# CHAPTER - II

## REVIEW OF RELATED LITERATURE

<table>
<thead>
<tr>
<th>Caption</th>
<th>Content</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0</td>
<td>Introduction</td>
<td>46</td>
</tr>
<tr>
<td>2.1</td>
<td>Studies Conducted in India</td>
<td>47</td>
</tr>
<tr>
<td>2.2</td>
<td>Studies Conducted Abroad</td>
<td>73</td>
</tr>
<tr>
<td>2.3</td>
<td>Conclusion</td>
<td>98</td>
</tr>
</tbody>
</table>
2.0 Introduction

Every piece of ongoing research needs to be connected with the work already done, to attain an overall relevance and purpose. The review of literature thus becomes a link between the research proposed and the studies already done. It tells the reader about aspects that have been already established or concluded by other authors, and also gives a chance to the reader to appreciate the evidence that has already been collected by previous research, and thus projects the current research work in the proper perspective.

A large part of review of literature actually needs to be done even before the research project is formalised. This is essential to make sure that it does not repeat the work that someone has already done earlier. Sometimes, if the research proposed has already been undertaken earlier, then it provides an option of modifying the work by adding a new perspective or altering some of the methods of research to obtain a perspective that will be different from earlier works and thus more valuable. Occasionally, the work may be exact repetition of the work done earlier, but with a different set of data or sources of facts, and purpose of the research may just be seeing if your results are similar to earlier works or otherwise.

A good researcher usually goes through a lot more literature than is actually incorporated in the paper. This is because different literature may have differing relevance for the current project and all of it may not worth reporting in the end, but in the initial phase, all aspects of an issue that could be relevant one would like to extensively explore the literature should be look upon and see if any relevant findings are already available. Some of the literature reviewed is directly relevant and hence used as a preface to explain the background of work. Then other reports
may be relevant from the point of view of the project as they provide some clues to the puzzle by suggesting a hypothesis, which may be the subject matter of your research project.

Lastly, review of literature is also important to highlight difference in opinions, contradictory findings or evidence, and the different explanations given for their conclusions and differences by different authors. In some cases, an analysis of these factors can help one understand many facets of a complex issue and at other times, such analysis can lead to a new possibility that can be researched upon in the current project. Thus review of literature is a very important part of one's research.

To summarise, there is hardly any research project which is totally unrelated with research that has already taken place. Usually every individual research project only adds to the plethora of evidence on a particular issue. Unless the existing work, conclusions and controversies are properly brought about, most research work would not appear relevant, nor will it appear important in the whole framework. Thus, review of literature is a very important aspect of any research both for planning your work as well as to show its relevance and significance.62

2.1 Review of Related Literature in India

The Findings of the studies conducted by Indian Scholars on Achievement, General Intelligence and Scientific Attitude are given in the following Paragraphs.

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2.1.1 Scientific Attitude

The Researches conducted by Researchers on Scientific Attitude is given in the following Paragraphs:

In a study conducted by Srivastava (1980) on a study of the Scientific Attitude and its measurement revealed that Boys and Girls differed in Respect of the Scientific Attitude whereas Male and Female teachers did not differ in respect of Scientific Attitude.

In a study conducted by Saxena(1981) on Self concept, Study Habit and School Attitude as correlates Cultural setting of Socio-economic status and Cultural setting in Different Divisions and failures of High Schools students of Kanpur found that Rural cultural had a better achievement level because the rural students did not innovate themselves in bad priorities prevalent in an Urban Society.

A study conducted by Sarah, Shanta Kumari, Williams, A., (1983) “A study of the Attitude of High School pupils towards General Science and Its Relationship with Achievement in the subjects” revealed that the attitude of the high school pupils towards Science and Science Education in Tamil Nadu was generally favourable but there was a wide Disparity in their attitudes. The Researchers also found that about 30 percent of the variance in science Achievement was accounted for by ones attitude towards Science and ones attitude towards Science Education.

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Srivastava, (1983)\textsuperscript{66} in “A study on Scientific Attitude of Science and Arts students when belonging to Scheduled Caste and Scheduled Tribes vis-a-vis Non-Scheduled Caste communities” found that the mean score of Science students on the Scientific Attitude scale were higher than those of the Arts students, irrespective of their caste, sex and education. The study also shows that boys scored consistently higher than girls on the Scientific Attitude scale when (i) group of all boys were compared with all girls. (ii) Boy of III year’s science was compared with girls of TDC III year science. But the girls score consistently higher than boys on Scientific Attitude scale when the following groups were compared: (i) boys (non- SC /ST ) vis- a- vis girls of (non SC/ST) of Higher Secondary and TDC III year of Arts and Science (ii) boys (non SC/ST) vis-a-vis girls (non SC/ST) of Higher Secondary Arts, (iii) all boys (non SC/ST) vis-a-vis girls (non SC/ST), (iv) boys (non SC/ST) of Higher Secondary science vis-a-vis girls (non SC/ST) of Higher Secondary Science. Higher Secondary girls belonging to Scheduled Castes/Scheduled Tribes or non- Scheduled Caste/Scheduled Tribes of Science scored consistently higher scores on the Scientific Attitude scale than their counterparts of III year of TDC (Three year degree course). Scheduled Castes/Scheduled Tribes boys of Higher Secondary Science and SC/ST girls of TDC III year Science scored consistently higher scores on Scientific Attitude scale than their respective counterparts of non- SC/ST boys of Higher Secondary Science and non SC/ST girls of TDC III year Science. The groups that differed significantly on Scientific Attitude in reference to caste as an independent variable were (i) all SC/ST students vis-a-vis all non SC/ST students (ii)SC/T girls of Higher

Secondary Arts vis-a-vis non SC/ST girls of Higher Secondary Arts (iii) SC/ST students of Higher Secondary vis-a-vis non SC/ST students of Higher Secondary of Arts and Science (iv) SC/St student of TDC III year and vis-a-vis non- SC/ST students of III year Arts and Science, (v) SC /ST girls of TDC III year vis-a-vis non SC/ST girls of TDC III year arts. Finally, Non- SC/ST student had a more positive scientific attitude than their counterparts belonging to SC/ST.

Dani, (1984)\(^67\) in a study on “Scientific Attitude and Cognitive Styles of Higher Secondary students” concluded that About 20 percent of the students had a positive Scientific Attitude and the Rural students were found to have a low level of Scientific Attitude as compared to Urban students.

Bandyopadhyay (1984)\(^68\) in a study on “Environmental Influence, Academic Achievement and Scientific Attitude as Determinants of Adolescent Attitude towards Science stream” found that people having a high positive attitude towards Science and a negative attitude towards Science were different with respect to the Independent variables either in Isolation or in Interaction. The Researcher also concludes that the pupil who had a favourable attitude to Science possessed higher ability in mechanical comprehension and visualization of objects in space and also they were higher achievers in Physical and Life science.

In a study conducted by Darchingpui (1989)\(^69\) on “A study of science achievement, Scientific attitude and Problem-Solving ability


among Secondary School student in Aizawl”, the Researcher showed that there is a significant relationships between scores on scientific attitude and achievement in science and there is significant differences in Achievement in Science.

Kar (1990)\(^70\) in a study on “A study of relationship between attitude towards and achievement in general Science of Class IX student of Cuttack City” observed that the distribution of the attitude score was negatively skewed and the boys were found to be more favourably disposed towards Science than girls.

In a comparative study conducted by Rao (1990)\(^71\) on scientific attitude, scientific aptitude and achievement in Biology at Secondary School level, found that (i) the scientific attitude in Secondary School pupils was average. There was no influence of sex in scientific attitude. But the pupil studying in Private Schools, Rural Schools, English Medium Schools and Residential Schools held relatively better scientific attitude than their counterparts.(ii) The achievement in Biology was average. The Rural Schools, Government Schools, English Medium Schools and Residential Schools were better in achievement. (iii) There was a highly significant and positive association between scientific attitude and Biology achievement.

