CHAPTER TWO

REVIEW OF RELATED LITERATURE
AND RESEARCHES

2.1 INTRODUCTION

Any worthwhile research can be done by to review the related literature and other resources.

It is essential to survey the research work done by others in various fields. It helps in growing a research project in our area of reach priorities. The current research is integrally connected with past-researches. The investigator surveyed various resources of literature from both primary and secondary resources. Primary sources in the form of direct description of the study by the researches who have actually observed the events and secondary sources in the form of publications by eminent scholars, not directly observing the events. The investigator surveyed various Encyclopedias of education and educational research, educational journals, thesis, Government publications, educational indexes, directories, bibliographies, technical reports of educational research survey of educational researches edited by Prof. M. B. Buch and published by NCERT, New Delhi. This survey could help the investigator in analyzing researches in the field of Scientific Aptitude.
2.2 RELATED LITERATURE SURVEY - A NEED

Review of related literature provides a summary of the writing of recognized authorities and the previous researches provide evidence that the researches is familiar with what is already known and what is still unknown and needs investigation. Since effective research is based upon past knowledge, this step helps to eliminate the duplication of what has been done and provides useful hypothesis and helpful suggestions for significant investigation. It also provides solution to some unanswered questions after experimentation on a sample. The investigator has searched the related literature carefully and is also thoroughly grounded in the terminology, concepts and technical skills – necessary to understand and analyze the data gathered.

Every worthwhile research study in the field of knowledge requires an adequate familiarity with the work, which has already been done in the same area. A summary of writings of recognized authorities and of previous research provides evidence that the research is familiar with what is already known and what is still unknown and untested. Since effective research is based upon past knowledge, this step helps to eliminate the duplication of what has been done, and provides useful hypothesis and helpful suggestions for significant investigation (Best 1982)

2.3 IMPORTANT ELEMENTS FOR PRESENT STUDY

In searching related literature, the researcher should note certain important elements. They include

1) Report of closely related studied that have been investigated.
2) Design of the study, including procedures employed and data gathering instruments used.

3) Populations that were sampled and sampling method employed.

4) Variables that were defined.

5) Extraneous variables that could have affected the findings.

6) Faults that could have been avoided, and

7) Recommendations for further new research in Education.

In India, systematic and sustained research is lacking in the field of aptitude testing in general and measurement of scientific aptitude in particular (Sharma 1980). Nevertheless, after the recommendations of the Secondary Education Commission (1952) were adopted, interest in aptitude testing grew and same independent attempts were made by Indian researchers to standardize scientific aptitude tests and to measure scientific aptitude. The researchers, namely Verma (1957), Mitra (1963), Choudhari (1965), Nair et-al (1968), Deshpande (1967), Mukherji and Chatterji (1972), Gupta (1975), Ojha (1975), and Sharma (1980) developed scientific aptitude tests.

2.4 REVIEW RELATED TO SCIENTIFIC APTITUDE

David Zyve\textsuperscript{14} (1926) Dr. Zyve completed at Stanford University a study of scientific aptitude. The measuring instrument in which Dr. Zyve devised in connection with this study in a test which requires between one and a quarter and two and a half hours to administer. The reliability, based upon the correlation between two forms administered to forty undergraduates is 0.93.

Crawford\(^{15}\) (1960) with Stanford Scientific Aptitude Test reported a correlation of 0.3 between scores earned on this test by entering pupils and their first year grades or marks in science and pre-engineering course. In support of this finding, Bennett, Seashore and Weishman (1960), the constructors of the Differential Aptitude Tests, found that the success in science shows highest correlation with verbal reasoning, numerical ability and certain aspects of language aptitude. The Guilford-Zimmerman Aptitude Survey of 1950 also revealed that there was a significant relationship between science achievement and scientific aptitude.

Dave\(^{16}\) (1964), The present test was designed to measure scientific aptitude of high school pupils and to help the authorities concerned in selecting and admitting pupils to the science courses at the university level and help in early identification of exceptional science talent.

The term scientific aptitude was analyzed in term of basic traits, viz. 1) Scientific comprehension 2) Mechanical reasoning 3) Numerical ability 4) space relation and 5) Scientific information. In the beginning 180 items were prepared and administered to two criterion groups consisting of pupils having high low scientific aptitude, selected on the basis of teachers rating and achievements in a general science test. Chi-square employed and the items which discriminated between the two groups were considered valid. The items difficulty and internal constancy of each valid item was found out by administering the test to 370 S.S.C. class pupils selected as random from


thirteen different schools of five districts of Gujarat State. The final test consisting of 100 items was standardized on a sample of 1218 S.S.C. class pupils selected randomly from thirty two schools and three coaching classes of seven districts of Gujarat. The time limit for the whole test was fifty minutes.

