CHAPTER I

THEORETICAL FRAMEWORK

Education is the key to all processes of development, especially, human development. Catalytic action of education in this complex and dynamic growth process needs to be planned meticulously and executed with great sensibility. Education is fundamental to all round development of human potential – material and spiritual. It refines sensibility and perceptions that contribute to national cohesion, a scientific temperament and independence of mind and spirit. Thus, furthering goal of socialism, secularism and democracy enshrined in our constitution. Education develops manpower for different levels of economy and empowers the poor masses to become self-reliant enough to participate in the process of national development. Education is thus an instrument for developing an economically prosperous society and for ensuring equity and social justice through enriching the knowledge.

In India, an attempt to take a holistic view of the role of education in national development was made in 1986. The National Policy on Education NPE-1986 (Govt of India, 1986) is a landmark in the history of Indian education. The NPE-1986, visualized education as a dynamic, cumulative, life long process providing diversity of learning opportunities.
to all segments of the society. It envisaged improvement and expansion of education in all sectors, elimination of disparities in access and stresses on improvement in the quality and relevance of education at all levels. The NPE-1986 also emphasized that education must play a positive and interventionist role in correcting social and regional imbalances in empowering women.

Science education is a part of education which makes a man rational, develops his independent thinking and helps in removing the superstitions, prevalent in the society in various forms. In view of the modern developments in Science and its importance in today’s world, Science education and scientific outlook have assumed a significant place. Don-Phillips (1973) stated that science education or indeed all education, must develop in students both an awareness of the problems facing the society and the capacity to contribute toward their solution.

Science has become a substantial and integral part of organised society. There is a close interaction between science and the economic, social, political and educational systems of the society. Never before in the history of mankind has society been so dependent upon scientific knowledge as it is today. We need specially trained personnel to maintain scientific projects and scientifically literate citizens to understand and support the growth of science. In this context, education at school stage is
crucial because students need proper understanding of their environment and the role of science in society. The continuity of science education requires the active participation of trained teachers as well as the full support of the parents.

There is hardly any need to justify the place of science in a scheme of general education for school children. The objectives of science teaching at secondary level, as spelt out by the National Council of Educational Research and Training (NCERT) in 1988 and the national curriculum Frame work published by it in 2005, clearly reveal that the basic purpose of science education at secondary level is to make children understand the nature of science, its processes, methods and scope so that they can use scientific method to solve their problems and develop a scientific attitude. Another important objective of teaching school science is to provide a sound foundation for those seeking to continue the study of science at higher level.

It is said that Science Education in the schools should make a revolution in attitudes and interest of children. In the words of Irawin L. Ramsay (1968) “we are living in a world of change and challenge – a world filled with shocking and awe inspiring discoveries as well as world filled with crumbling of moral rot and decay.” Such a time with its fast
tempo has many implications for science education, unimagined hither to especially for a developing country like India.

Education systems worldwide are trying to build a scientific temper in children and scientific literacy in society. The attitude of Indian students towards science is changing because of a feeling that science can solve our national problems of over population, mass illiteracy, abysmal ignorance, backwardness and low-standards of living. Science is all pervasive. Modern societies exist on the basis of science. Science is intimately related to the means of production, communication and transportation. Even economics and politics have to depend on scientific factors such as productivity from land or from industry. The power of modern weapons of the speed of transportation on land, air and water. In the present situation, therefore, everyone in every walk of life must know of certain quantum of science and technology. The fact of today may not be a fact of tomorrow and theories may also undergo changes but there can be no going away from the scientific method.

In this context the role of science is of utmost importance. Science education must become an integral part of school education, and ultimately, some study of science should become a part of all courses in the humanities and social sciences at all stages from school to the
university stage. The quality of science teaching is also to be raised considerably.

1.1 Teaching of Science in India: Historical Perspective

1.1.1 The Harappan Culture:

The history of science and technology in India begins with the Indus Valley Civilisation which is often referred to as the Harappan Culture. The Harappan Culture had established commercial inks with the neighbouring cultures in the central and western Asian regions, including Mesopotamia. The overall picture of this period appears to be that it had a farm economy having a reasonable agricultural surplus. The life was enriched by many a craft and industry.

1.1.2 Science and Technology in Medieval Period:

From about the twelfth century to the end of the eighteenth century AD, science and technology in India was impacted by the Islamic and the European influences. Though some technological practices underwent perceptible changes and new developments took place in fields such as paper, gunpowder, enameling, glass and metalworking, the Indian scientists chose to move in the previously determined grooves and were unable to develop new methods and attitude conducive to the development of modern science.
1.1.3 Birth of Modern Science in India:

The nineteenth century was the great dividing line. These hundred years changed the face of India far more than did the preceding thousand years. One of the main causes for this development was the introduction of English education. The British started scientific activities in India in several areas and established the first three universities in Calcutta, Bombay and Madras. Thus foundation was laid for the introduction of science education in English medium in India which helped the Indian scientists to have access to the scientific knowledge available in Western countries.

The last quarter of the nineteenth century witnessed eminent personalities like Mahendra Lal Sircar, Asutosh Mookerjee, Jagdish Chandra Bose, and Prafulla Chandra Ray, who were instrumental in heralding Western science teaching and research into India. In 1876, Mahendra Lal Sircar founded the Indian Association for the Cultivation of Science on the model of the Royal Institution of London. During the first thirty years it functioned more or less as a science college, but in the early part of the twentieth century it developed into a research instituting young students from all over India including C.V. Raman and K.S. Krishnan. Asutosh Mookerjee played a pioneering role in converting universities into institutions of higher learning and original research.
Prafulla Chandra Ray built up a centre for active chemical research in the Presidency College and later University College of Science, Calcutta. In 1990 he started the Bengal Chemical and Pharmaceutical Works, which was a pioneering and pace-setting organization in the field of indigenous chemical and pharmaceutical industries.

1.1.4 Scientific Developments after Independence:

Jawaharlal Nehru, the first Prime Minister of India, established the basic framework for science and technology in India. He recognized the unique role of science and technology for national development at an early stage of his regime. He gave a free hand to men of science and vision (Bhabha, Bhatnagar and Sarabhai) who set about organizing science in a big way by establishing major national institutes and research laboratories outside the university system. While Homi J. Bhabha launched a major atomic energy programme in the country and land firm foundation of a rapid growth of nuclear science and technology, Shanti Swarup Bhatnagar’s strategy was to establish a chain of national laboratories dealing with disciplines of physical sciences, with emphasis on research and development. The huge space research network that is witnessed in the country today may be traced to the vision of Vikram Sarabhai.
The twentieth century has been the most rewarding in terms of developments in science as well as in technology. The century began with the epoch-making arrival of the quantum mechanics which subsequently influenced practically every major advancement in science and technology. Gradually, the understanding of the world in terms of physics, chemistry and mathematics gave way to the new understanding of the universe. This was augmented by the discovery of relativity and general relativity. Newer perceptions of the structure of matter and its relationship to the larger universe were better understood in this century. From astronomy, the shift to astrophysics was initiated by none other than Prof. M.N. Saha.

