mathematics achievement and factors of intelligence, Johnson, Eileen Susan (1998) advocated significant influence of intelligence on achievement in Mathematics.
In the study of intelligence and some personality factors in relation to academic achievement of school students, Sinha, N.C.P., (1967) reported that a positive relationship was found between intelligence and academic achievement.

Lal, K., (1968), in his attempt to study the emotional stability of mentally superior and average adolescents, inferred that pupils with superior intelligence were significantly better adjusted and emotionally more stable.

On investigating the relationship between achievement motivation, anxiety, intelligence, sex, social class and vocational aspirations, Chaudhary, N., (1971) found significant relationship between achievement motivation and intelligence for girls and not significant for boys at .01 level.

An investigation made by Lalithamma, K.N., (1975), on some factors affecting the achievement of secondary school pupils in Mathematics revealed that achievement in Mathematics was positively related to intelligence and interest in Mathematics. Intelligence and interest in Mathematics were higher in boys and urban pupils than their respective counterparts.

The research study of Abrol, D.N., (1977) on achievement motivation in relation to intelligence, vocational interests, achievement, sex and socio-economic status showed that there was significant positive relation between intelligence and achievement motivation.
Acharyulu, G., (1978) clarified the nature of relationship among creativity, intelligence and school achievement, especially to test for interactive effects of intelligence and creativity upon achievement in different school subjects. The study found that the average correlation between intelligence and verbal creativity was not only significant, but was also higher than that between intelligence and figural creativity. Further, the correlation between verbal creativity and achievement was so high as that between intelligence and achievement.

A psychological analysis of the mathematically gifted at the secondary and higher levels of education made by Kabu, C.L., (1980) reported that there was significant influence of intelligence on mathematical talent. Numerical ability and abstract reasoning were found significantly high in the mathematically gifted than in the non-gifted.

In an attempt made by Magotra, H.P., (1982) to study mental health as a correlate of intelligence, academic achievement and socio-economic status, he found that girls were found to be suffering from a sense of insecurity and anxiety and they scored higher than boys in the intelligence test.

Investigating intelligence, achievement and socio-economic patterns of different sociometric groups of adolescents, Kumari Sudha (1982) confirmed the findings of Sinha, N.C.P., (1967) stating that correlation between intelligence and academic achievement was significant.

According to Dutt, M.L., (1983) who studied achievement motivation in relation to sex, intelligence and socio-economic status, Students with same
socio-economic status, but of different intelligence level did not differ significantly in their level of achievement motivation.

It, A.S., (1984) undertook a study on academic achievement of students in Mathematics in relation to their intelligence, achievement motivation and socio-economic status. He inferred that intelligence affected the achievement of students in Mathematics significantly. There was superiority of the high intelligent group of students over the average and low intelligent groups of students in their achievement in Mathematics.

A casual comparative study on school failure was undertaken by Deka, U., (1985). According to him, low academic achievement was significantly and positively related to low intelligence.

Probing the influence of socio-economic status on academic achievement of higher secondary Students in rural and urban areas of Kanpur, Misra, M., (1986) reported that intelligence positively influenced academic performance. Moreover, significant differences were found to exist between academic achievement of rural and urban students.

Singh, R., (1986) investigated the relationship between achievement motivation, intelligence (general mental efficiency), Introversion - Extraversion, achievement in Mathematics and a comparison thereof between Haryana and Delhi students belonging to various socio-cultural strata. He found significant correlation between n-ach scores and intellectual efficiency and mathematics achievement. The difference in mathematics achievement was significant for
low and high groups on n-ach in the case of Delhi schools; but in the case of Haryana schools, it was not significant.

Trivedi, R.C. (1986) studied achievement motivation and its correlates of high school students of East Uttar Pradesh. He obtained the following findings.

(i) Achievement motivation was highly correlated with intelligence and achievement.
(ii) Girls showed better average scores in intelligence.
(iii) Urban girls secured better scores on the intelligence test.