The value of the mean, median and standard deviation of the test scores were found to be 28.17, 28.00, and 9.90 respectively. The chi-square test of goodness of fit showed that the scores were normally distributed. The reliability coefficients calculated by test retest, split-half, rational equivalence and analysis of variance method were 0.92, 0.92, 0.91 and 0.89 respectively content, construct, concurrent, predictive and cross validity coefficient were also computed.

Deshpande\textsuperscript{17} (1964), in this study, a sample has been made to evolve a battery of test of measure aptitude for science. The major purposes for constructing the test were 1) to help and select pupils for science courses at the end of Class VIII and 2) to provide a tool to predict the likely achievement of the pupils in science courses in future. The test was constructed for use in the Vidharbha area of Maharashtra State.

The battery consists of six sub-tests on 1) Number 2) Reasoning 3) Problem solving 4) Memory 5) Physical relation and 6) Finger dexterity. The test was tried out on a sample of 409 pupils of grade VIII from eight high schools of Nagpur, Amravati and Washim. In the tryout from there were 268 items in addition to the finger dexterity test. Davis’ table were used for item

analysis the final draft of the test consisted of 201 items and the finger
dexterity test for normative data, the final test was administered to 856 pupils
from seven schools of Nagpur and Amravati. The pupils have passed Class
VIII. The distribution of the scores was found to be normal. The reliability
coefficients of the individual test ranged from 0.65 to 0.92. The reliability
coefficient for the composite test, by using Mosier’s formula, was found to be
0.94 the validity coefficient of the test, by using Thompson’s inverse matrix
method and by Aitken’s method of pivotal condensation and corrected for
shrinkage was found to be 0.56. A sharp differentiation between the poor and
good achievers was made available by the use of discriminant function. The
factor analysis involved in the test and criterion performances. The existence
of a substantial ‘g’ as a first major factor running through all the variables was
displayed. The highest loading of 0.72 of the second factor was obtained by
the criterion. The factor showed that there was a soft of ‘Motor Mechanical
Manipulative’ factor in the criterion which linked it with higher dexterity. The
Factor matrix without criterion showed the highest loading of 0.68 in the first
general factory on problem test which nearly assumed the character of
achievement in science examination. The school factor was a pure ‘N’ factor
having no linkage with other test. In both the analyses, the second factor was
of subordinate nature, particularly in the bipolar grouping variables. The
variable in the order of their saturations by the factor had the following pattern
criterion, number, problem, reasoning, memory, physical relations and finger
dexterity. This process demonstrated that the tests were working together in
the common direction of a functional unity which had a major share in the
criterion of examination marks unknown reliability and validity.
Sood (1974) The major objectives (1) To construct an attitude scale so as to measure the differences of attitude towards science and scientists between male and female pupils and teachers (2) To determine the relationship between the pupils' and teacher's understanding of nature of science.

The sample of the study comprised 1,000 students and teachers. The pupils were selected from high socio-economic strata and from seven English medium schools of Delhi and Rajasthan respectively. An attitude scale, the test on understanding science. From W, the Socio-Economic Status 6 Scale Questionnaire (SESSQ) urban developed by Jalota, Pandey, Kapoor and Singh were the tools of research. In addition annual examination marks of the pupils were also used as data.

The major finding (i) The sample reflected positive attitude towards science and scientist which was significantly related to understanding science. (ii) The attitudes of pupils and teachers differed significantly (iii) There was significant deference in attitude towards science and scientist between National Science Talent Search (NSTS) awardees and non-selected NSTS pupils. (iv) Sex deference was not significantly related to attitude towards science and scientists.

Dani (1984) The major objectives of the study (i) To measure the scientific attitude of higher secondary pupils (ii) To find out the cognitive styles of the higher secondary pupils, (iii) To compare the scientific attitude and

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cognitive styles of boys and girls, village, town and city pupils, science arts and commerce pupils.

The sample for the construction of a scientific attitude test comprised 1265 pupils selected by stratified cluster sampling and by purposive sampling techniques. The sample was selected from a total of 48 schools from cities, towns and villagers. The tool used was Scientific for Attitudes Study (SAS) constructed by investigator and Group. Embedded figures tests by Offman Rasin, Witkin. The method employed for the study was a combination of the normative, correlational and comparative survey method. For analysis of the data and drawing of conclusions, analysis of variance regression and factor analysis were used.