In India, recommendations that science be made a compulsory subject for all children up to Class X was made in the mid-fifties. However, it was only in 1968 Policy on Education which accepted the Kothari Commission’s recommendations that science and mathematics be made compulsory subjects in the first ten years of school both for boys and girls. This was reconfirmed in the National Policy on Education 1986. Needless to say that the merit of these recommendations has universal acceptability as these are based upon sound logic and rationale. In subsequent years, during the implementation of the recommendations on science and mathematics in schools, several critical areas have been
identified which require inputs in terms of content, its relationship to other disciplines, transaction strategies and the level and extent of interest, activity and utility as perceived by the learners. Globally the focus has also shifted from science education to science and technology education and the global focus at present is on scientific and technological literacy which can be well understood in the context of initiative to universalize elementary education for all. The NCERT has been the key player in all aspects of science education in schools. Its first major attempt was made in 1975 when it published the curriculum framework for the first ten years of schooling. This was built up around the recommendations of the Kothari Commission. Science is the most potential vehicle for inculcating and nurturing the creative talent of every single individual, irrespective of all other differences and diversities. In the ageing society, utilization of leisure could also become a major issue. Leisure is no gift but a load which is tiresome, burdensome and cumbersome to the individual. Science education provides a vast potential for inculcation of values, particularly the values enshrined in the Constitution of the country concerned. Science has responded to human concerns in several areas like medicine and agriculture. The technological developments have reduced drudgery for a considerable sector of the population. In future, however, the side effects of the developments and
developmental activities which alienate human society from nature will have to be seriously responded to. Every individual will require training and preparedness in areas like disaster management. Need based knowledge would be valued by the society and the community.

1.2 Factors Affecting Achievement in Science

Academic achievement has always been given much importance since the origin of formal system of education. In today’s competitive world, it is given more importance than ever before. Academic achievement not only facilitates the process of role allocation for the social system but opens out avenues for advancement. Perhaps it is a ladder through which a child of today can reach his destination. It is a root for future development. Success in school, therefore, has often been shown to be predictive of success in further education, career, and personal fulfillment. Obviously in the school, great emphasis is placed on academic achievement right from the beginning of formal education. Inspite of considerable efforts, achievement of students is not satisfactory. A great difference of performance is found among students. Few students in a group are found to be high achievers on one hand, and a few are low achievers, while a sizable number of students always appear as moderate achievers. The question which arises now is, why such a difference in academic achievement appears when school provides more
or less uniform instruction? Is this difference due to certain inherent qualities? Can this difference be attributed to psychological factors or to social factors? Or this differences depends upon all the factors mentioned above. Search for an answer to these questions has made academic achievement a popular area of educational research.

1.2.1 Intelligence and Achievement in Science

There have been innumerable research studies on the relationship between intelligence and achievement, especially during the later half of the 20\textsuperscript{th} century. However, the present investigator has reviewed only the most relevant ones. Pupil’s intelligence is probably one of the earliest factors which, besides teaching, was found to cause variations in achievement. As a matter of fact, such was the degree of faith among some research workers that they ascribed variations in achievement to intelligence alone.

Although Intelligence is defined in many different ways, most of the definitions fall into one or more of the following categories: (i) capacity to learn (2) capacity to perform intellectual tasks (3) capacity to think abstractly, and (4) capacity to make adequate adjustments to new experiences.
A more recent definition of intelligence has been offered by Stoddard: “Intelligence is the ability to undertake activities that are characterized by (1) difficulty (2) complexity (3) abstraction (4) economy (5) adaptiveness to a goal (6) social value and (7) the emergence of originals, and to maintain such activities under conditions that demand a concentration of energy and a resistance to emotional forces.” Most of the studies related to intelligence and achievement have correlated I.Q. scores and scores on some achievement test. In certain studies, teacher’s ratings or marks obtained in public examinations were used as measures of academic performance.

**Kulshrestha, S.K. (1956)** Studied the relationship of Intelligence and Scholastic Attainments of X and XI Class Students in Uttar Pradesh with a view to (a) measuring the intelligence and the effect of rural and urban origin on it; (b) finding out the possible relationship existing between intelligence and scholastic attainments of students in different subjects; and (c) finding the factors responsible for the relationships and finding the significance of differences between the students offering literature and science groups of study and the study reveals that (i) in all the three tests the science group proved to be superior to the literature group in each class; (ii) the intellectual maturity of students in the intermediate science was far superior to the intermediate literature group;
(iii) in comparison to the intermediate literature group, the students in the high school offering science group occupied a superior position; (iv) the correlations of the intelligence test scores with the subject marks were comparatively smaller than the inter-correlations amongst the scores of subjects themselves—most of the correlation coefficients between intelligence test scores and subjects marks were too small to have any predictive value.

**Baker, Schutz & Hinze (1961)** tested the hypothesis that the academic achievement of pupils with “average” and “high” mental ability does not differ significantly when socioeconomic status is controlled. Ss were assigned to a “high” or an “average” mental ability group. Socioeconomic status was controlled in analyses of covariance involving even achievement criterion variables. For each criterion, evidence was obtained to reject the hypothesis at the .01 level. The two mental ability groups differed significantly on all achievement criteria even after adjustments were made for individual differences in socioeconomic stated. **McCandless, Roberts and Sternes (1972)** conducted a study on intelligence in relation to scholastic achievement – using the California Test of Mental Maturity for obtaining intelligence scores. The correlation coefficient between intelligence and academic achievement including
reading, language, arithmetic social studies and science was found to be as high as 0.56.

**Rastogi, K.G. (1964)** conducted a study into the Relation between Intelligence, Interest and Achievement of the High School Students with a view to studying the relationship between intelligence, interest and achievement in English and science of high school students.

Results revealed that: (i) the reliability coefficients calculated by split-half and test-retest methods for the test of interest in English were found to vary from 0.66 to 0.80, whereas in case of the test of interest in science, they varied from 0.68 to 0.82; (ii) validity indices for the first test ranged from 0.60 to 0.69, whereas in case of the latter, they varied from 0.66 to 0.70; (iii) the relationship between interest and achievement in English (r=0.50) and that between interest and achievement in science (r=0.37) in the present study were not found to be so high that interest could be said to be the major predictor of achievement; (iv) the relationship between intelligence and interest in English and that between intelligence and achievement in science were found to be significantly positive; (v) interest and intelligence were found, more or less, equally correlated with achievement in English and with that in science; (vi) interest and intelligence were found to be related more with achievement than between each other; (vii) the relationship of intelligence with
achievement in English and that of intelligence and achievement in science were found nearly to be the same; and (viii) a combination of intelligence and interest was a better predictor of achievement in English and in science than either interest or intelligence alone.

Srinivasan, R. (1969) made a comparative study of Language Abilities and Scholastic Achievement of Secondary School Children belonging to certain Social Class Categories. The main aim was to study the process by which a given social climate becomes part of the experience of the individual and the way it influences his school education. The major hypotheses tested were: (i) children coming from professional group will be found superior to the children coming from, urban labour class and rural artisan peasant group; (ii) the conditions of home environment of different categories will exhibit differences in favour in the middle class on certain variables related to school performance; (iii) variations in the levels of intelligence will be found along the same line; and (iv) the indices showing language abilities and scholastic achievement will be positively correlated. The sample representing the three categories was drawn from classes VIII and IX of twelve high schools in Madras City as well as in the rural areas. The major findings of the study were as follows: (i) Eighty five percent of the fathers of professional group had education above the high school level,
whereas about sixty percent of the other two categories had no education. (ii) The parents of middle class children took more interest in education of their children than the other two classes. (iii) Children of the middle class had a decidedly favourable home environment. (iv) Children of urban professional sample performed better on the Raven’s Progressive Matrices than the other two groups; the difference was significant at .01 level (v) Children of middle class family got better scores in the language ability test than the other two classes and the difference was significant at .01 level. (vi) The difference between the urban and the rural lower class boys in the test score was negligible, but urban girls were found to be superior to the rural girls. (Vii) the marks secured by middle class students were found to be higher than those of the lower class pupils in both the samples. (viii) scores on language ability test and scholastic achievement were found to have a co-efficient of correlation of 0.65.