Sharma (1990)\(^72\) in a study of Scientific Literacy, Attitude towards science and Personality traits of students and teachers, showed that the

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Total sample had favourable attitude towards Science and that there was effect of type of School and Sex on attitude towards Science.

The study conducted by Kumar (1991)\textsuperscript{73} on “The Teaching of General Science and the development of scientific attitude in Secondary School students in relation to achievement in general science” showed that (i) the scientific attitude test scores of boys and girls of the average grouped differed significantly and there was no significant difference between the mean of scientific attitude test scores of the pupils of urban and rural areas of the average group, (ii) the mean score of the scientific attitude test of boys and girls did not differ significantly in the high group and the mean scores of the scientific attitude test of the pupils of urban and rural areas in the high group differed significantly, (iii) There existed a relationship between urban boys and urban girls in scientific attitude test scores, (iv) The science test scores of urban boys and urban girls were positively correlated, (v) The mean of boys and girls in low group did not differ significantly in respect of Scientific Attitude.

In a study conducted by Malviya, (1991)\textsuperscript{74} on “A study of attitude towards science and interest in science in school going adolescent”, the researcher found that (i) A positive attitude towards science was observed among all the six groups of students( boys-girls, tribal school-government school, private school- educational school, rural school- urban school, general caste- backward castes students and high socio-economic status- low socio-economic status of students) (ii) Significant differences between means of rural school and urban school


boys and girls revealed that attitude towards science had no effect on the attitude towards science in the later year (iii) Significant difference between means of rural and school and urban school boys and girls revealed that attitude towards science had no effect on the attitude towards science in the later years. (iv) No significant difference between male and female teacher attitude towards science revealed that sex had no effect on the attitude towards science. (v) No significant difference between male and female teachers attitude towards science revealed that sex had no effect on the attitude towards science. (vi) Coefficient of correlation between the different factors of attitude towards science showed moderate correlation with each other.

Sam (1992)\textsuperscript{75} in his study on “The teaching of General Science and the development of Scientific Attitude in Secondary School students in relation to achievement in General Science” concluded that the Scientific test score of boys and girls of the average group differed significantly and there was no significant difference between the mean of Scientific Attitude test scores of the pupils of Urban and Rural areas of the average group. Further, it is also found that the mean scores of the Scientific Attitude test scores of boys and girls did not differ significantly in the high group and the mean score of the scientific attitude test of the pupils of urban and rural areas in high group differed significantly. Also, the mean of the boys and girls in low group did not differ significantly in respect of scientific attitude.

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Srivastava (1992)\textsuperscript{76} in a study on “A study of creativity among Higher Secondary students in relation to scientific aptitude and attitude towards Science” concluded that the girls had more favourable attitude towards Science than the boys.

### 2.1.2 Intelligence

The Researches conducted by Researchers on Intelligence is given in the following Paragraphs:

Choudhuri (1959)\textsuperscript{77} in a study “A Comparative study of Concrete Intelligence of the Tribal and Non-Tribal Schools girls of Ranchi” found that there was basically no difference in the concrete Intelligence of the Tribal and Non-Tribal group.

Chathopadhyay (1961)\textsuperscript{78} in his study “A Psychological study of Intelligence of Tribal and Non-Tribal children of Tripura” observed that the Tribal boys did not compare favourably as a group with the Non-Tribal boys.

In a study conducted by Sinha (1964)\textsuperscript{79} on “Comparative study of Tribal and Non-Tribal Intelligence, the Researcher found there was no significant difference between Intelligence of Tribal and Non-Tribal and that the Intelligence scores of rural tribal differed significantly from urban tribal. Further, Rural Non-Tribal did not differ significantly in Intelligence score from Urban Non-Tribal. Study also reveal that the


mean Intelligence score of Non-Tribal was greater than that of Tribal in Rural areas and there existed no innate difference in Intelligence scores of Tribal and Non-Tribal.

Thakur (1977) in “A Study of the Scholastic Achievement of Secondary School pupils in Bihar” concluded that Scholastic Achievement and Intelligence were significantly associated.

In a study conducted by Makhija, (1973) on “Interaction among Values, Interest and Intelligence and its Impact on Scholastic Achievement” found that intelligence had a significantly positive influence on Scholastic Achievement.

The study conducted by Lalit (1975) on “Some factors Affecting Achievement of Secondary School pupils in Mathematics” showed that there was a significant difference in the performance of boys and girls in mathematics, the difference being in favour of boys. The study also revealed that the intelligence in mathematics was higher in boys than in their respective counterparts and also the achievements in Mathematics was positively related to Intelligence.

Gupta (1975) in his study “A study of some Variables Related to students, Teachers and Instructional material having their bearing or learning outcomes in Biology” showed that boys were significant superior to girls in the achievement of knowledge.

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In a study conducted by Sadhi (1977)\textsuperscript{84} on “Evaluation of Programmed Learning in Chemistry in relation to Taxonomy of Educational Objectives, Intelligence and Personality Traits at the Higher Secondary Level”, the researcher found that Intelligence facilitate Achievement.

The study conducted by Contractor (1977)\textsuperscript{85} on “Educational Attainment as a function of certain variables” concluded that the Educational Attainment was functionally related positively to Intelligence and Achievement.

In a study conducted by Abrol (1977)\textsuperscript{86} on “A study of Achievement Maturation in Relation to Intelligence, Vocational interest, Achievement, Sex And Socio-economic status” it was found that the mean Achievement of student from Unaided, aided and Government schools differed significantly and the mean achievement of boys was significantly greater than that of girls.

Mishra (1978)\textsuperscript{87} in his study on “A comparative study of High and Low achievers in Science, Commerce and Arts on Creativity, Intelligence and Anxiety” observed that Intelligence exhibit no relationship to Science stream students.


The study conducted by Narula (1979)\textsuperscript{88} on “A study of Achievement Maturation, Personal Preferences, Perception, Anxiety, Risk taking Behaviour and other correlates in Secondary schools teachers of Orissa State” revealed that male scored more on measures of Achievement and Intelligence was not found to have any relationship with Achievement.

In a study conducted by Pillai (1981)\textsuperscript{89} on “Sex difference in certain personality and Aptitudinal Dimension related to Science Achievement” it was found that the rate of Intelligence was found significant sex difference in Science Achievement was found to be significantly correlated for both boys and girls.

The study conducted by Shah, (1982)\textsuperscript{90} on “A Comparative study in Scholastic Achievement of the students who have taken their Primary Education in Corporation Schools” concluded that the mean Intelligence score of the students coming from privately managed Schools was higher than that of the students coming from the Corporation Schools.

The study conducted by Chatterji (1983)\textsuperscript{91} on “A Comparative study of Personality, Intelligence and Achievement maturation of students in Different Academic Groups” revealed that scores on Intelligence test in Science group were significantly higher than those in


all other academic group with respect to all factors of Intelligence, namely verbal, numerical and reasoning.

Jogi, (1984)\(^92\) while conducting a study on “The Effect of Response on Achievement on Different level with reference to Intelligence and Taxonomic categories through a programme in Micro-Economics” concluded that Intelligence had significant effect on the Achievement.

Patil (1984)\(^93\) conducted on “A Differential Study on Intelligence, Interest and Attitude of the B.Ed college students as contributory factors towards their achievement in the compulsory subjects” concluded that there was no significant difference between the achievement of male and female, Graduate and post Graduate, and Inexperience and Experienced pupil-teachers in four compulsory subjects. The Researcher also found that there was a significant difference between the scores of the male and female and Inexperienced and Experienced pupil-teachers in respect of Intelligence but no significant difference was found between graduate and post graduate teachers. There was a significant difference between the scores of male and female, inexperienced and experienced pupil-teachers regarding attitude.