On studying the relationship between intelligence, socio-economic status, anxiety, personality adjustment and academic achievement of high school students, Mehrotra, S., (1986) also found a positive relationship between intelligence and academic achievement.

In an attempt to study different structures and components of the strategies of acquiring and processing information, Dixit, S., (1988) inferred that performance in Mathematics was found to be significantly related to deep processing, while IQ was significantly related to success dependence and prediction orientation factors. Selection of various information acquisition strategies was independent of students’ IQ and achievement in Mathematics.

Ray, Mrinmarji (1988) examined the ethnic difference in intelligence. To study the genetic and racial differences in intelligence, the sample comprising 100 Santhals and 100 koras was drawn from Santhal Parganas. It
was found that the mean intelligence scores of Santhalas were significantly higher than those of koras. There was no significant difference in the intelligence scores of Santhal females and kora females, and kora males and kora females.

Shankara Narayanan, B.L., (1990) investigated achievement in Mathematics under guided discovery learning and reception learning conditions in relation to intelligence and anxiety. It was found that the students of high intelligence performed better than the average intelligence students, irrespective of the method of instruction employed on the criterion methods. There was significant first order interaction between instructional method and level of intelligence in their effect on criterion measures, while with the trait anxiety, it was not significant.

According to Vasanthi, R., (1991), Mathematical learning disabilities had a significant negative relation to intelligence and socio-economic status, and a positive relationship to behaviour problems. The degree of prevalence of mathematical learning disabilities was the greatest among monolingual pupils and less among bilingual pupils.

Yadav, R.S., (1991) inferred that heridity sets the upper limit in the development of intelligence; however, much depends on the factors that operate in the environment of an individual. Intelligence is contributed by 80% by heridity and 20% by environmental factors. Generally the brain follows a spurt of growth of neurons three months before birth and 18 months after
birth. *Hence any* deficiency in food may cause irreparable loss in intelligence. *Schooling raises* the level of intelligence.

The experimental work undertaken by *Viney* (1992) revealed that high ability *students* required better mathematical concepts and a more positive attitude *than average* and low ability students. Moreover, cognitive style and level of *intelligence* were found to be interacting.

The various research studies reviewed suggest that intelligence has a significant positive correlation with achievement in Mathematics at all levels. However, the influence of intelligence on learning styles and learning environment in Mathematics has not been probed so far, with a view to enhance pupils' achievement in Mathematics.

2:4 STUDIES RELATED TO LEARNING ENVIRONMENT

2:4:01 Foreign Studies

Investigating the impact of educational environment on the vocational maturity of rural and urban high school students, *Gakhar, S.C.*, '1985; inferred that the urban high school students were more vocationally matured than the rural high school students, because of better educational school environment.

The study of *Warren, E.N.*, (1988) reported no significant difference in the perceptions of Mathematics class room environment by two groups of students, one belonging to a small class size and the other to a large class size. There was no significant difference in their achievement in Mathematics too.
Bradley R.H., Caldwell, B.M., Rock, S.L., (1988) examined the relationship between home environment, school performance and the classroom behaviour. A longitudinal study of the three models of environmental actions was undertaken. The strongest relations were noted for the contemporary environment although all three models received some support.

Nenty, Johnson H., (1988) examined the influence of some school climate factors on students' academic performance. A positive and significant interrelationship among school environment factors and students' performance was found out. The school environment factors (eight) were found to influence in varying; but significant degrees students' academic performance.

On studying the relationship between home environment and class room performance of eighth grade students of Chicago, Fulford (1990) found that where parents held high expectations for the students' home behaviour, academic success followed. It was reported that a healthy and nurturing home environment was a positive component relative to the academic performance of the pupils.