Jha, V. (1970) studied some factors related to achievement in science at secondary schools to examine the nature of relationship between intelligence, science aptitude, adjustment, anxiety, extraversion, study habits, and socio-economic status on one hand and achievement in science on the other. Hypotheses tested in the study were: (i) there exists a substantial positive relationship between achievement in science and each of the factors, viz., general intelligence, scientific aptitude,
adjustment, study habits, and socio-economic status; and (ii) there exists a substantial negative relationship between achievement in science and anxiety and extraversion. The study led to the conclusion that: (i) there was a significant positive relationship between achievement in science and (a) general intelligence, (b) scientific aptitude and (c) adjustment; (ii) there was a significant negative relationship between achievement in science and anxiety in the case of boys and combined samples, but not so in the case of girls; (iii) there was no relationship between achievement in science and extraversion; (iv) there was a significant positive relationship between achievement in science and study habits in the case of boys and combined samples, but not so in the case of girls; and (v) there was no relationship between achievement in science and socio-economic status.

Chatterji & Mukherji (1974) attempted to predict achievement scores from the knowledge of the Differential Aptitude Test Battery scores. Highly significant relationship was found between the aptitude scores and the total marks of the subject. Glossop, Appleyard and Roberts (1979) studied achievement in relation to general intelligence. The results showed a positive linear relationship between intelligence and achievement scores. The correlation coefficient of intelligence with mathematical ability was found to be 0.805 and with reading ability 0.815.
Crano, Messe and Rice (1979) conducted a study on the predictive validity of mental ability for classrooms performance. The investigation based on correlations between the two abilities yielded a ‘strong predictive relationship’ between mental ability scores and academic achievement the correlation coefficients ranging from 0.747 to 0.505.

Roberge and Flexer (1981) conducted a study on the relationship between intelligence and academic achievement. High positive correlations were obtained between mental ability on the one hand and reading, mathematical concepts and mathematical problems solving on the other.

Yule, Lansdown and Urbanowicz (1982) carried out a study on prediction of educational attainment through intelligence. The results showed very high relationship between intelligence scores and achievement scores, the coefficient with different aspects of reading ability and Mathematics ranging from 0.457 to 0.911.

Chopra (1982) made a study of some non-intellectual correlates of academic achievement at high school level. The study was designed to find out the relative importance of intelligence and various non-intellectual variables in determining academic achievement. The major findings of the study were (i) socioeconomic background was a very
important determinant for contribution of education. Significantly a larger number of students from the lower socioeconomic classes failed in the X exam. and significantly a larger number of I class students belonged to higher socioeconomic classes. Parents from higher socioeconomic classes gave greater help and encouragement to their children for studies. (ii) Study habits were positively related to academic achievement. (iii) Students from higher socioeconomic classes had higher educational and occupational aspirations. (iv) A larger number of students from higher socioeconomic classes did some planning for a future career in life. (v) Home adjustment was more closely related to academic achievement than emotional health and social adjustment. (vi) Attitude towards education had very high positive correlation with academic achievement. (vii) As regards relative importance of difference variables, the coefficient of multiple correlation between academic achievement and intelligence, S.E.S., study habits, home adjustment, health adjustment, social adjustment, emotional adjustment and attitude towards education was 0.874. The coefficient of multiple determination was 0.764. To determine the importance of different variables for the prediction of academic achievement. Beta coefficient were calculated and the variables in order of magnitude of the coefficient were attitude towards education, S.E.S., intelligence, study habits, home adjustment and social adjustment. Health
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and emotional adjustment did not appear to add to predictive value when these variables were taken together.

Mehna (1986) did an investigation into some factors affecting academic achievement in science of standard IX students of Greater Bombay. The major findings of the study were: Six variables, viz. verbal intelligence, motivation for learning general science, scientific knowledge and aptitude, numerical ability, liking for teachers of science and interest in medicine were significant predictors of achievement of class IX students in general science. The significant predictor variables for boys were scientific knowledge and aptitudes motivation for general science, verbal intelligence, interest in commerce, numerical ability and liking for science teachers. The significant predictors of achievement in general science for girls were verbal intelligence, motivation for general science, scientific knowledge and aptitude, liking for teachers of general science and numerical ability.

Deshpande (1986) studied the interactive effects of intelligence and socioeconomic status of students and homework on the achievement of students. The findings were: 1. Students, parents, teachers, girl students and students of middle and upper socioeconomic status had a more favourable attitude towards homework. 2. No significant differences in their attitudes towards homework were found when teachers were
classified under the four variables of marital status, sex, age and teaching experience. 3. Parents with an only child had significantly less favourable attitude towards home work than parents with two or more children. 4. The amount of homework and delay in evaluation of homework were not significantly related to achievement of students. 5. Intelligence was significantly related to achievement at the 10 percent level. 6. Intelligence was significantly related to achievement at the 1 percent level. 7. The trend of the relationship between homework and achievement indicated that students who were given homework performed better.

Nabi Ahamad and others (2005) conducted a study with the purpose to analyse the independent and interactive effects of variables viz. sex, socio-economic status (SES) and intelligence on attitude towards science (ATS) of secondary school students. The study revealed (i) males and females enjoy the same degree of ATS (ii) the students of higher SES show more positive ATS than the middle and lower counter parts (iii) the students who are from high and middle levels of intelligence enjoy significantly greater ATS than the lower ones. Moreover, the students of middle level of intelligence show significantly better ATS than the lower one.

Sergej Flere, Marina Tavcar Krajnc, Rudi Klanjsek, Bojan Musil, Andrej Kirbis (2010) concluded that cultural capital, originally a
general sociological concept, has been transformed into a construct that is often applied in predicting scholastic attainment. Intellectual ability (IQ) has also been proven to be a strong, although basically psychological, predictor of educational attainment. However, these strands of research have hardly been contrasted in terms of their predictive power and in terms of their potential interaction. In the current study of Slovenian secondary school students, the results indicated that both constructs had statistically significant predictive power, both as to attainment and as to transition into type of secondary education. Results also indicated that: both constructs were fairly robust, as their predictive power remained statistically significant even after control variables were entered into the model; and they operated independently as results indicated no interaction between these constructs. The ‘return’ on cultural capital was greater for students whose parents had lower educational status.

The studies discussed above stand testimony to the fact that the factor of intelligence is very closely associated with academic achievement and as such a very reliable predictor of school performance. But at the same time it also becomes quite evident from the results that the relationship between the two is not perfect.
1.2.2 Attitude towards science and achievement in science

Attitude plays a very dominant part in determining human behaviour. There is good evidence that one consists of good and bad acceptable and unacceptable, what is to be agreed or disagreed with attitude or correlated with behaviour. It is found that a person with favourable attitude towards the subject knows or atleast tries to know more about it. He will assert himself more which will help him in achieving knowledge and proficiency in that field. On the other hand a person who has got unfavourable attitude towards a particular subject will shun it. According to K.K. Das Gupta “Attitude of the pupil towards a subject has pronounced effect upon the amount of work attempted by them, the efforts expanded and the learning they acquire.”

Allport (1967) according to Allport, attitude towards science refers to the feelings, opinions, beliefs in and about and appreciations which individuals have formed as a result of interacting directly or indirectly with various aspects of the scientific enterprise and which exert a directive influence on their behaviours towards science.

By studying the attitude towards Science subject one can know how a child would reach to the Science subject, consequently how he would be able to benefit from the subject cognitively, affectively and cognitively. The measurement of attitude has become vital part of
educational system. In the words of Rammer “The use of opinion and attitude measurement in education has become very wide spread. It helps all concerned pupils, parents, classroom teachers, guidance personnel and administration within the system.” Science the student of today will be the agent of the development of tomorrow, it will be worthwhile to study their attitude towards science subject.