A study conducted by Pandey (1985)\(^94\) on “A study on Cognitive Process and Maturational Pattern of Deprived students in relation to their achievement” showed that low deprived students “Boys and girls


together” scored significantly higher than high deprived students on verbal reasoning ability and intellective performance. They also perform higher in science in comparison to high deprived students.

Sahai (1985) in a research conducted on “A study of Relationship of Students’ sex-role Identity with Intelligence and certain Personality and Demographic variables” revealed that male were found to be higher on mean Intelligence as compared to females.

Jethwani (1986) in a study on “An Investigation into the Frustration of school going Adolescent of Kutch District in the content of Cognitive and Non-cognitive variables” found that the pupil with high intelligence and those with low intelligence had no significant difference between their mean scores of frustration.

The study conducted by Tripathy (1986) on “Home and Personality Determinants of Intelligence and Social competence of Tribal and Non-Tribal children” showed that the Tribal and the Non-Tribal children differed significantly in their Intelligence.

Tripathi (1986) make a study on “Achievement Maturation and its Correlates of High Schools students of East U.P.” and found that Intelligence appeared to be influence by the difference in sex. The study also shows that urban girls generally secured better scores on the Intelligence test.

2.1.3 Academic Achievement

The Researches conducted by Researchers on Achievement is given in the following Paragraphs:

A study on Medical Aptitude and other Psychological Variables associated with proficiency in Medical Examination” by Agarwal (1973) revealed that Intelligence was highly correlated with Examination marks of Medical students.

In a study by Thakur (1974) on “The Academic Achievement of High School boys- A study” concluded that Academic Achievement as a whole was not quite satisfactory.

In a study conducted by Bhola (1978) on “Measurement of achievement in physics and Chemistry-A critical study of the effectiveness of the Matriculation Examination in physics and Chemistry conducted by the board of school education Haryana,” found that there is a large number of failures, and very few first and second class which indicated the quantity and quality of achievement in Physics and Chemistry.

Chhaya (1978) in a study on “Achievement in Physics of the students of Class VIII and X of (i) The Central School. (ii) Public School of Central Board of Secondary Education (iii) School of the Council of the Indian School certificate of Education of Bombay, Delhi,

Calcutta and Madras” reveals that there is no significant difference between the mean achievement in physics of pupils of Class VIII as well as Class X belonging to Central Schools and the Public Schools affiliated to the Central Board of Secondary Education.

A study conducted by Gupta (1978) on “The study of the Personal Characteristics and Academic Achievement of Scheduled Caste and Backward class students of Meerut University” indicated that the Scheduled Caste Postgraduate students perceived themselves as good achievers in his study.

In 1978, Acharyulu (1978), “A study of the Relationship among Creative Thinking, Intelligence, and School Achievement”, was investigated and the result of the study shows that there is no sex differences in Achievement in general science.

Das, (1978) in “A psychometric study of low achievement of school Final candidates in general science” concluded that a positive correlation existed between Intelligence and achievement in general science.

In a study conducted by Desai (1979) on “a study of Classroom Ethos, Pupil’s Maturation and Academic Achievement”, found that boys were higher than girls in the level of pupil’s academic achievement.


Aruna (1981)\textsuperscript{107} in a research on “A study of the factors influencing the achievement of the standard VII students belonging to Scheduled Caste and Scheduled Tribe whose medium of instruction is Kannada” indicated that the academic achievement of Scheduled Tribe students was superior to that of Scheduled Caste students and also the Academic Achievement of boys belonging to Scheduled Castes and Scheduled Tribes taken together was superior to that of girls.

Rangani, (1981)\textsuperscript{108} in his work “comparative study of the scheduled caste and the non-scheduled caste college student of Aurangabad” found that the Non-Scheduled caste students did better than the Scheduled Caste among students with regards to the Academic Achievement. The relationship among Creative Thinking, Intelligence and School Achievements” shows that there is no difference in the achievements in general science in his study.

A research conducted by Baruah (1981)\textsuperscript{109} on “Influence of the capacity of memorisation on Scholastic Achievement” observed that boys of and girls were not different with respect to Intelligence and Scholastic Achievement.

A study of Self disclosure and Academic Achievement as related to Self Concept and Parent Child relationship among major caste with special reference to girls conducted by Agarwal (1982)\textsuperscript{110} showed that

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“Students conclude that there were no significant caste differences with regard to Academic Achievement. The girls belonging to Scheduled Caste were low achievers than Kshatriyas, Brahmin and Vaish girls.

Patil (1982)\textsuperscript{111} made a study on a Psychological study of Intellectually Superiors” and found that there was no significance difference in the academic achievement of the superior and average group.

A study conducted by Jasuja (1983)\textsuperscript{112} on “A study of Frustration Level of Aspiration and academic Achievement in relation to Age, Educational and Sex Difference among Adolescents” conclude that girls achieved higher in the academic field as compared to boys.

An Investigation by Shanmugasudaram (1983)\textsuperscript{113} into the Factors related to the Academic Achievements among Undergraduates students under semester system concluded that high achievers had a higher Intelligence than Low achievers and also found that urban students were more intelligent and performed better academically than Semi-Urban and Rural students. Also among high Achieving, Urban student, Intelligence had a significant positive influence upon academic achievement.

Deshpande (1984)\textsuperscript{114} in his study on “A study of Determinants of achievements of students at the SSC Examination in the Pune Division of Maharashtra State” found that the students from the higher achieving

schools were higher in Intelligence than their counterparts in the lower achieving schools.

Shukla (1984)\textsuperscript{115} in a study on “Achievement of Primary Schoolchildren in relation to their Socio-economic status and Family Size” revealed that there were no significant sex differences in the Academic Achievement of Primary School children.

Srivastava (1984)\textsuperscript{116} in a work on “An Investigation into the Relationship of Reading Ability with General Mental ability, Socio-Cultural status and School Achievement” observed that the correlation of Intelligence and the Achievement in the various school subjects was positive and significant.

Verma (1985)\textsuperscript{117} in a study on “Factors Affecting Academic Achievement. A cross cultural study of Tribal and Non-Tribal student at Junior High School level in Uttar Pradesh” concluded that the mean achievement of the Scheduled Caste students was significantly lower than that of Tribal students and student from other castes. However, there was no significance difference in the mean achievement of the students belonging to the Scheduled Tribes and those belonging to other Castes.


In a study conducted by Chand (1985) on “A comparative study of various Naga Tribal Pupils in Relation to their Self Perception, Socio economic status, Vocational and Educational Aspiration and Academic Achievement” the researcher revealed that the academic achievement of the Angami people was significantly different from those of Ao and Sema pupils whereas pupils belonging to Ao and Sema Tribe were not found to differ significantly as far as Academic Achievement was concerned. Further, the academic achievement of boys belonging to the three tribes was significantly different from that of girls in their respective tribes. The study also observed that academic achievement of Angami boys was significantly different from that of the boys of the Ao and Sema tribes whereas the boys belonging to the Ao and the Sema tribes were found to be similar on the same variable. However, the girls belonging to the three tribes were not found to differ significantly on academic achievement as such.

The study conducted by Das (1986) on “Peer influences and Educational Aspiration of Secondary School students, a study in relation to their Academic Achievement” shows that Intelligence was the most powerful prediction of Academic Achievement.

A study conducted by Deshpande (1986) on “Interactive Effects of Intelligence and Socio Economic status of students and homework on the Achievement of students conclude that Intelligence was significantly related to achievement at the 10 percent level.

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Malhotra (1986)\textsuperscript{121} in his study on “A study of the relationship between Intelligence, Socio-Economic Status, Anxiety, Personality adjustment and academic Achievement of High School students” remarked that there was a positive relationship between Intelligence and Academic Achievement.

However, in the study conducted by Misra (1986)\textsuperscript{122} on “A critical study of the Influence of socio economic student on Academic Achievement of Higher Secondary students in Rural and Urban areas of Kanpur” observed that there was a positive relationship between the Intelligence test score and academic performance of the students and the academic performance of girls was superior to the performance of boys. Further, the study reveals that Intelligence positively affected academic performance of the student and the academic achievement of the rural students was lower than the achievement of the urban students.