Some of the major findings were 1) About 80 present of pupils had a positive a scientific attitude. 2) Boys and Girls did not defer in scientific attitude scares. 3) The scientific attitude of the science student was higher than that of the arts and commerce pupils.


The objects of the study were (i) To assess adolescent pupils’ attitude towards science, and (ii) To find out environmental and academic factors that influenced their attitude towards science. The dependent variable was attitude towards science, and three categories of independent variables were environmental influence measured by parental education, income and socio-

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economic status, influence of teachers and peers, and vocational value of science; achievements in language, physical science, life science and social study; and scientific aptitude measured by numerical ability, mechanical reasoning and space relations. The hypothesis was: There is no significant difference between the pupil having a highly positive attitude towards science and those having a highly negative attitude towards science with respect to any of the independent variables stated above either in isolation or in interaction.

The sample drawn on the basis of stratified random technique, consisted of 420 adolescent pupils, 221 boys and 199 girls, from 21 schools of Calcutta. The scientific attitude was measured by Science Attitude Scale of Avinash Grewal. The data were represented by Charts and Tables, and analyzed by statistical tools like t-test, ANOVA and Chi-square test.

The major finding of the study were (1) Pupils having a high positive attitude towards science and negative attitude towards science were different with respect to the independent variables either in isolation or in interaction.

**Banamali Das** (1986) The major objective of the study was to construct and standardize a scientific aptitude test in the oriya language for the class tenth pupils as a tool for use in schools of Orissa for selection and identification of scientific talent. For the construction of the test, four component of scientific aptitude were selected, viz. general intelligence, reasoning ability, operational ability and scientific knowledge for the purpose

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measuring general intelligence the Cattell’s Test of General Intelligence was adapted. In order to measure reasoning ability, the test has two sections having 36 and 12 items respectively. Similarly the test of operational ability was divided into two sections having 22 and 18 items respectively. The scientific knowledge test had 92 items in total. The first try-out of the test was done on a sample of 200 tenth grade pupils. On the basis of the performance of sample pupils, item difficulty and item validity were computed. The final form of the test battery had 215 items in total whereas the area of general intelligence has 35 items, reasoning ability 48 items; operational ability 40 and scientific knowledge had 92 items. The time required for all these components was 15, 25, 25 and 35 minutes respectively. The test retest reliability was established for all the four components of the test battery. The reliability coefficients for the four components were 0.81, 0.91, 0.92 and 0.80 respectively. The validity of the test battery for making predictions was computed on the achievement scores of science and mathematics.

**Jose** (1987) conducted a study by using Kerala University Science Aptitude Test and found that about 70 percent of 9th class pupils possessed average scientific aptitude and about 15 percent each possessed high and low scientific aptitude.

**Ghosh** (1989) the main purposes of the study were (i) To ascertain the aptitude of the pupils in science with the help of a specially developed scientific aptitude test. (ii) To appraise the extent of scientific attitude of the

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pupils with the help of a specially developed attitude test. (iii) To find out the extent of academic motivation of the pupils with the help of a standardized test, and the SES of the parents of the pupils with the of an SES questionnaire. (iv) To find out sex-wise the strata-wise differences, if any, in the scientific aptitude and scientific attitude of the pupils. (v) To determine relationship between the scientific aptitude and variables such as scientific attitude and academic motivation of the pupils (vi) To develop a regression equation of the scientific aptitude on the independent variables indentified by the researcher.

A scientific aptitude test was standardized on 620 boys and girls of class IX in 13 different schools situated in urban and rural areas in different districts of West Bengal. A scientific attitude test was also developed (N = 200) Bhattacharya’s Academic Motivation Test, Kuppuswamy’s (Urban) and Pareeks (Rural) SES scales were used. Central tendency, variability, ANOVA, correlation, F-test, and t-test were used

The major findings were: 1 Urban pupils did not show better performance in the scientific aptitude test than rural pupils.2 Pupils having high scientific attitude were superior to those having low scientific attitude with respect to their scientific aptitude.