Jarrell (1991) investigated the family environments of gifted primary school children to determine whether the parents' perceptions of their children's competence and ability in Mathematics were differentiated along lines of gender. The study further examined the children's school mathematics achievement to establish whether beliefs of parents of children were related to their actual performance. Significant differences were found in the means of the parents of the boys and parents of girls regarding their perceptions of their
respective children's competence in Mathematics. Girls were perceived to be less competent in Mathematics than boys by the girls themselves and also by their parents. This difference was seen in their achievement too.

According to Rose S.A., (1992), women students of higher abilities at the women's college displayed more favourable attitude towards success in Mathematics than the women students of higher abilities in the co-educational college. This suggests that educational environment of women's college might have an impact favourably on certain mathematics attitudes and on the course taking behaviour of women with higher mathematics aptitude.

On studying the students' interests in mathematics class rooms, Mitchell, M.T., (1992), distinguished between personal interests and situational interests. Personal interests are the interests that the students bring with them to the class room which means that they are the products of previous experiences. Situational interest represents the interest which is sparked due to the class room environmental conditions. This situational interest was found to have a significant association with perceived learning.

On probing the differences in perceptions of school effectiveness at the middle and high school levels, Subbs, James (1995) found that significant differences were noted between middle and high school students for all seven school effectiveness characteristics: safe and orderly environment, positive school climate, high expectations, frequent assessment/monitoring of student achievement, emphasis on basic skills, maximum opportunities for learning and parent/community involvement.
According to Jankoski Elizabeth Wilks (1996), Effective learning occurs through a cooperative effort of the home, school and community. Classroom relationships include not only teacher-student interactions, but teacher-parent and student-student interactions as well. It was found that the majority of parents felt their children were happier and learned more by remaining with the same teachers and peers.

According to Kanu, Isaac Almamy Idrisa (1996), the attitudes of teachers, staff and professionals, safety and security, classroom and school interaction, friendships, the family background of students, parents' interest in their children's education and home-school relations are independent factors which contribute to effective learning.

A longitudinal study over a period of 8 years to identify the influence of the home learning environment on the school success of five migrant Latina students was done by Chase, Loretta A. Diaz (1997). It was reported that not only the support of their parents, but the support and encouragement of school counsellors, teachers, and peers were instrumental in their successful schooling.

2:4:02 Indian Studies

The results of the study of Varma, R.P.S., (1977) on the effect of teacher's classroom behaviour on the learning ability of the students reported that there was significant relationship between classroom climate and pupils' academic achievement. The prevailing classroom climate in privately managed schools was better than in the Government schools.
In the investigation made by Desai, S.D., (1979), the following conclusions were reached.

i) The level of students' perception of the class room is positively related to their motivation and their academic achievement.

ii) Students' socio-economic status has not influenced their academic achievement.

iii) Boys are higher than girls in the level of class room climate, pupils' academic motivation and pupils' academic achievement.

iv) Boy's schools have higher mean scores of class room climate, pupils' motivation and academic achievement than mixed and girls' schools.

Attempts have been made by Salunke, R.D., (1979) to study the effect of certain variables on the academic achievement of the students with 693 students of the first year in four faculties (Science, Commerce, Arts and home Science) of the M.S. University of Baroda. The following were the important findings:

i) The academic achievement of the students was significantly and positively related to the home environment.

ii) Educational climate and environment climate were related with academic achievement.
iii) Students of the four faculties significantly differed in their perceptions of the home environment and socio-economic status.

iv) There was significant difference between boys and girls in their perception of the home environment, but not in respect to their socio-economic status.

The research work by Rani, B., (1981) found evidence to suggest that there was a significant and positive relationship between the students' academic achievement and their perceptions of their institutional characteristics, revealing the relationship between academic achievement and school environment.

Reddy, C.A., (1981) selected 1080 teachers and 1607 students from 103 schools of Telengana area in Andra Pradesh by using stratified random sampling technique to study the effect of organisational climate. It was reported that academic achievement significantly associated with the types of organisational climate of schools. Further, a positive correlation was found between students' socio-economic status and their academic achievement.