Kapoor (1987)\textsuperscript{123} in a Study on factor responsible for High and Low achievement at the Junior High School Level found that among both the boys and girls, the high achievers tended to show higher as compared to the average and the low achievers.

Patel (1987)\textsuperscript{124} in a work in “Academic Achievement in relation to Cognitive and Personality Differential of Socially Disadvantaged and Advantaged. Secondary School children of Orissa” showed that all the


three groups, viz, Scheduled Caste, Scheduled Tribe and the advantage children, differed significantly in their achievement in academic subjects, intelligence and achievement maturation. On all the variables related to academic achievement viz, Intelligence, Self Concept, Creativity etc, the advantaged students scored significantly higher than the Scheduled Caste and Scheduled Tribe children. Further the subject general science was positively correlated with intelligence and achievement maturation. The study also reveals in the case of Scheduled Castes, academic achievement in General science was predicted by Intelligence and in the case of Scheduled Tribe children, Intelligence contribute significantly towards General Science.

A study conducted by Chakrabarti (1988)\textsuperscript{125} on “A Critical Study of Intelligence, Socio-economic background of the family, Educational Environment of the Family and Quality of Schools in children in standard V. A case study of some school in and around Pune”, the researcher found that students from urban areas were found to be significant better than students from rural areas in term of academic achievement and students from private school scored better than Zilla Parishad and cooperation school. Further students from Marathi Medium School scored better than those of English medium school and also there was no significance difference in the achievement of boys and girls.

Dave (1988)\textsuperscript{126} in a study on “Pupils Achievement at the Primary Stage” concluded that achievement of the children in language was found to be excellent in Class I, good in Class II, better in Class IV.


Further achievement of pupils in Mathematics was found to be excellent in Class I and II, good in Class III, and poor in Class IV. However the achievement of pupils in Environmental Studies was found to be more than excellent in Class I and II. Also, the achievement of pupils in Science was found to be slightly less than good in Class III and poor in Class IV and achievement of pupils in Social Sciences was slightly less than good in Class III and a bit below minimum in Class IV.

In a study conducted by Gawande (1988)\(^\text{127}\) on “A study of the relationship between achievement maturation and Scholastic achievement of Higher Secondary students of Class XI of Amaravati District of Maharashtra State”, showed that the mean differences in the scores of scholastic achievement in boys and girls was not significant.

In a study conducted by Bhusari (1988)\(^\text{128}\) on “Intelligence of the Scheduled Castes and Scheduled Tribes students and its correlation with their Scholastic achievement in Vidharbha” the researcher found that there was positive correlation between Intelligence and Scholastic achievement of Scheduled Tribe student in almost all the subjects in all the District. Also, the study reveal that the correlation between Intelligence and Mathematics and Intelligence and science were at a higher level than the Correlation between Intelligence and language and between Intelligence and Social Science.


Saraswati (1988)\textsuperscript{129} in a study on “A differential study of achievement maturation, occupational aspiration and academic achievement of adolescents in different types of school climate in Aligarh District” found that the boys-girls, rural-urban students, science-arts students significantly differed in their academic achievement.

A study conducted by Kumar (1989)\textsuperscript{130} on “Children curiosity, intelligence and scholastic achievement”, reveals that correlation between intelligence and scholastic achievement was found to be significant and no difference was found in the scholastic achievement of the students of rural and urban background. Further, the study also shows that scholastic achievement was predicted by treating curiosity and intelligence as independent variable.

Dhar (1989)\textsuperscript{131} in a study on “Effect of School environment and approval nature in memory and achievement”, the researcher concluded that the mean performance of Science students in academic achievement as well as in Hindi were found to be satisfactory where the majority of science students secured 50% of the aggregate marks.

Chandra and Chadha (1990)\textsuperscript{132} in their study on “Creativity, Intelligence and Scholastic achievement. A residual study” concluded that correlation was positive between Intelligence and Scholastic achievement. Further, the study also shows that there was positive and


significant correlation between Intelligence and Scholastic achievement when the effect of creativity partially out.

The study conducted by Devi (1990)\textsuperscript{133} on “Pupils academic achievement in relation to their intelligence, neurotic and locus of control” revealed that (i) Girls had a significantly higher academic achievement than boys. (ii) There was no significant difference in the intelligence level of boys and girls. (iii) Academic achievement showed a positive and significant correlation with intelligence.

However, the study conducted by Samal (1990)\textsuperscript{134} on “Relationship between planning and academic achievement of boys and girls: Effect of home-environment variables”, showed that there was no significant difference between boys and girls with regard to academic achievement.

A study by Thilagavathi (1990)\textsuperscript{135} on “Academic Achievement in relation to Intelligence, Creativity and Anxiety” revealed that (i) of the total 400 subjects of the sample, 19.25% were high achievers, 60.75% were average achievers and 20% were low achievers. (ii) The high, average and low achievers differed significantly among themselves in their intelligence.

A study conducted by Shah (1990)\textsuperscript{136} in a study on “A study of relationship among intelligence, self-concept and academic achievement


of pupils of standard X of semi-urban and rural areas of SihareTaluka”,
the researcher revealed that there was significant difference in Academic
Achievement, in favour of boys, in both semi-urban and rural areas and
also intelligence was same related to Academic Achievement.

In a study conducted by Diwan(1991)\textsuperscript{137} on “A study of the
Predictors of academic achievement of students-teachers in terms of
aptitude, participation and human values”, it is found that academic
achievement of students-teachers was related to scientific outlook.
Further, the study reveals that female students-teachers were found
significantly higher in comparison to male student-teachers in academic
achievement and the student-teachers of urban background were found
significantly better as compared to student-teachers of rural background
in academic achievement and scientific outlook.

Indra (1991)\textsuperscript{138} in a study “A study of the relation of social class,
religion, and family size and with order to academic achievement of
High School students” concluded that students belonging to different
social classes differed in their academic achievement and the Hindu,
Muslim, Christian students differed in their academic achievement
scores.

Sahay (1991)\textsuperscript{139} while conducting a study on “Familial correlates
of academic achievement in Rural School students” found that the level
of education, sex and caste had no independent effect on the
development of scholastic achievement.

\textsuperscript{137}Denesh Kumar. Diwan (1992). “A Study of the Predictors of Academic Achievement of Students-
Teachers in Terms of Aptitude, Participation and Human Values”, in Fifth Survey of Educational

Academic Achievement of High School students” in Fifth Survey of Educational Research Vol-II,
New Delhi: NCERT.

\textsuperscript{139}N.Sahay (1991). “Familial correlates of Academic Achievement in Rural School students”, in Fifth
Sinha (1991)\textsuperscript{140} in a study on “A cross sectional study of the Impact of Scientific Attitude, Motivation and Self concept in Science upon the achievement of the students of Science”, concluded that in Physical Science, Urban boys and Urban girls achieved higher than rural boys and urban girls and there was no difference in the achievement in Physical Science of boys and girls.

Garg and Chaturvedi (1992)\textsuperscript{141} in a study on “Intelligence and Socio-economic status as correlates of academic performance: Some field evidences concluded that the mean academic score of rural students was lower than the mean academic score of urban students and there appeared to be a linear relationship between IQ and academic performance which held good for rural and urban students.

In a study conducted by Harikrishnan (1992)\textsuperscript{142}on “A study of academic achievement of the students of the Higher Secondary stage in relation to achievement- maturation and Socio-economic status”, the researcher found that Girls obtained a higher mean in academic achievement compare to boys.

In a study conducted by Kaur (1992)\textsuperscript{143} on “Relationship among creativity, intelligence and academic achievement in different subjects of X grades”, he researcher found that the Intelligence of males and females was positively related with achievement in all the subjects and that


intelligence was found to be a better predictor of achievement in all the subjects.