**Burner (1960)** suggests that attitudes are wholesomely and favourably developed towards the subject matter, toward the field of science and toward the study and inquiry. Schwave (1962) strongly suggests, a need to develop favourable attitudes towards all aspects of Science so as to maintain and support scientific inquiry Klopfer (1964) states that a major objective of Science education should be fostering of whole some attitude towards science, scientific endeavour and scientist. Story and Brown (1979) noted that the development of positive attitudes towards Science is one of the major goals of science education. The development of favourable attitudes toward science and scientists is considered important for two main reasons. First, the attitudes which an individual has influences to a considerable degree his learning of science and his use of the scientific information. Second, the possession of favourable attitudes toward science is an important characteristic of a scientifically literate person. Science teaching, must result in
scientifically literate citizens if it is to be effective to meet the changing demands of society. Several attempts have, therefore, been made to identify students’ attitudes toward science, and to investigate some means by which desirable changes in their attitudes could be induced and fostered. There is vast literature in the journals of psychology, sociology, education and politician science dealing with attitude, some of these articles have had as their concern the comparison of attitudes of members of different groups, others have reported upon the way in which attitude are developed in young children. The interest of some writers has been in the theory and nature of attitudes and in the way in which attitudes are defined. Other have investigated and reported upon the problem of attitude change, the manner in which new experiences modify the existing attitudes. Still others reported upon the relationship between attitudes and other variables such as personality traits and level of intelligence. The influence of attitude upon such psychological process as learning, remembering, perceptions, reasoning and thinking has also been investigated in some details. However, much less attention has been given to the attitudes that pupils have and their achievement in science. This is why measurement of attitude and achievement in science is necessary. Unfortunately in India proper measurement of attitude towards science and achievement in science has not been done by research workers.
few researches only on general population have been done in this area by Sood (1975), Misra and others (1983). Srivastava (1983), Kishore and Aggrawal (1991) and Khatoon (1996).

Hedley (1966) conducted a study on the student’s attitude and achievement in science courses in Monitoba secondary schools (Doctoral Dissertation). He found that there was a positive relationship between achievement science scores and attitudes towards science.

Lowery (1967) studied an experimental investigation into the attitudes of fifth grade students towards science. The result indicted that at the start of the study, girls generally have significantly more positive attitudes towards science than boys.

Ayers & Price (1975) assessed the children’s attitude towards science and reported that there is no major differences in the attitudes of male and female towards science. More than 55% of the students indicated positive or very positive attitudes toward science.

Sood (1977) reported the findings of his study:

(i) The sample reflected positive attitude towards Science.

(ii) Sex difference was not significantly related to attitude towards Science.

(iii) The attitude of students and teachers differed significantly.
Srivastava N.N. (1980) studied “the scientific attitude and its measurement.” He found that the amount of scientific knowledge of general exposure to science course made impact on scientific attitude positively. Scientific knowledge helped in formation of scientific attitude positively. Boys and girls differed in respect of scientific attitude. Male teachers and female teachers did not differ in respect of scientific attitude.

Hough & Piper (1982) have examined “the relationship between attitudes toward science and science achievement of elementary pupils. They used two tools – “Hough pupil process test” – for pupil’s science achievement and ‘Hough Attitude Inventory’ for assessing attitude towards science. It was concluded that there was a significant relationship between the pupil’s residualized gain scores on the Hough Pupil Process Test’ and their residualized gain scores on the “Hough Attitude Inventory” (r = 0.45).

Misra & Others (1983) have taken the sample of 100 scheduled caste students comprising 50 boys and 50 girls of high school science students the results obtained, showed that both boys and girls (scheduled caste) have favourable attitude towards science.

Saxena (1986) investigated students attitudes towards physics in relations to type of school, class & sex. The conclusions of the study were:
(i) The means of scores of different groups reflect, that all groups of students possessed favourable attitude towards physics.

(ii) Independent variables type of school and class were found to have effects on attitudes of students toward physics.

(iii) Independent variable sex was not found to have effect on attitude of students toward physics.

Molly Weinburgh (1993) has conducted a study using meta-analysis covering the literature between 1970 and 1991 to examined gender differences in student attitudes toward science, and correlations between attitudes toward science and achievement in science. Thirty-one effect sizes and seven correlations representing the testing of 6,753 subjects were found in 18 studies. The mean of the unweighted effect sizes was 20 (SD = .50) and the mean of the weighted effect size was .16 (SD .50), indicating that boys have more positive attitudes toward science than girls. The mean correlation between attitude and achievement was .50 for boys and .55 for girls, suggesting that the correlations are comparable. Results of the analysis of gender differences in altitude as a function of science type indicate that boys show a more positive attitude toward science than girls in all types of science. The correlation between altitude and achievement for boys and girls as a function of science type indicates that for biology and physics the correlation is positive for both,
but stronger for girls than for boys. Gender differences and correlations between attitude and achievement by gender as a function of publication date show no pattern. The results for the analysis of gender differences as a function of the selectivity of the sample indicate that general level students reflect a greater positive attitude for boys, whereas the high-performance students indicate a greater positive attitude for girls. The correlation between attitude and achievement as a function of selectivity indicates that in all cases a positive attitude results in higher achievement. This is particularly true for low-performance girls. The implications of these findings are discussed and further research suggested.

Kumar Lalit (1995) conducted a study of attitude towards mathematics among secondary school students in relation to sex. The major findings of the study were as follows:

1. Attitude of male and female towards mathematics was expressed to the same extent on utilitarian value dimension of attitude towards mathematics.

2. Female group expressed more favourable attitude towards mathematics than male groups on social value dimension of attitude towards mathematics.
(3) Attitude of male and female towards mathematics was expressed to the same extent on aesthetic value dimension of attitude towards mathematics.

(4) Attitude of male and female towards mathematics was expressed to the same extent on intellectual value dimension of attitude towards mathematics.

(5) Attitude of male and female towards mathematics was expressed to the same extent.

The following conclusions were drawn by Khatoon (1996) in a study of the minority students attitude and achievement in science.

(1) In general there exists a positive trend of attitude among students of both communities and 86.3% students have favourable attitude towards science.

(2) Application of t-test shows that Hindu students have significantly higher mean attitude score towards science than Muslims.

(3) The mean percentage of marks of Hindu and Muslim mail students shows that both differ significantly in their achievement, i.e. Hindu students have significantly higher mean percentage of marks in science than Muslim students.
Leslie J. Francis, John E. Greer (1999) conducted a study on a total of 1549 pupils between the ages of 13 and 16 years attending 12 Professional and 12 Catholic grammar schools in Northern Ireland completed the Menis scales of attitude toward science. The data demonstrate that although the importance attributed to science is unrelated to sex, age or denominational group, girls, fifth formers and pupils in Catholic schools hold less positive attitudes toward science in the school curriculum and to science as a career than is the case among boys, third formers and pupils in Protestant schools.

Leslie J. Francis, John E. Greer (1999) presented a paper to describes the development of a new measure of attitude towards science for use among secondary school pupils which operationalises the affective attitudinal domain. Item selection, the internal structure and reliability of the scale, content validity and construct validity were established were established on a sample of 2129 pupils in the third, fourth, fifth and lower sixth years of Protestant and Catholic grammar schools in Northern Ireland. Scale norms demonstrate that males record a more positive attitude towards science than females, and that younger pupils record a more positive attitude towards science than older pupils.

Leslie J. Francis, John E. Greer (2001) studied on a sample of 1584 pupils between the ages of 14 and 16 years, attending year 9, year
10 and year 11 classes within Protestant and Catholic grammar schools in Northern Ireland completed indices of attitude towards Christianity, attitude towards science, creationism and scientism. The data demonstrate that the apparent independence of attitude towards science and attitude towards Christianity is transformed into a positive relationship offering taking into account individual differences in scientism and creationism.