Bhaskara\textsuperscript{24} (1995) conducted a study on a comparative study of scientific attitude, scientific aptitude and achievement in biology at secondary school level. The total sample of 600 pupils studying in tenth class in

secondary school of Guntur district Andhra Pradesh were included age levels of pupils was 14 to 15 years. The tools used were scientific attitude scale of J. K. Sood and R. P. Sandhya and Kerala University science aptitude test of Nair et al. The marks in biology scored in the pre-public examination of the tenth class of the district were taken into consideration among scientific attitude; scientific aptitude and biology achievement was highly significant and positive.

Ariyo\textsuperscript{25} (2007) conducted a study on construction and Validation of general science aptitude, whose major purpose was to develop and validate a General Science Aptitude Test (GSAT) for junior secondary school graduate seeking admission into senior secondary school one in Nigeria. The specific objectives were to describe the various stages in the development and validation of GSAT and determine the psychometric properties of the instrument. The Pearson product Moment Correlation, Test difficult index, discriminative index and the Kuder Richardson 21 statistics were used for the analysis of results. The result of analysis shows that GSAT was moderately difficult for the sampled pupils, while the instrument was found to be reliable since internal consistency was found to be 0.90. The inter-correlation among GSAT’s sub scale was found to be substantial. GSAT is recommended for use in other part of world.

Paramanand Singh\textsuperscript{26} (2007) The present world is witnessing a number of environmental crises, which are the result of the unmindful exploitation of natural resources by human being. There is an urgent need to create environmental awareness among all human beings to conserve, protect and nurture our environmental resources. Consequently, environmental education is included in school curriculum right from the very beginning. The present study was conducted to study the environmental awareness among higher secondary pupils of Varanasi District of Uttar Pradesh. The Finding of the study indicated that environmental awareness has positive relationship with scientific attitude among pupils and science pupils were found more aware about their environment as compared to arts pupils.

This paper attempts to explore the extent of which scientific attitude and scientific aptitude help in improving environmentally sensitive behaviour. In this paper environmental practices pertaining to conservation of nature, control of noise pollution, water conservation, health and hygiene, energy conservation and limiting use of poly products have been taken into consideration. The sample consisted of 480 pupils who are studying in IX and X standards. It is found that scientific attitude is influencing environmental practices of children where as scientific aptitude is influencing environmental practices of children where as scientific aptitude is not curiosity and open mindedness components of scientific attitude do contribute in developing environmental practices that could be developed through scientific attitude are conservation of nature, control of noise pollution and limited use of poly products.

\textsuperscript{26} Paramanand Singh (2007). Studied on Relationship between Environmental Awareness and Scientific Attitudes among higher secondary pupils. \textit{Journal of Indian Education}. Vol. XXXIII, Number 2, p. 52-62.
2.5 REVIEW RELATED TO APTITUDE, ATTITUDE, TOWARDS SCIENCE SUBJECT

Giri\textsuperscript{27} (1976) The main purpose of the study was to develop a test battery to measure the aptitude for the study of physics of the high school science seniors of the state of Bihar.

A battery of tests having four main parts (Parts I, II, III, IV and IV B) covering different areas (viz. functional knowledge, conceptual understanding of physics, creative thinking in physics, knowledge of the nature and structure of physics, and scientific attitude) was developed. Difficulty level, discriminative power and internal consistency of item were found out. The final version of Parts I, II, III, IV A and IV B included 30, 30, 30, 16 and 16 items, respectively. The standardization sample was derived from seven institutions of Palamau, Ranchi, Patna, Dhanbad and Singhbhum by adopting the purposive – incidental sampling technique. The scores on the full test battery were available for 177 pupils. Central tendency, variance and nature of distribution of scores were computed. Reliability was calculated through split-half, K-R formula-20 and Flanagan’s formula. Content, criterion-related and factorial validity were determined. Scales and norms (standard scale, T-scale, P.R., Percentile, Stanine and letter grading) were prepared. Multiple correlation (R) was computed and prediction equations were prepared. Forecasting efficiency of the test was determined. The Doolittle test selection method was used to select tests to form the present test battery. A test manual was prepared.

Khouy and Voss (1985)\(^{28}\) found, among the attitudes, student motivation and usefulness of science were the most important predictors for course plans. Napier and Riley (1985) explored the relationship between affective determinants and science achievement and found that affective determinants are highly correlated with science achievement. Harty et. al. (1986) investigated relationships among attitude towards science, interest in science, curiosity and self-concept in science ability. The study revealed attitude towards science, interest in science, and science curiosity are highly related with science ability.