On probing the effect of students' perceptions of their home and school environments on their scientific creativity, Mishra, K.S.S., (1982) found a significant relationship between perceived home and school environments and their creativity. There was significant difference between boys and girls in respect of their perceptions of these environments.
The brief review of literature throws light on the fact that achievement in Mathematics is greatly influenced by learning environment. However, most of the studies have investigated learning environment in terms of classroom climate as well as home environment. It is very rare to find research studies on the combined home and school learning environment on academic achievement and that too in Mathematics.

2.5 STUDIES RELATED TO ACHIEVEMENT IN MATHEMATICS

2.5.01 Foreign Studies

Helen (1983) studied the differences between field dependent / field independent cognitive styles of low and high achieving mathematics students. The results showed that the low achieving students were more field dependent than high achieving students; female students in traditional schools were more field dependent than male students.

The results of the study of Roherge and Flexer (1983) showed that field independent students scored higher than field dependent students on the total mathematics concepts and problem solving tests.

Sanchez, Lori Ann Willis (1994) studied the influence of achievement motivation and prior mathematics achievement on locus of control and mathematics performance. She inferred that achievement motivation significantly influenced mathematics performance.

On studying the effect of single - sex mathematics classes on achievement and attitude for eighth grade students, Wear, Stella Brown
(1997) suggested that placing students in single sex classes did not result in an increased level of mathematics achievement that was statistically different than the students who remained in mixed classes. Girls in all the girls' classes were more positive at the beginning than at the end of the project as compared to girls in mixed classes; but it was not statistically significant.

Allan, Bradfor D Drake (1997) studied the influence of emotion on problem-solving in Mathematics among undergraduate students. He concluded that emotions may be more differentiated because psychological responses are stronger for better problem-solvers. Further, it was found as math interest increased for low achievers, their self-esteem decreased.

On probing the effects of selected teacher background variables on mathematics attitude and achievement, Zuiker, Mark Arthur (1997) inferred that prior mathematics and attitude significantly predicted achievement in Mathematics; location of the school relative to the degree of urbanism showed significant indirect effects on tenth grade mathematics attitude and achievement.

Thomas, John Philip (1997) studied productivity and mathematics achievement and attitudes among African-Americans. He concluded that students' mathematics achievement outcomes were influenced by ten of the fourteen independent variables namely prior mathematics, quantity of instruction, self concept, quality of instruction, peer influence and socio-economic status.
According to Jensem, Judith, A., (1997) who made an attempt to study gender difference in relationship to attitudinal and background factors of high school students' choice of Math-intensive curriculum and careers, High school males showed more positive mathematics attitudes than high school females. Females chose higher mathematics in high school and aspired to math-intensive careers equally well, as compared to males.

Khalid, Mohammed Nasir (1997) investigated factors affecting Mathematics in Malaysian schools and concluded that female students performed significantly in Mathematics achievement. Students from urban schools and urban areas performed significantly better.

On studying the relationship between students' attitude towards Mathematics and achievement in Mathematics, Dlamini, Maxwell Sidumo (1998) found that there was no gender difference in achievement in Mathematics.

2:5:02 Indian Studies

A field study undertaken by Desai, H.G., (1973) on the attitude towards Mathematics of high school students of Saurashtra indicated that no sex difference was found in attitude towards Mathematics. Girls in grade X had a more favourable attitude towards Mathematics than those in grade IX. Urban children, in general, had more favourable attitude towards Mathematics than rural children.
Vaidhya (1979) found out the relationship between cognitive style and achievement of the students. Results of analysis of variance for the total mathematics test score indicated a significant main effect for cognitive style in all grades. The observed significant relationship between field dependence and mathematics achievement suggested the implication for considering cognitive style in the teaching of Mathematics.