Elena C. Papanastasiou and Michalinos Zembylas (2002) examined how pupils’ attitudes towards science and their beliefs about themselves affect their achievements in science, and vice versa. Cyprus provided an interesting location for the study, being a developing nation that has adopted educational ideas from a variety of countries, including the US, UK and Greece. The results of this study demonstrated the differential effects that science achievement and science attitudes can have on each other, depending on the characteristics of the educational systems of the country.

Elena C. Papanastasiou, Michalinos Zembylas (2004) conducted a study for the purpose to investigate the ‘locality’ of the relationship between attitudes towards science, self-beliefs and science achievement for senior high school students in Australia, Cyprus and the USA. These relationships were examined with the use of the structural equation modeling software, AMOS. The data for this study were obtained from
the Third International Mathematics and Science Study database. The results of this study demonstrated the differential effects that science achievement and science attitudes can have on each other, depending on the characteristics of the educational systems within each of country.

**Constantinos Papanastasiou and Elena C. Papanastasiou (2004)** conducted a research to study to investigate the attitudes toward science of 8th-grade students in Australia, Canada, Cyprus, and Korea, based on recent TIMSS data, and suggests a model of family and school influences on their attitudes. The structural equation model contained 3 exogenous constructs – family’s educational background, aspiration, school climate – and 2 endogenous and constructs – teaching and student attitudes toward science. Educational background, aspiration, and school climate were shown to have a direct effect on attitudes, while teaching was shown to directly affect attitudes and to be affected by aspiration and school climate.

**Derek Cheung (2009)** has studied to examine the interaction effect between grade level and gender with respect to students’ attitudes toward chemistry lessons taught in secondary schools. The sample consisted of 954 chemistry students in grades Secondary 4-7 (approximately) 16-19 years of age in Hong Kong. Students’ attitudes were surveyed using an attitude toward chemistry lessons scale (ATCLS), and subscale scores
were produced on four dimensions: liking for chemistry theory lessons; liking for chemistry laboratory work; evaluative beliefs about school chemistry; and behavioral tendencies to learn chemistry. When the ATCLS data were subjected to two-way MANOVA, the interaction effect between grade level and gender on students’ attitudes toward chemistry lessons was statistically significant. The interaction effect was attributable to scores on the theory-lessons subscale and laboratory work subscale. Male students in Secondary 4 and 5 liked chemistry theory lessons more than their female counterparts. However, male students’ liking for chemistry laboratory work declined when they progressed from Secondary 4 to Secondary 7; no such a significant decline in attitude toward chemistry laboratory work was found in females. Overall, both males and females were just marginally positive about chemistry lessons during the years of secondary schooling. Implications of these findings for curriculum design are discussed.

**Amy M. Masnick, S. Stavros Valenti, Brian D. Cox, Christopher J. Osman (2010)** studied the students career in Science, Technology, Engineering and Mathematics (STEM) fields, it is important to gauge students’ implicit and explicit attitudes towards scientific professions. We asked high school and college students to rate the similarity of pairs of occupations, and then used multidimensional scaling
(MDS) to create a spatial representation of occupational similarity. Other students confirmed the emergent MDS map by rating each of the occupations along several dimensions. We found that participants across age and sex considered scientific professions to be less creative and less people-oriented than other popular career choices. We conclude that students may be led away from STEM careers by common misperceptions that science is a difficult, uncreative, and socially isolating pursuit.

1.2.3 Studies pertaining to socio-economic status and achievement in science

Satyanandam (1969) found that (1) The children of graduate parents performed better than that matriculate parents. (2) The children belonging to upper and lower strata differ significantly in their academic achievement. (3) There were no great difference between middle and lower economic groups. (4) Sex had no bearing upon the achievement level.

Chatterji, Mukherji and Banerjee (1971) investigated the effect of some aspects of social class such as income, parents’ education, family size, general conditions of the home, etc. upon the scholastic achievement. The subjects were 230 students, both boys and girls...
studying in classes VI and VII in eight different Bengali – medium schools in Calcutta. The findings of the study were:

(i) The economic conditions of family seemed to have no effect upon the scholastic achievement in all the intellectual ability group. Similarly possession of a study room had no favourable effect in increasing the achievement score in almost all the cases.

(ii) The family size and the number of siblings were inversely related to the scholastic achievement, specially, in the low intellectual level. In some cases, parents’ help had significant positive contribution to higher achievement.

(iii) Parents’ educational level was directly related to the achievement of their children.

(iv) Father’s occupation was not consistently related to children’s achievement.

Satyanandan (1971) in his study found the following results: (i) The children of graduate parents performed far better than the children of matriculate parents. (ii) The children of upper economic strata and lower economic strata deferred very significantly in their achievement. The upper and middle economic groups deferred significantly. (vi) The
middle and the lower economic groups did not differ significantly. However the middle economic group was better than the lower economic group.

**Anand (1973)** studied the effect of socioeconomic environment and medium of instruction on the Mental abilities and the academic achievement of children in Mysore at secondary school level. The analysis revealed the following (i) the F values of score on all the criteria tests were found significant. (ii) three S.E.S. groups differed significantly from one another in their non-verbal and verbal intelligence; (iii) high S.E.S. group achieved higher Mean scores than pupils in both low S.E.S. group and middle S.E.S. group, (iv) whereas the mean score difference between middle and low S.E.S. groups were not significant, (v) the relationship between S.E.S. and academic achievement was found to exist even when the influence of intelligence of non-verbal as well as verbal type was partialled out (vi) the relationship of media of instruction to intelligence was found inconsistent whereas that of S.E. environment remained almost identical; the impact of socioeconomic environment was found to influence mental abilities and academic achievement, (vii) students studying through Kannada medium achieved significantly higher mean score than those studying through English medium.
Dhami (1974) found statistically significant relationship between socioeconomic status and scholastic achievement. But it was not very high.

Ojha (1979) conducted a study on 1050 male students of class XI belonging to both rural and urban intermediate college of Jaunpur Distt. (U.P.). They filled the personal information, which was devised to collect information about the determinants of socioeconomic status. The marks obtained in the high school exam served as the criterion for achievement. The analysis of data revealed a significant positive correlation of 0.34 between achievement and socio-economic status for rural boys and 0.69 for urban boys. The achievement of rural boys was found to be better than urban students. For both rural and urban students the t-test analysis led the investigator to conclude that the higher the SES better would be the academic achievement of students at high school level, parental education occupation and income were also related with educational achievement of both rural and urban boy of class XI.

Khanna (1980) made a study comprising of 1000 students of class VI, VII and VIII (among 30 schools of urban and rural areas). The academic achievement scores of half yearly and annual examination of students were used as the criteria of achievement. The Chi-square and contingency of correlation were used for analyzing the data. Major
findings are – (1) Socioeconomic status was positively and significantly related with academic achievement. (2) The correlation was more consistent in urban areas than rural areas. (3) The academic achievement of rural and urban students was closely related with their guardian’s income. (4) The academic achievement of children of various schools was significantly related with the socioeconomic conditions of their family. (5) The academic achievement of children of educated parents, illiterate persons and educated mothers significantly correlated with the socioeconomic status of the family.

Kulshrestha (1981) conducted a study on 276 students selected on the basis of scores on General Mental Ability Test of Joshi, found that bright, normal and under-achievers in science, mathematics and English differed in their attitude to parents whereas the common students did not. Under-achievement was related to some extent, with economic conditions at home but not with personal health of students. Under-achievement was directly related with the parents cares concerning collecting fees and other facilities for their children.