Johnson and Vitale (1988)\(^{29}\) conducted a survey on the gifted pupils’ attitude towards science and the result affirmed that liking science and achieving in science are related. Baker and Piburn (1988) identified the factors responsible for the perceived decline in attitudes toward science observed in an intervention study designed to enhance scientific literacy. Negative attitudes toward science were found to be related to the demand characteristics of the scientific literacy course, which emphasized problem solving. Paul et.al. (1988) determined the development of the attitude towards science.

Dabir\(^{30}\) (1988) the sample for the study was selected from schools in and around Nagpur. The sample consisted of 1080 pupils for standards 9, 10 and 11. The Occupational Aspiration Scale (OAS) and differential aptitude test


were administered to sample. The result did not show that aptitudes have positive association with the vocational aspiration of the school going youth.

Shrivastava\textsuperscript{31} (1988) probed into the science aptitude of higher secondary school science pupils in relation to their cognitive styles found significant sex differences in “dogmatism” only Srivastava, V. (1992) examined creativity among higher secondary pupils in relation to scientific aptitude and attitudes towards science. Whereas the study showed a relationship between scientific aptitudes and creativity, at the same time significant sex differences in aptitude, creativity and towards science existed in her study.

Schneider\textsuperscript{32} et al. (1989), studied in experiment 1 a total of 576 middle-class from 3\textsuperscript{rd}, 5\textsuperscript{th} and 7\textsuperscript{th} graders from rural and urban schools. Tools used were a-13 item questionnaire was used to assess children's knowledge about soccer children's scores on the verbal aptitude component of a German cognitive ability test fieller, Gadicks and Weinlader (1985) in experiment 2 a tools of 185 middle class children from 3\textsuperscript{rd}, 5\textsuperscript{th} and 7\textsuperscript{th} graders. Two studies compared memory performance and text comprehension of groups that were equivalent on domain-specific knowledge but differed in overall aptitude level was more important when the task was to acquire and use new information in the domain of interest. Results show that the levels of soccer knowledge and over all aptitude were varied in a factorial design. Neither study detected significant differences between high aptitude and low aptitude experts,


regardless of their ages. Low aptitude experts outperformed high aptitude novices on all memory and comprehension measures. The result indicates that domain specific knowledge can compensate for low overall aptitude on domain related cognitive tasks.

**Pillai**\(^{33}\) (**1990**) conducted a study on the sample of 800 pupils studying in Std. IX of 20 secondary schools in Kerala. The tools used were (1) Achievement test in biology developed by Ayishabi and Sulatha (2) Kerala University Science aptitude test std. by Nair and Ramanandan. (3) Scale of attitude towards science developed by Anand and Pillai; F value for factor science aptitude is significant at 0.01 level indicating that the pupils of three different levels of science aptitude is significant at 0.01 level indicating that the pupils of three different levels of science aptitude performed differently in biology achievement test. Similarly for factor attitude towards science also the F value is significant. The study reveals that biology achievement of secondary pupils may differ according to the differences in science aptitude or attitude towards science as the present study shows no interaction effect of science aptitude and attitude towards science. It may be possible that these two variables are contributing independently on biology achievement.

**Swanson**\(^{34}\) (**1990**) conducted study children from 4 to 5 whose cores were selected from 4 elementary schools additional information related to school aptitude was observed from the Comprehension Test of Basic Skills (CTBS1978). A sample of 25 high aptitude and 25 low aptitude children were

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taken. A questionnaire modified from Krcutzer et al. (1978) was used to assess metacongnition in the general domain of problem solving. The important finding was that high metacognitive individuals outperformed lower metacognitive individual’s problem solving regardless of their overall aptitude test. In fact high metacognitive knowledge/low aptitude children performed significantly better than low metacognitive knowledge children with higher overall aptitude scores.

**Sharma**\(^\text{35}\) (1990) studied scientific literacy, attitudes, towards science and personality tracts of pupils and teachers. His findings too received support from the large study by Sood, J. K. (1992). It is suggested that the conflicting finding as reported in these studies may be treated as hypothesis for further testing as known groups of pupils, teachers and members of the general public with a view to bring out the limitations of paper and pencil tests as well as the value and significance of the so-called theoretical mean. Further, the factor of desirability, that is, always giving the best response, may be further looked into.