2.2 Review of Related Literature Abroad

The studies on Academic Achievement, Intelligence and Scientific Attitude conducted abroad are given in the following paragraphs below:

2.2.1 Scientific Attitude

Research has consistently shown attitudes as an important component of science education (Gardner, 1975\textsuperscript{144}, Joyce & Farenga, 2000\textsuperscript{145}, Osborne, Simon, & Collins, 2003\textsuperscript{146}, Schibeci & Riley, 1986\textsuperscript{147}) impacting not only pupils participation and interest (Greenfield, 1996\textsuperscript{148}, Koballa, Crawley, & Shrigley, 1990\textsuperscript{149}; Simpson & Oliver, 1990\textsuperscript{150}), but also their performance in science (Linn, 1992\textsuperscript{151}). Moreover, Wilson (1983)\textsuperscript{152}, Rana (2002)\textsuperscript{153}, and Papanastasiou and Zembylas (2004)\textsuperscript{154}

\footnotesize{\textsuperscript{144} P. L. Gardner (1975)."Attitude to Science: A review." \textit{Studies in Science Education}, 2, 1-41.}  
\footnotesize{\textsuperscript{148} T. A. Greenfield (1996). Gender, Ethnicity, Science Achievement, and Attitudes.\textit{Journal of Research in Science Teaching}, 33(8), 901-933.}  
\footnotesize{\textsuperscript{153} R. A. Rana, (2002). \textit{Effect of Parents, Socioeconomic Status, Students, Self-Concept and Gender on Science-Related Attitudes and Achievement} (Doctoral Thesis).Institute of Education and Research, University of the Punjab, Lahore.}  
reported a high correlation between positive attitude towards science and achievement in science.

Anwer, Iqbal and Harrison (2003)\textsuperscript{155} conducted a study to examine students’ attitude towards science. The sample of the study consisted of 3526 students of 10th grade (Boys = 1914, Girls = 1612) and were from urban \((n = 2304)\) and rural \((n = 1222)\) localities of Pakistan. The instrument administered was ‘‘Test of Science Related Attitudes’’ (TOSRA) developed by Fraser (1981). Results of the study depicted a significant effect of gender and locale on students’ attitude towards science. Girls had significantly higher attitude towards science than boys on total scale and on all sub-scales of TOSRA with only one exception of Career Interest in Science subscale on which boys were slightly high than girls but it was not significant. Locality wise results showed rural students to score significantly higher on the total scale and on the subscales of Social Implication and Career Interest in Science than the urban respondents, while the urban respondents scored significantly higher on the subscale of Adoption of Scientific Attitudes than the rural respondents. There was no significant variation between the rural and urban respondents in their Attitude towards Scientific Inquiry, Enjoyment of Science Lessons and Leisure Interest in Science. This study has wide implications for educationists.

Numerous studies document that students attitude towards science decreases with increase in grade levels (Francis & Greer, 1999; Pell &

Jarvis, 2001) and this decline is more rapid in middle and high school years (Rani, 2000).

According to Osborne et al. (2003), attitude consists of different sub-constructs which ultimately give rise to a person’s attitude towards science. Different components of attitude towards science have been discussed by different researchers (Crawley & Black, 1992; Gardner, 1975; Koballa, 1988; Oliver & Simpson, 1988; Salta & Tzougraki, 2004). Bennett (2003) makes the distinction between attitude towards science and scientific attitude. According to him, attitude towards science is linked with the views and images that the individual develops about science as a result of interaction with different situations, while the term scientific attitude is linked to the ways of thinking or scientific method, which covers the skills and is related to the undertaking of practical work.

According to Yara (2009)\textsuperscript{165}, attitude towards science denotes interest or feeling towards studying science. It is the students’ disposition towards liking or disliking science.

Fraser (1981)\textsuperscript{166} based on Klopfer’s scheme, described seven components of attitude towards science. He categorized these components as subscales of his science attitude scale “Test of Science-Related Attitudes (TOSRA)”. While Fraser’s ideas fitted with Klopfer’s scheme, the main difference was the division of the first category of Klopfer’s scheme, i.e., the manifestation of favourable attitudes towards science and scientists into two separate scales, i.e., Social Implications of Science and Normality of Scientists. The above discussion has unveiled the concept of attitude towards science and it is clear now that this concept is best described by Fraser who designed a comprehensive scale (TOSRA) to measure the seven distinct and wide-ranging categories of attitudes toward science (Social Implications of Science, Attitude to Scientific Inquiry, Adoption of Scientific Attitudes, Enjoyment of Science Lesson, Leisure Interest In Science, Career Interest In Science and Normality of Scientists) at secondary level.

Researches in science education indicate a number of factors influencing students’ attitude towards science. Studies completed so far in this area have linked attitude towards science with gender (Greenfield, 1996\textsuperscript{167}; Stables, 1990\textsuperscript{168}), parental education (Mordi, 1991)\textsuperscript{169}, socio-


economic status (Okebukola & Jegede, 1990)\textsuperscript{170}, and age and grade (Ye, Wells, Talkmitt, & Ren, 1998)\textsuperscript{171}.

Walberg (1984) mentioned nine different factors i.e., students ability, maturity, motivation, quality of instruction, quantity of instruction, psychological environment at home, classroom environment, peer group outside the classroom and the time involved with video/television media that contribute to an individual’s attitude towards science.

Schibeci and Riley (1986)\textsuperscript{172} reported that sex, race, home environment, amount of homework, and parents’ education had an effect on students’ attitudes in science.

Most researchers (Nieswandt, 2005\textsuperscript{173}; Osborne et al., 2003\textsuperscript{174}) consider the effects of curriculum on science attitudes. On the other hand, some studies have indicated that personality and behaviour of the teacher is very important in the formation of pupils’ attitudes (Mcmillan & May, 1979)\textsuperscript{175}.

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Jegede and Fraser (1989)\textsuperscript{176} have reported that socio-cultural factors and attitude influence each other in science. Similarly, Rana (2002)\textsuperscript{177} found parents socio-economic status, students’ self-concept and gender as the important factors influencing students’ attitude towards science. Therefore, it can be seen that this is quite a complex situation in which many factors may be acting simultaneously to influence attitude.

Although the worldwide debate on what factors influence attitude towards science is in progress, a consensus appears to emerge within the researchers that gender has a significant effect. Gardner (1975)\textsuperscript{178} and Schibeci (1984)\textsuperscript{179} reported that gender has more consistent and significant effect on attitude towards science.

Similarly, Becker (1989)\textsuperscript{180} and Weinburgh (1995)\textsuperscript{181} after conducting meta-analysis of a range of research studies from 1970 to 1991 also concluded that of all variables that may influence attitude towards science, gender is the most significant. Weinburgh in meta-analysis of eighteen studies representing 6753 students (3337 boys and 3416 girls) reported that boys consistently showed more positive attitude towards science.

\begin{thebibliography}{999}
\bibitem{177} R. A. Rana (2002). \textit{Effect of Parents, Socioeconomic Status, Students, Self-Concept and Gender on Science-Related Attitudes and Achievement} (Doctoral Thesis). Institute of Education and Research, University of the Punjab, Lahore.
\end{thebibliography}
Smist, Archambault, and Owen (1997)\textsuperscript{182} studied gender differences in attitude towards science of 572 secondary level students. The scale used by them in this study was also TOSRA and boys were found to have higher attitude towards science than girls on the total score of this instrument, but in case of sub-scales, girls expressed more positive attitude towards Normality of Scientists and Attitude to Scientific Enquiry and boys had more positive attitude toward Leisure Interest in Science, Career Interest in Science and Enjoyment of Science Lessons. In contrast, no significant gender differences were found on the subscales of Social Implication of Science and Adoption of Scientific Attitude scales.