Chopra (1982) found socioeconomic background as a very important determinant for the continuation of education. Home adjustment was found more closely related to academic achievement.
Shukla (1984) studied achievement of primary school children in relation to their socioeconomic status and family size. The following conclusions were drawn. 1. There were no significant sex and rural – urban differences in the academic achievement of primary school children. 2. S.E.S. was positively and significantly related to academic achievement. 3. At class III level, children belonging to the large family size category had significantly better academic achievement than those of average and small family size categories. 4. At class V level, the positive impact of large family size had been completely nullified. There was a tendency of better achievement among the children belonging to the small family size category. 5. The structure of family, whether joint or unitary, had no significant differential impact on academic achievement. 7. The Adult child ratio of (1:1) had shown significantly greater relationship with academic achievement. Testing a sample of 1000 students or classes VI, VII, VIII (among thirty schools of rural and urban areas), Khanna (1986) found positive and significant relationship between SES and academic achievement. The students’ achievement was related with their socioeconomic status irrespective of whether their home town was a village of city. The correlation was more consistent in urban than in rural areas.
Sachidahanda (1989) undertook an in depth analysis of disparities in elementary education in Bihar states conclusion were:

1. In respect of literacy and elementary education, Bihar is far behind most of the other states in the country.
2. The dropout rate at the elementary stage was heavy and had increased over the years.
3. Until the children completed the first three years of schooling, they tended to relapse into illiteracy.
4. The literacy and enrolment were poorer among SCS and Non-Christian tribals.

The causes were poverty of rural families, lack of teacher’s commitment to their duties lack of effective supervision and rampant corruption in the supervisory care, paucity of women teachers, highly politicized teaching community.

White (1982) studied the relationship between socioeconomic status and academic achievement. Results indicated that as SES is typically defined (income, education, and occupation of household heads) and typically used (individuals as the unit of analysis), SES is only weakly correlated ($r = .22$) with academic achievement with aggregated units of analysis, typically obtained correlations between SES and
academic achievement jump to .73. Finally characteristics, such as home atmosphere, sometimes incorrectly referred to as SES, are substantially correlated with academic achievement when individuals are the unit of analysis (r = .55). Factors such as grade level at which the measurement was taken, type of academic achievement measures, type of SES measures, and the year in which the data were collected are significantly correlated statically with the magnitude of the correlation between academic achievement and SES. Variables considered in the meta analysis accounted for 75% of the variance in observed correlation coefficient in the studies examined.

Ibrahim (1996) studied the relationship between the academic achievement of student in Jordan State Universities and the Socioeconomic Status (SES) of their families. In this study statistically significant negative relationship were found between students GPA and their fathers and mothers income, occupation and education. However, the relationship between parents SES and students GPA were weak and without practical significance.

Caldas and Bankstone (1997) studied the relationship between the socioeconomic status (SES) of peers and individual academic achievement was examined in this study. Regression techniques were used to analyses the data. Peer family social status in particular does have
a significant and substantive independent effect in individual academic achievement, only slightly less than an individual’s own family social status.

**Byrnes and Miller (2007)** propose a new framework that integrates literature on achievement, supports the testing of novel hypotheses, and stresses the importance of examining a large number of factors in the same study. This framework assumes that high achievement is a function of three categories of factors: (a) opportunity factors (e.g. coursework), (b) propensity factors, (e.g., prerequisite skills, motivation), (c) distal factors (e.g., SES). A secondary analysis of the National Longitudinal Educational Study (NELS: 88) using hierarchical regression and structural equation modeling revealed that 58-81% of the variance in achievement was explained by family variables and specific opportunity and propensity factors.

**Margareta Gregurovie, Simona Kuti (2010)** concluded that one’s socio-economic status affects almost every aspect of his/hers life, including education. The main objective of this paper is to determine the relationship between familial socioeconomic status and students’ educational achievement. The paper is based on the OECD – PISA international study carried out in Croatia in 2006 on the sample of 5209 15-year-old students involved in secondary education. Students’ results in
scientific literacy, as well as variables and indices constructed by OECD, were used in analyses. The distributions of selected variables linked to socio-economic status definition, such as parental education, monthly household income, educational expenses and home educational resources are presented, as well as their regional differences. Multiple regression analysis proved the relationship between socioeconomic factors and students’ science test accomplishment. Regression model which includes three indices (Highest International Socioeconomic Index of Occupational Status, Index of home educational resources and Index of cultural possessions) and four variables (average monthly household income, average monthly educational expenses, household book number and highest educational status of parents) explain 23 per cent of the total variance of students’ achievement in scientific literacy. The second regression model with the region of residence additionally contributes to variance explanation by 1 per cent, indicating significant relation between living in specific Croatian region and science achievement. The main conclusion of this paper is that socioeconomic status (along with the region of residence) represents a significant predictor of the educational achievement, and that it is relevant in analyses and interpretations of PISA results, even though Croatia could use an
adaptation of PISA indices in order to trustworthy represent the data. It is advisable to continuously analyse the test results and, besides some general indicators of educational success, such as educational system, teacher qualifications and school infrastructure, also to consider the effect of students’ socioeconomic status.

1.2.4 Types of school and achievement in science

As well as socioeconomic status, research has shown the importance of the type of school a child attends in influencing educational outcomes. While research in the US has found that SES variables continue to influence educational attainment even after controlling for different school types, the school context tends to affect the strength of the relationship between SES and educational outcomes (Portes and MacLeod, 1996).

Similarly, research in Britain shows that schools have an independent effect on students’ attainment (Sparkes, 1999). While there is less data available on this issue in Australia, several studies using the Longitudinal Surveys of Australian Youth have found that students attending private non-Catholic schools were significantly more likely to stay on at school than those attending state schools. Students from independent private schools are more likely to achieve higher end of school scores (Buckingham, 2000a). While school-related factors are
important, there is again an indirect link to SES, as private schools are more likely to have a greater number of students from high SES families, select students with stronger academic abilities and have greater financial resources. The school effect is also likely to operate through variation in the quality and attitudes of teachers (Sparkes, 1999). Teachers at disadvantaged schools, for instance, often hold low expectations of their students, which compound the low expectations students and their parents may also hold (Ruge, 1998).

Reeta (1986) conducted a study to compare private and government schools on matriculation result of 1985. A correlation statistics was also worked out to find out the mean scores on mathematics and sciences (in both private and government settings). The results show that the pass percentage government students were 45.8 as compared to the 87.5 percent of the boys belonging to private institutions.

1. The pass percentage of government girls was 44.8 and that of 81.8 in case of private girls.

2. The highest marks percentage was 81 in case of private schools and only 76 in case of government school.

3. The private institution got 7 positions with an average of 80 percent marks as compared to position from government schools with an average of 78 percent marks.
4. The number of first divisioners from private sector was more than govt. sector. It was 263 in private schools and only 48 in govt. schools.

5. The number of students failed in math and science was more in case of govt. schools than private schools.

On the whole of was found that: The boys have done significantly better than girls (the level of significance .01).

1. Private schools boys have performed significantly better than government school boys (the level of significance .01).

2. Similarly private school girls have done significantly better than government school girls.

Murthy and Kulshrestha (1991) tried to study whether academic anxiety facilitates or impedes academic achievement in two management system viz. private and public school. A sample of 199 class IX students comprising boys and girls (100 boys and 99 girls) were taken form Government and public school of South Delhi. The academic anxiety scale of Sinha was used as a tool to collect the data. The collected data were analysed statistically using mean, standard deviation, correlation coefficient, one way ANOVA and for post hoc comparison, Duncan’s Multiple Range Tests. Major findings of the study are as under: Academic anxiety and academic achievement are inversely and
significantly related. It means, as the academic anxiety increases, the achievement level decreases.

1. That the mean difference of boys and girls of government and private schools differed significantly on their academic achievement. The private boys have achieved far better followed by private girls. Govt. boys and girls while as, on the whole boys and girls do not differ significantly in academic achievement.

2. It has been found that government and private school students differ significantly (level of significance .01) in academic achievement and this difference is in favour of private school students.