Grewal and Kirpal Kaur (1981) made a study on achievement motivation and anxiety as related to academic success in Mathematics. It was suggested that the subjects with low anxiety and high motivation have better academic achievement in Mathematics than any other combination of anxiety and motivation, supporting the theory of achievement motivation put forth by Atkinson (1961).

Patel, N.R., (1984) investigated the mathematical ability of pupils of classes IX and X in the context of some cognitive and affective variables. His findings were:

i) Pupils possessing high reasoning ability were found to be better in mathematical ability than those with low reasoning ability.

ii) Pupils having good space visualization were found to be better in mathematical ability than pupils having poor space visualization.

iii) Pupils possessing a favourable attitude towards Mathematics were found better in mathematical ability than those with less favourable attitude.
iv) Pupils with high anxiety were inferior in mathematical ability as compared to pupils having low anxiety.

In an attempt made by Sabapathy, T. (1986) to study the relationship among manifest anxiety, emotional maturity, social maturity and academic achievement of standard X students, he concluded that emotional maturity was positively and significantly related to achievement in Mathematics and total academic achievement. Girls were higher achievers in Mathematics. Private school students scored higher than Government school students.

From the studies of Doshi, P.C., (1989), it was found that there was an insignificant relationship between cognitive preference styles and achievement in Mathematics.

Chel, Madan Mohan (1990) identified that the major mistakes found in the performance of the students and teacher trainees in the areas include mathematisation of verbal problems, interpretations of mathematical results and learning new topics in Mathematics. Under-achievement was caused due to lack of understanding of the mathematical concepts of the earlier stage and the abstract nature of Mathematics.

The research study of Yadav, R.S., (1990) reported that the factors age, socio-economic status and school environment have significant effect upon concept formation in geometry at the primary level, whereas age had the greatest effect and the school environment had the lowest effect. The socio-economic status occupied the second position. The position was reversed in the case of middle schools.
According to Akpan, Asuquo Asuquo (1991), cognitive abilities exert the strongest and the most significant total effect on students' problem solving ability, mathematical language, home background and problem characteristics variables, in descending order of magnitude, exerts significant total effect on problem solving in Mathematics.

The studies of Ngailiankim, Caroline (1991) revealed that there was significant association between (a) attitude towards Mathematics, (b) educational aspiration, (c) numerical ability, (d) abstract reasoning, (e) personality factor A and (f) personality factor G and achievement in Mathematics.

Rangappa, K.T., (1992) made an investigation into the relationship between self-concept, reading ability and achievement in Mathematics. It was found that there was a significant interaction of self concept, reading ability and location of schools on achievement of students of standard VII in Mathematics.

Research studies of Srinivasan, K.J., (1997) revealed that students' achievement in respect of the two objectives namely 'Knowledge' and 'Understanding' show a tendency of being higher than the average level and the other two objectives namely 'application' and 'skill' show a tendency of being below the average level.

A critical study attempted by Rama, S., (2000) on achievement of secondary class students in Mathematics in Tinneveily educational district reported the following findings.
i) Students of secondary classes whose parental educational status is high show better achievement in Mathematics than others.

ii) Last born students of secondary classes show better achievement in Mathematics than others.

iii) Students of secondary classes studying in progressive classrooms show better achievement in Mathematics than the students studying in non-progressive class rooms.

2.6 CONCLUSION

A brief resume of research studies scanned above reveals that learning style has emerged as a new line of enquiry in research to address the question of individual differences in learning and achievement in Mathematics. The available related literature suggests that students differ in their learning styles, intelligence and learning environment which account for a significant portion of the variation found in pupils' achievement. Learning styles are conceptualized on different frames of reference and all of them have not been simultaneously employed to find the influence on pupils' achievement as well as among themselves. Similarly the combined effect of school and home learning environment on academic achievement has not been studied. The relationships among learning styles, intelligence, learning environment and achievement in Mathematics are yet to be assessed and this has given the way for the research problem to be studied in the present investigation.
CHAPTER III

RESEARCH DESIGN AND METHODS