Similarly, TOSRA was used by Joyce and Farenga (2000)\textsuperscript{183}, who conducted a study to examine attitude towards science of 111 high ability students of ages 9 and 13 years. Boys showed more interest to participate in physical sciences than girls. Some studies have reported that girls have more attitude towards science as compared to boys (Akpinar, Yildiz, Tatar, & Ergen, 2009)\textsuperscript{184}; Dhindsa & Chung, 2003\textsuperscript{185}; Greenfield, 1996\textsuperscript{186}; Morrell & Lederman, 1998\textsuperscript{187}. There appears to be a difference in attitude towards science that is linked to gender but this does not remain static over age nor context.

\begin{thebibliography}{9}
\end{thebibliography}
Moffat (1992)\textsuperscript{188} reported that boys had higher positive attitude towards science than girls and group attitude towards science decreased as grade level increased. Similarly, Francis and Greer (1999)\textsuperscript{189} concluded that interest of both the gender decreased as grade level increased although they found like Moffat’s study that girls had less interest in science than boys.

Pell and Jarvis (2001)\textsuperscript{190} also reported a decline in enthusiasm for science in both gender of ages 5-11 years. In contrast, Morrell and Lederman (1998)\textsuperscript{191} found no gender differences in attitudes among 5th, 7th and 10th grade students.

Similarly, Greenfield (1996)\textsuperscript{192} also concluded no gender differences in attitude towards science among students from grade 3 to 12 in four major ethnic groups of America.

Barrington and Hendricks (1988)\textsuperscript{193} and Cokadar and Kulce (2008)\textsuperscript{194} also did not offer any support for the effect of gender on attitude towards science. The above mentioned studies demonstrate students’ attitudes at fixed snapshots in time but do not give a clear message of what experiences led to the formation of these attitudes nor whether they are stable and sustained in long term.

\textsuperscript{188} N. Moffat (1992). Girls and Science Careers: Positive Attitudes are not enough. Paper presented at the Annual Meeting of the National Association for Research in Science Teaching, Boston, MA.
However, some longitudinal studies offer some explanations in this regard. For example, Breakwell and Robertson (2001)\textsuperscript{195} conducted a longitudinal study to examine the change in attitude towards science over a period of ten years in students between ages 11 to 14 years. The results indicated that boys had more positive attitude and better performance in science as compared to girls. Boys also participated more in extracurricular activities and liked science more at school than their girls counterparts.

In another longitudinal study, Rani (2000)\textsuperscript{196} found that students attitude towards science generally declined over the middle and high school years, and boys were found to have high attitudes towards science and their attitudes dropped faster than girls. Similarly, Reiss (2004)\textsuperscript{197} conducted a seven year longitudinal study to explore gender patterns in science attitudes and concluded differences in attitudes of both gender in favour of boys. Some researchers have focused on cross-national comparisons of student’s attitude towards science. The findings of such studies are noteworthy in a sense because the same instrument (TOSRA) was administered on respondents in different countries.

Ye et al. (1998)\textsuperscript{198} conducted a cross-sectional survey research on grades 7 to 12 in China and America about students’ attitudes toward science. It was concluded that attitude of students was influenced by different factors. American students considered science subjects easy but disliked it due to mathematical calculations whereas Chinese students

were encouraged by their schools to study science and they liked reading
science books and news. Grade levels and gender differences were not
significantly different between students of the two nations, although
boys showed slightly higher attitude towards science than girls. A
number of studies have been reported in the literature regarding the
relation of attitude towards science with locale.

Ankarah-Dove (1998)\textsuperscript{199} mentioned the low quality and turnover
of teachers, inferior buildings, insufficient facilities, deprived health
conditions and above all low socio-economic state of affairs in rural area
schools of developing countries. Consequently, there are concerns about
the quality of education in rustic areas.

Similar results were reported by Sherman (1992)\textsuperscript{200} and Stern
(1994)\textsuperscript{201}. In contrast, Monk and Haller (1986)\textsuperscript{202} reported no differences
in achievement of rural and urban students in New York (America).
From the above discussion it can be concluded that Locality
(rural/urban) may have a significant effect on cognitive and affective
patterns of the students, but the researchers could not find many studies
on attitudes regarding this variable. Even though a small number of
researches have been reported on locality of respondents, urban
respondents were marginally better in attitude than rural respondents
(Zacharia& Barton, 2004)\textsuperscript{203}.

\textsuperscript{199} L. Ankarah-Dove (1998). The Deployment and Training of Teachers for Remote Rural Schools in
\textsuperscript{200} A. Sherman (1992). \textit{Falling by the Wayside: Children in Rural America}. Washington, DC: Children's
Defense Fund.
Printing Office
Cornell University, Department of Education.
\textsuperscript{203} Z. Zacharia & A. C. Barton (2004). Urban Middle-School Students Attitudes toward a Defined
A recent notable contribution in Pakistani context was made by Muhammad, Tabassum, and Pell (2008) who reported that girls from semi-urban areas performed better on attitude towards science.

Work in the realm of students’ attitudes toward science has been motivated by the desire to increase interest, performance, and student retention in science (Third International Mathematics and Science Study, 2001). Educational studies have produced mixed results but tend to show that attitudes affect students’ persistence and performance (for a review, see Schommer, 1994). Modest positive correlations between science attitude and science achievement have been reported in many studies (Schibeci & Riley, 1986; Keeves & Morganstern, 1992). Models propose that science instruction influences attitudes in ways that predict achievement (Hegarty-Hazel, 1990; Schibeci & Riley, 1986; Simpson & Oliver, 1990). In particular, science instruction that is activity-based (Fraser, 1980; Freedman, 1997) and issue oriented

(Iskandar, 1991\textsuperscript{213}; McComas, 1993\textsuperscript{214}) has been shown to enhance positive attitudes toward science.

Another reason to extend research on scientific attitudes is that attitudes and beliefs are part of “cognition” itself (Schoenfeld, 1985\textsuperscript{215}). Research has suggested that people who view science in a sophisticated way are better able than others to use their knowledge in more contexts and to make sense out of complex information (Davis, 1998\textsuperscript{216}; King & Kitchener, 1994\textsuperscript{217}; Linn & Songer, 1993\textsuperscript{218}). Thus, science attitude research may be viewed as fundamental to understanding scientific cognition.

Shrigley’s (1990)\textsuperscript{219} review of the research on science attitudes and behaviour showed that science attitude scores can possibly predict science behaviours. Positive science behaviours should show an interest in science and science learning. Students should be given the opportunity to try to attitude scores can possibly predict science behaviours led to my first hypothesis: Students with a positive attitude towards science will show higher levels of effort during computer use.

It can be seen that researchers frequently use “Draw a Scientist Test” (DAST) developed by Chambers (1983)\textsuperscript{220} to determine the

\begin{itemize}
\item \textsuperscript{217} P.M.King & K.S.Kitchener (1994). Developing Reflective Judgment: Understanding and Promoting Intellectual Growth and Critical Thinking in Adolescents and Adults.
\item \textsuperscript{218} M.C.Linn & N.B.Songer (1993). How do Students Make Sense of Science? Merrill-Palmer Quarterly, 39, 4773.
\end{itemize}
student views about scientists. In a study by Rubin et al. (2003)\textsuperscript{221}, Israeli pre-service teachers’ descriptions of scientists were sought. It was noted that the students mostly described scientists as male, physician or chemist and as working in a lab. In his study, Fung (2002)\textsuperscript{222} used DAST and studied how Chinese students’ views of scientists differed in terms of gender and class. According to the results of this, it can be seen that student specified scientists generally as male. In their study,

Bodzin and Gehringer (2001)\textsuperscript{223} reported that scientists were described mostly as white, male, working in a lab and wearing glasses. To alter this common conception, scientists were invited to lectures and the students are allowed to observe them at work. Intentionally, some of the invited scientists were female. Following this study, the students are asked again to draw a scientist and it was found that the number of male, glassed and with a laboratory coat scientist pictures decreased.