White (1992) conducted a study to examine the effect of type of schools on achievement in vocabulary and mathematics. The Major results of the study are as under: Once public and private schools are statistically equated they appear be produce similar gain in achievement. (i) ON average catholic school students, slightly scored higher in vocabulary and mathematics test then public school students. (ii) Student background characterized like SES largely influence the educational gains. (iii) That the difference in achievement in public and private school are trivial in size and highly uncertain.
Theoretical Framework

**Sajitha (1994)** investigated as whether the greater managerial discretion associated with the private sector leads to high academic performance in Tamil Nadu. A multi grade sampling design was used, yielding on analytic sample of 2667 pupils in 113 schools (65 public school, 20 private aided schools and 20 unaided private schools) located in five districts of state. Major findings of the study are: (i) Neither the father’s education nor mother’s education seems to affect student performance. (ii) Aided schools exert a strongly positive effect on mathematics achievement but the effects for reading comprehension are mixed. (iii) The class-teacher ratio has a positive effect on mathematics achievement. (iv) Pupils in school with physical facilities score higher. (v) Private unaided schools performed worse than public schools. (vi) Other important results included the fact that longer teacher experience seems to produce a negative effect.

**Geeta (1994)** in her study found that in Uttar Pradesh, private unaided junior school were significantly more cost-effective than either government or private aided junior schools. Surveying grade 8th students in 30 secondary schools in Lucknow in 1991 and controlling for student background characteristics and selection effects, it was found that students in private unaided junior schools performed significantly better on tests of reading and mathematics then students in government and
private aided schools.


**Singh and Saxena (1995)** attempted to study the effects of school related variables on pupil achievement using the Baseline Assessment Studies (BAS) data in eight states. Main Results: The results show that there are large and statistically significant differences between boys and girls within school in their achievement in mathematics in states of Assam, Haryana, Karnataka, Madhya Pradesh and Orissa. These differences also found statistically significant in language achievement for all states except Haryana and Kerala.

i) At the school level the mean SES is positively associated with the achievement in mathematics and language after adjusting for pupil’s background.
ii) Mother and Father’s education and father’s occupation have positive association with pupil achievement and are mostly consistent across states.

The factors of educational and physical facilities in school have positive association with school mean achievement in mathematics.

David Newhouse and Kathleen Beegle (2010) used Indonesian data, to evaluates the impact of school type on the academic achievement of junior secondary school students (grades 7-9). Public school graduates, after controlling for a wide variety of characteristics, score 0.17 to 0.3 standard deviations higher on the national exit exam than their privately schooled peers. This finding is robust to OLS, fixed effects, and instrumental variable estimation strategies. Students attending Muslim private schools, including Madrassahs, fare no worse on average than students attending secular private schools. Our results provide indirect evidence that higher-quality inputs at public junior secondary schools promote higher test scores.

1.2.5 Medium of instruction and achievement in science

The objectives of the study were (i) to compare the science achievement, science interest and mental health status of secondary school pupils in the English medium and Malayalam medium classes, and (ii) to determine the relationship between the medium of instruction and science achievement, science interest and mental health for the total sample and sub-samples. The main hypothesis was that the pupils studying in the English and Malayalam medium classes differed significantly in their science achievement, science interest and mental health status.

The main findings of the study were: 1. Science achievement, science interest and mental health status of pupils of English medium classes were higher than those of pupils of Malayalam medium classes. 2. Science achievement, science interest and mental health status of pupils of English medium classes were higher than those of pupils of Malayalam medium classes for sub-samples equated on the basis of intelligence, interest and mental health status. 3. For sub-samples equated on the basis of high socio-economic status and high mental status, Patil, S.P. (1999), found that English medium school in Bhubaneshwar city had very good infrastructural facilities like building, qualified teaching staff, furniture, playground, laboratory, library, sports equipments, computer and school but which were not available in most of
the state managed schools. Talent and economic status were two main considerations for selection and admission in English medium schools.

**Begum T.S. and Phokan M. (2000)** conducted a study in English Medium Schools at Jorhat district following the syllabus of Board of Secondary Education, Assam. The sample consisted of 180 students of class IX. Out of which 118 were male and 62 were female. Total annual marks obtained by the students in the last annual examinations were considered as their academic achievement records. A questionnaire on socio-economic status was prepared. Results revealed that type of the family, number of siblings, education of the parents and family income had significant impact on academic achievement of students.

**Shek Kam Tse, Ka Yee Elizabeth Loh, Yu Hong Raymond Lam, Wail Ip Joseph Lam (2010)** studied the Hong Kong children’s comprehension of Chinese and English text is of concern to parents and teachers since school leavers need to be proficient readers both of Chinese and English. Although Chinese has been officially designated the medium of instruction in most secondary schools, many parents want their children to be taught in English-medium schools for, although Hong Kong is now a Chinese region, being literate in English is still highly prized by the public. A comparison was made of the bilingual reading attainment of Hong Kong primary students, using instruments and
procedures used in the 2001 Progress in International Reading Literacy Study. The average standard of reading English was below the international average, and only 70% of the average standard of reading in Chinese. Only 7% of students read English as well as age-related peers in English-speaking countries. Whereas this minority can be taught via English to no academic detriment, most students understand text much less well in English than in Chinese. The best readers were good both in English and Chinese, the poor readers being particularly weak readers of English. Being taught via English enhanced students’ general English reading ability, and being taught in Cantonese enhanced their Chinese reading ability.

1.2.6 Studies related to gender differences and achievement in science

Linn C. Marcia (1989) investigate that male have greater access to science and technical fields and greater earning power than females. Many argue that cognitive and psychosocial gender differences explain these career differences. In contrast evidence from meta analysis and process, analysis indicate that (a) gender differences on cognitive and psychosocial tasks are small and declining, (b) gender differences are not general but specific to cultural and situational contexts, (c) gender differences in cognitive processes often reflect gender differences in
course enrolment and training, and (d) gender differences in height, physical strength, career access and earning power are much larger and more stable than gender differences on cognitive and psychosocial tasks. These trends imply that small gender differences in cognitive and psychological domains be deemphasized and instead that learning and earning environments be redesigned to promote gender equity.

**Manning, M. Lee (1998)** has reviewed literature concerning the gender differences in mathematics and science achievement and reveals certain stereotypes perpetuated by society, school and family. The ‘Mathematics Report Card for the Nation and the states’ by the National Assessment of Educational Progress and ‘Everybody Counts: A Report to the Nation on the Future of Mathematics Education’ report on the results of gender differences surveys conducted on male and female elementary students. Males were found to show higher motivation levels than females who were stereotyped as not having mathematical skills.

**Pinchas Tamir (1998)** Study a representative sample of Israel 12th grade students (N=2153) responded to a series of questionnaires and achievement tests in the last term of the academic years 1983 or 1984. The sample consisted of four groups, three of which specializing each in one of the science (biology, chemistry and physics) and one comprised of students who did not study any science in their junior and senior years.
The purpose of this paper was to report on gender differences in achievement, attitudes, preferences, learning experiences and study habits. The major findings were as follows:

(1) The percentage of girls in each of the specializing groups are as follows: Biology: 61; chemistry: 49; physics: 31; non-science: 66.
(2) More boys perceive themselves as high achievers in science and math.
(3) Significantly more boys like a study math and science more than other school subjects.
(4) Significantly more boys aspire for science-oriented careers.
(5) Boys achieve better than girls in physics and in earth science, but their achievement in biology and chemistry is similar to that of girls. The achievement of non-science girls is alarmingly low and with the exception of biology much lower than that of boys.
(6) Boys have more positive attitudes toward science and better understanding of the nature of science.
(7) Girls express more positive attitude to school but boys are more interested in science studies.
(8) there are no differences in cognitive preferences.
(9) Girls report on having more inquiry oriented experiences.
More boys aspire for scientific research and engineering careers. Relatively more girls aspire for medical careers.

Isiksal, Mine; Gakiroglu, Erdinc (2008) has conducted a study related to the gender differences in mathematics achievements. The purpose of this study was to explore gender differences in mathematics achievement as demonstrated by performance on the mathematics subsection of a nationwide high school entrance examination in Turkey. In this study, the cities in Turkey were separated into five groups according to their level of economic development. The analysis was based on 2647 students that were randomly selected from these five different groups of cities. Although results indicated a statistically significant difference in mathematics achievement in favor of cities with the highest economic status, the effect size was quite small, which indicates the difference was not practically significant.

Petra Lietz and Dieter Kotte (2002) studied the entry of women into science-related careers remains problematic in the UK and Australia. Although recent initiatives have resulted in increased participation of girls in science-related subjects in schools, there remains a significant gender divide in entry to scientific programmes of study at post-compulsory and university levels. In this study, datasets for 13 years old pupils in Australia and England taken from the Third International Maths
and Science Survey (TIMSS) were used to derive path models that identify factors influencing the extent to which science-related careers were viewed as desirable by Australian and English pupils. Results indicated that, in both countries, attitudes to science were the strongest factor influencing desire for a job in science. While gender was not found to impact on attitudes, the teaching approach adopted influenced the development of pupil attitudes towards science.

1.2.8 Other factors and achievement in science

Hansley, Clementine, Elizabeth Barber (1982) studied the influence of selected social variables on the achievement of Elementary school children in a Textile Mill Community. The data were analyzed through a series of stepwise multiple regression equations and through a discriminant analysis. The findings did not support the hypotheses. The only variable found to be significantly related to achievement were sex and grade. Boys consistently scored lower than girls at every grade level and scores of both boys and girls declined as grade increased.

Sarkar (1983) studied the contribution of some home factors on children’s scholastic achievement. The major findings were: 1. The home variables such as educational environment, income spatial environment, social background, provision of facilities and parent child relationship showed a significant difference between the high achievers and low
achievers at 0.01 level. 2. The child rearing attitude of the mothers of the two groups showed a significant difference between the mothers of the high achievers at 0.01 level, indicating thereby that the mothers of the two groups possessed different attitudes regarding child rearing practices.

Singh (1984) explored the relationship of home environment, need for achievement and academic motivation with academic achievement.

The major findings were: (1) Aggregate marks were significantly and positively related to average marks and self concept of academic ability. (2) Self-Concept of academic ability was significantly and positively related to academic motivation. (3) Need for n-Ach as an operant was not related to any of the respondent’s measures. (4) Sex differences were statistically effective in all the four areas of ‘home environment’. Males had significantly higher mean score on school, economic recreation and home problems. There were sex differences in respect of permissive, loving, protecting and rejecting behaviors in father, whereas girls perceived permissive, loving, neglecting and rejecting behaviours in their mothers. Sex differences were unrelated to self concept of academic ability and need for achievement motivation. 5. School differences were significant in the area of school, economic and home problems of ‘home environment’, restrictive, permissive, loving,
protecting and rejecting behaviours of father; and restrictive behaviour of mother.

**Shukla (1994)** conducted another study to find out the level of attainment of primary school in various states in India. For the entire country the SC/ST pupils performed lower than the non-SC/ST ones. Further, the pupil’s achievement was found to be positively related with father’s education, facility for learning and educational environment at home. The variables related to schools and teachers indicated somewhat weak relationship with achievement.

**Nagaraju, Sumalatha, and Reddy (2002)** they made a study of academic achievement of senior secondary students in relation to certain factors. The sample was consisted of 240 senior secondary students of Tirupati and Chandragiri Mandals of Chittoor distt. In Andhra Pradesh. The students marks in Junior intermediate class were considered as their academic achievement. The study indicated that the performance of girls was better than that of the boys in academic achievement and the performance of urban students was significantly higher than rural students in academic achievement.

**Barry J. Fraser and Jane Butler Kahle (2007)** have conducted a study using secondary analysis of a large database from a Statewide Systemic Initiative, and examined the effects of several types of
environments on student outcomes. Over 3 years, nearly 7,000 students in 392 classes in 200 different schools responded to a questionnaire that assess class, home, and peer environment as well as student attitudes. Students also completed an achievement measure that, developed by scientists, teachers, and science educators, was not aligned with any particular curriculum. Students were enrolled in middle-school science and mathematics classes in schools that had participated in the Statewide Systemic Initiative. Findings confirmed the importance of extending research on classroom learning environments to include the learning environments of the home and the peer group. Although all three environments accounted for statistically significant amounts of unique variance in student attitudes, only the class environment (defined in terms of the frequency of use of standards-based teaching practices) accounted for statistically significant amounts of unique variance in student achievement scores. The findings are supported by other studies of systemic reform in the United States.

1.3 RESEARCH GAPS

Education is universally recognized as the most effective instrument of bringing out change towards the social and economic betterment and cultural transformation of a society. Science has become a substantial integral part of organized society. There is a close interaction
between science and economy, social, political and educational issues of the society. Science is all-pervasive. Modern Societies exist on the basis of science. Science is also powerful means of social change. No doubt modern world has been created by science and maintained by science, yet it is an established fact that science education is not equally popular in every cross section of our society. Particularly, Muslim minority is lagging far behind in science education, as compare to Hindu majority community in India and hurting fact is that gap is increasing day-by-day. Effort to remedy situation has undoubtedly being made by government of India HRD (Human Resource Development) with the cooperation of the NCERT, New Delhi which organized a Programme in science education for the teacher’s of Muslim managed institution in February 1985. This work was especially assigned to A.M.U., Aligarh.

In India, Muslim community account for 13.4 per cent of the population of the country, next only to Hindus (86.6 per cent), majority in numerical strength. This makes it the biggest Muslim minority, and also the second largest Muslim community in the world. The Muslim community of India, as a whole, is an economically and educationally backward section of the Indian people.

In India, equalization of educational opportunity is referred to as the provision of right to education to every citizen on the basis of their
own abilities, interests and attitudes, by which they would be equipped to contribute to the well-being of the community and the country. In view of the modern developments in science and its importance in today’s world, science education and scientific outlook has assumed a significant place. Phillips (1973) states that science education, indeed all education, must develop in students both an awareness of the difficulties facing our society and the capability to contribute toward their solution. Klopfer (1964) states that a major objective of science education should be the fostering of wholesome attitudes towards science, scientific endeavour and scientist. Story and Brown (1979) noted that the development of positive attitudes toward science is one of the major goals of science education. Attitudes towards science refer to the feelings, opinions, beliefs in and about and appreciations which individuals have formed as a result of interacting directly or indirectly with various aspects of scientific enterprise and which exert directive influence on their behaviours towards science (Allport, 1967).

Research in the area of students’ attitudes toward science is very important because these attitudes may have influence on the learning and achievement of the pupils. A large part of the research reported is concerned with curriculum methodology, achievement in science, understanding of science and critical thinking ability, however, much less
attention has been given to the attitudes that pupils have and their achievement in science. This is why measurement of attitude and achievement in science is necessary. Unfortunately, in India proper measurement of attitudes toward science has not been done by research workers. Very few researches only on general population have been done in this area (Sood, 1974; Misra, et al. 1983; Shrivastava, 1983; Kishore & Aggarwal, 1991).

India is a vast country with diverse religious, ethnic, cultural and linguistic communities with differing economic conditions. These differences may indeed affect their attitudes and achievements in science. The present study is among those conducted in the area of students’ attitudes and attempt is here made for a comparative study of attitudes and achievements of students belonging to two different religious and cultural groups, i.e. Muslim minority and Hindu majority. In India almost negligible efforts have been made in this direction.