Song and Kim (1999)\textsuperscript{224} examined the views of the Korean students about scientists in terms of the scientist image shaped in their minds, the physical images, the source of the images shaped in their minds, the scientists observed around and the scientists viewed as famous.

In another study, Balkı et al. (2003)\textsuperscript{225} directed open ended questions to primary education students. It was noted that the students defined scientists typically as individuals carrying out research. The

\textsuperscript{223}A.Bodzin, M Gehringer M (2001) “Can Meeting Actual Scientists Change Students’ Perceptions of Scientists?”, Science and Children, January: 36-41.
\textsuperscript{225}N.Balkı, A.K Çoban, M Akta_ (2003) “The Views of Primary Education Students about Science and Scientist”, Uluda University Faculty of Education Journal, 17 (1): 11-17 (in Turkish)
students stated that when a person becomes a scientist, she/he will have to deal with works such as discovery, invention and being a scientist would be arduous. There are several studies on the importance of changing the negative conceptions formed in students' minds. Because these negative opinions will affect the prospective success and attitudes of students.

In his study, Türkmen (2003)\textsuperscript{226} reported that the attitudes of the students towards science weakened over time and this affected their success and the comprehension of scientific concepts. He stressed the necessity of organizing the school environment by considering this point.

Schibeci (2006)\textsuperscript{227} suggested that the views about scientists were formed stereotypically (glassed, wearing laboratory coat, etc.) and that these conceptions should be removed.

Scherz and Oren (2006)\textsuperscript{228} implemented a program named “Investigation into Science and Technology (IST)” to change the conceptions of students about science and technology. In this program, applications of science and technology in real life were covered. As a result of the applications in this study, it was noted that students developed positive attitudes towards science.

In the context of the students' views about the nature of science, Kang et al. (2005)\textsuperscript{229} investigated the titles of the purpose of science, definition of history of science, structure of the models, the precision of


the scientific theories and the origin of the scientific theories and they reported that the students were inclined to experimental studies.

Varelas et al. (2005)\textsuperscript{230} investigated the differences and similarities when the teachers imagined themselves both as a teacher and a scientist. As a scientist; they defined themselves as individuals changing by time, not representing a uniform line, dealing with complex science subjects and leading the society.

Rahm and Charbonneau (1997)\textsuperscript{231} employed DAST to 49 university students and graduates and attempted to collect their views about scientists. In this study, it was reported that the childhood experiences and media had a deep impact on the scientist image in the students’ minds.

Jones et al. (2000)\textsuperscript{232} examined the views of students about science, out of school activities, engaging science subjects and future profession selection. It was noted that male students preferred easy and paying professions. Moreover it was stated by the students that science was difficult and involves dangerous studies. In the study of Morrison et al. (in the press), it was found that the students did not have sufficient level of knowledge about the nature of science. As a result of this study it was suggested that a number of activities explicating how scientists viewed science and what the applications of science were should be carried out. Moreover, allowing students to observe scientist at work, having conversations with them on science will add to their knowledge about science.


\textsuperscript{232} M G Jones, A. Howe, M.J Rua (2000) “Gender Differences In Students’ Experiences, Interests and Attitudes Toward Science and Scientists”. Science Education. 84: 180-192.
Eijck et al. (2008)\textsuperscript{233} claimed that the scientific studies conducted by students will have significant effects on their ideas about science and the more number of activities implemented the more positive views students will have about science.

Smith and Erb (1986)\textsuperscript{234} conducted a study which concluded if students’ modeled scientists this would affect their attitudes towards science and scientists. In this study, they reported that the students in the experiment group developed more positive attitudes towards science when compared to the control group. In addition, Maoz and Rishpon (1990)\textsuperscript{235} conducted a study to enable the primary education students to learn scientists and their studies and then to examine the attitudes gained by the students in this way. This study showed that students developed a high level of attitude and 8th graders demonstrated a higher level of attitude when compared with 11th graders.

Flick (1990)\textsuperscript{236} inquired the development of students’ conceptions of science and scientists within the frame of “scientists in primary schools program”. Over the course of one year, four scientists and a doctorate student participated in the program and made class visits. At the end of the instruction the data were gathered with DAST and the results were interpreted. When the findings were examined, it was seen that the students' perceptions of scientists developed in a positive manner. In this regard, it was claimed that maintaining a long term positive attitude in students towards science and scientists could be

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\textsuperscript{236} L Flick (1990) “Scientist Residence Program Improving Children’s Image of Science and Scientist”, *School Science and Mathematics*, 90(3): 204-214
\end{footnotesize}
achieved only by developing programs with the cooperation of teachers and scientists and carrying out joint activities.

Moreover, in another study by Demirbas and Yagbasan (2005), teaching methods involving the studies of scientists were employed on the primary education students and as a result of the study it was found that the students' conceptions of scientists were changed in a positive manner.

Mason et al. (1991) used DAST in order to determine the scientist image in students’ minds. The scientist pictures obtained were categorized with respect to certain properties and they were evaluated. Especially the female students were reported to have negative views on science classes and to be reluctant in choosing a scientific profession. In this study it was concluded that positive attitudes towards science and scientists would enhance their attitudes towards science and they would become more exited in choosing a scientific profession. When we examine the results of this study, it can be seen that the students generally had certain descriptions about the scientists. Furthermore, the view that scientists are generally male is another issue we confronted. Hence, the results of the studies towards changing these ideas are also important. In the following part, the importance of the study will be revisited and the findings of this study will be elucidated by linking them to the results of previous studies.

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2.2.2 Intelligence

In a study conducted by Belmont and Marolla (1973)\textsuperscript{239} on birth order and intelligence, it revealed that, Children from large families tend to make poorer showings on intelligence tests and on educational measures, even when social class is controlled.

In the early 1900s, the French psychologist Alfred Binet (1857–1914)\textsuperscript{240} and his colleague Henri Simon (1872–1961) began working in Paris to develop a measure that would differentiate students who were expected to be better learners from students who were expected to be slower learners. The goal was to help teachers better educate these two groups of students. Binet and Simon developed what most psychologists today regard as the first intelligence test, which consisted of a wide variety of questions that included the ability to name objects, define words, draw pictures, complete sentences, compare items, and construct sentences.

On the basis of these results, the psychologist Charles Spearman (1863–1945) hypothesized that there must be a single underlying construct that all of these items measure. He called the construct that the different abilities and skills measured on intelligence tests have in common the general intelligence factor (g). Virtually all psychologists now believe that there is a generalized intelligence factor, g, that relates to abstract thinking and that includes the abilities to acquire knowledge, to reason abstractly, to adapt to novel situations, and to benefit from

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instruction and experience (Gottfredson, 1997; Sternberg, 2003). People with higher general intelligence learn faster.

L. L. Thurstone (1938) proposed that there were seven clusters of primary mental abilities, made up of word fluency, verbal comprehension, spatial ability, perceptual speed, numerical ability, inductive reasoning, and memory. But even these dimensions tend to be at least somewhat correlated, showing again the importance of g.

Sternberg (1985, 2003) argued that traditional intelligence tests assess analytical intelligence, the ability to answer problems with a single right answer, but that they do not well assess creativity (the ability to adapt to new situations and create new ideas) or practicality (e.g., the ability to write good memos or to effectively delegate responsibility).

Furnham & Bachtiar (2008) has found that creativity is not highly correlated with analytical intelligence and exceptionally creative scientists, artists, mathematicians, and engineers do not score higher on intelligence than do their less creative peers (Simonton, 2000).

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Tarasova, Volf, & Razoumnikova, (2010)\textsuperscript{248} found that the brain areas that are associated with convergent thinking, thinking that is directed toward finding the correct answer to a given problem, are different from those associated with divergent thinking, the ability to generate many different ideas for or solutions to a single problem.

Gardner (1983)\textsuperscript{249} argued that it would be evolutionarily functional for different people to have different talents and skills, and proposed that there are eight intelligences that can be differentiated from each other. Gardner noted that some evidence for multiple intelligences comes from the abilities of autistic savants; people who score low on intelligence tests overall but who nevertheless may have exceptional skills in a given domain, such as math, music, art, or in being able to recite statistics in a given sport (Treffert & Wallace, 2004)\textsuperscript{250}.

In a study conducted by Belmont and Marolla (1973)\textsuperscript{251} on birth order and intelligence, it revealed that, Children from large families tend to make poorer showings on intelligence tests and on educational measures, even when social class is controlled.

One distinction is between fluid intelligence, which refers to the capacity to learn new ways of solving problems and performing activities, and crystallized intelligence, which refers to the accumulated knowledge of the world we have acquired throughout our lives.


These intelligences must be different because crystallized intelligence increases with age—older adults are as good as or better than young people in solving crossword puzzles—whereas fluid intelligence tends to decrease with age (Horn, Donaldson, & Engstrom, 1981; Salthouse, 2004).

### 2.2.3 Academic Achievement

A study on Influences of Gender on Academic Achievement conducted by Linver, Davis-Kean and Eccles found that Overall, young women have slightly higher grades than young men (within each tracking group). For both young men and women in the honors/college track group, math grades start out fairly high (around a B+ or B), and then decline throughout high school, ending up at about a B- or C+. For students in the regular/basic math track, lower (about a C+) and then decline, ending up at about a C-. *t*-tests was conducted to determine gender and track differences in both math school grades from 6th through 12th grades. It was found that young women’s school grades in math were consistently higher at every grade (all *t*-tests significant at *p* < .05). Young women’s grades were about .5 to 1 point higher on a scale of 16, corresponding to about one-sixth to one-third of a standard deviation. When groups were examined by math class track, it was found that math school grades were higher in 6th and 7th grade for students the honors/college math class track; there were no significant differences for high school math grades.

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For all four math track by gender groups, math interest starts out between a 4.5 and 5.5 on a 7 point scale. For all gender and track groups, math interest declines, so by 12th grade is much lower (between 3 and 4). A $t$-test to examine differences by gender and track was conducted. Young men’s math interest was consistently higher than young women’s; this difference, however, was not statistically significant at any grade level. Math interest was significantly higher for 6th and 7th graders in the honors/college math track, with no significant differences for high school math grades.

Work by Eccles, Lord, Roeser, Barber, and Jozefowicz (1997)\textsuperscript{255} found that gender differences in enrolment in advanced mathematics courses in high school are mediated by gender differences in expectations for success in math and physics and perceived value of competence in math.

Jacobs, Lanaz, Osgood, Eccles, and Wigfield (2002)\textsuperscript{256} found that self-concept of ability and task value in math decline for both genders between first and twelfth grades with no real difference between girls and boys trajectories over time. In fact, by the twelfth grade, girls valued math more than boys when controlling for self-concept of ability in math. This research might suggest that women should be just as represented in the technology or mathematical work force as men. This, however, is not the case. Even though women have made great strides in the law, medical, and social science professions, very few can be found in graduate programs or professions in mathematics, computer science, and other technical fields.


physics, engineering, or information technology jobs (Eccles, 2001).

Many ideas have been put forth on why high achieving women may not be entering this profession including discrimination, gender-typed socialization, self-concept of ability in these areas, and the value and interest that women have in these professions (Eccles, 2001).

Busch (1995) reported female students have significantly lower self-efficacy than males with respect to Mathematics related and other traditionally male dominated subjects including Computer. Other researches on inter-relationship of gender and Mathematics have reported no significant gender difference in academic achievement in Mathematics (Abubakar and Eze, 2010; and Witt-Rose 2003). Another observable trait Age has been reported to have significant influence on achievement in Mathematics. Agwagah and Harbor-Peter (1994) have reported that little differences are identified between males and females in Mathematics achievement at ages 9 through 13 years but at age 17, females perform poorer than the males.

Determinants of academic achievement in basic education have been widely studied in the literature. Most of the studies that are indented to evaluate the determinants of quality of education by using academic performance tests include as explanatory variables the student’s socioeconomic background, school inputs, and inborn factors.

Some of the most common findings of these studies are: i) Socioeconomic background, usually measured by the educational level of the student’s parents, has a positive impact on the school achievement (Peragine and Serlenga, 2007\textsuperscript{262}; Checci and Peragine, 2005\textsuperscript{263}); ii) Boys do better than girls in standardized tests of Mathematics and Science (Hyde \textit{et al}, 1990\textsuperscript{264}; Benbow and Stanley, 1980\textsuperscript{265}; and Fuchs and Woessmann, 2008\textsuperscript{266}); iii) the quality and quantity of school’s resources maintain an unclear relation with school attainment (Altinok and Bennaghmouch, 2008\textsuperscript{267}; Al Samarrai, 2002\textsuperscript{268} among others). However, the increase and efficiency of the amount of educational resources in the school will have a higher effect when the student is open to learning and has incentives to study because one of the main components of the ‘effort’ done by the student is his motivation to learn. The role of self-motivation is usually not included in empirical applications as a consequence of the information availability. Self-motivation could positively affect educational attainment by at least two different channels.

On one hand, greater motivation is directly related to students’ effort (attendance, discipline, time devoted to homework, among others)

\textsuperscript{263} Checchi, D., Peragine, V., 2005. Regional Disparities and Inequality of Opportunity: The Case of Italy. IZA Discussion paper series, DP No. 1874.
\textsuperscript{267} Altinok, N., Bennaghmouch, S., 2008. School Resources and the Quality of Education: Is there a link. Association Francaise de Cliometrie. Working Papers, No.1
(Cooper, 1989\textsuperscript{269}; Betts, 1996\textsuperscript{270}; Bishop et al., 2003\textsuperscript{271}). On the other hand, motivation could increase the perceived utility of learning. Several studies, carried out at personal level, showed that the outcomes of cognitive skills tests are good indicators of pupil’s future income (Boissiere, Knight and Sabot, 1985\textsuperscript{272}; Bishop, 1989\textsuperscript{273}, 1992\textsuperscript{274}; Moll, 1998\textsuperscript{275}).

Hanushek (1986)\textsuperscript{276}, Colclough and Lewin, (1993)\textsuperscript{277}; and Schultz (1995)\textsuperscript{278}, among others. Al Samarrai (2002)\textsuperscript{279}carries out a review of literature concerning the relationships between school resources and educational performance. He concludes that there is no clear relationship between these two variables.

Dzama and Osborne (1999)\textsuperscript{280} studied on the causes of poor performance among African students including the interaction between traditional cultures and science and find that poor performance in science

among African students is caused by the absence of vocational incentives rather than by the conflict between science and African traditional values and beliefs. They argue that conflict between science and traditional beliefs and values is not peculiar to Africans. They demonstrate that in the growth of science in developed countries, improvement in the performance of students succeeded rather than preceded industrial and technological development. As it can be seen, student’s motivation is crucial for better academic results when it is complemented with basic resources or assets. The relationship between student’s test scores and school’s capital stock is neither unique nor statistically significant.

Hanushek and Kimko (2000)\textsuperscript{281} found that results on tests in mathematics and sciences are positively correlated to the economic growth of the per capita GDP at international level.

Wossmann (2000)\textsuperscript{282} found some interesting results. First, boys outperform girls in math and science but not in reading; second, there is a positive relationship between the country’s educational expenditure per student and the final score in math and science. Third, having better equipment materials and better educated teachers increases student performance in science. Fourth, students in publicly operated schools perform worse than those in privately operated schools.

\section*{2.3 Conclusion}

In this chapter the Investigator has presented a brief review on the studies conducted by different researches in India and abroad. The first


group of studies deals with the Scientific Attitude, the second group of studies deals with Intelligence and the third group of studies deals with the Academic Achievement of the students. Therefore, this chapter deals only with the past researches.