**Baker and Piburn**\(^\text{36}\) (1991) reported the effect of a scientific literacy course on the skills in cognitive ability and attitude of pupils in the first year of high school. 250 ninth standard pupils were enrolled in a specially designed literacy course, which met for 3 hours and 20 minuets each week, for 39 weeks. Pupils were pretested for logical, spatial variable and mathematical ability as well as for attitude towards self and science and psychological type. The course was successful in teaching skills. In addition, there were

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significant increases in spatial, verbal, and quantitative ability. Increases in cognitive ability were predicted by logical ability, measurement skills, and academic self-concept.

Kulshrestha\textsuperscript{37} (2006) studied on Educational Aptitude of Prospective Teachers. Objectives (1) To study the teaching aptitude of prospective teachers; (2) To study the guidance aptitude of prospective teachers; (3) To study the management aptitude of prospective teachers; (4) To compare these aptitudes sex-wise. Method two hypotheses were formulated and tested in the light of objectives of the study (a) Prospective teachers do not differ significantly with respect to teaching, guidance, management and research aptitude; (b) No significant difference exist in educational aptitudes of male and female prospective teachers. A sample of 140 B.Ed. pupils, 64 males and 76 females, were selected by accidental method. R. P. Gupta’s differential aptitude test for four-fold educational activity was used to measure the aptitude of prospective teachers for teaching guidance management and research sectors of education. Findings: (1) Prospective teacher of both the groups have higher aptitude for teaching than the other three aptitudes; (2) Male prospective teachers are better in guidance and management aptitude than in teaching and research; (3) While comparing the differences of mean of both the groups no significant difference was observed.

2.6 REVIEW RELATED TO ACHIEVEMENT IN SCIENCE

Sharma\textsuperscript{38} (1975) The main objective of the study was to compare the achievement of pupils of delta class in general science and mathematics.

The institutions selected for the administration of the tests comprised 24 each of the four types of institutions, viz. rural, urban, boys’ and girls’ of the state of Rajasthan. The final form of the test in general science had 149 items and that in mathematics 100 items. The reliability of the tests was calculated by the application of split-half method on the scores of 200 boys and 200 girls. Guttman formula and Kuder-Richardson-21 formula were used. The coefficients of concurrent and congruent validities of the tests were obtained by correlating test scores with marks of the pupils in the annual examination, and also with the ratings of the pupils made by their respective teachers on a predetermined five-point rating scale. The coefficient of correlation was calculated by the application of product moment correlation technique taking the entire sample of 1708 pupils into consideration. In order to find out the variance in attainment of the different strata of the samples, analysis of variance was used.

The study revealed the following:

1) The prevalent syllabus in general science and mathematics for the pupils of the delta class in Rajasthan was highly effective, outmoded and wanting in a proper process of evaluation. There was no proper relationship between the course content prescribed in the syllabus and that presented in the textbook for the delta class pupils.

\textsuperscript{38} Sharma, V. S. (1975). New Delhi Comparative Study of the Achievement of Boys and Girls in General Science and Mathematics at Delta Class in Rajasthan. SIERT; Rajasthan, NCERT, Fourth All India Educational Survey, Vol. I, p. 748
2) The reliability of the test prepared by the investigator in general science ranged from 0.91 to 0.93 and that in mathematics from 0.96 to 0.88.

3) The validity coefficients of the test in general science ranged from 0.45 to 0.58 and that for the test in mathematics from 0.44 to 0.57.

4) The performance of the pupils in general science was highest in Sirohi, Sikar and Tonk districts and lowest in the districts of Bikaner, Udaipur and Bundi.

5) The performance of the pupils in mathematics was highest in Alwar, Ajmer and Sirohi districts and lowest in Bundi, Sawai Madhopur and Udaipur districts.

6) There was a significant difference between the performance of boys and girls on the test in general science and mathematics. The girls were superior to the boys in both the subjects.

7) There was also a significant difference between the performance of the rural and urban population on the test in general science whereas there was no significant difference between the performance of the rural and urban population on the mathematics test.

Chatterjee et al. (1978) conducted study on 115 boys reading in Class X in three different schools at Calcutta selected at random from Bengali medium higher secondary boys schools. Their ages ranged from 15 to 17 years. The tools were (1) Scientific Knowledge and Aptitude test (SKA) by Chatterjee. (2) Chatterjee’s Non-language Preference Record (CNPR). The results proved that considering the score in scientific scale in CNPR along

with the scientific aptitude score the prediction of the achievement in science can be significantly improved.

Bhattacharya ⁴⁰ (1979) The investigation was an endeavour to determine the position as to where Assam and Meghalaya stood in science education and also to find how they could go forward more effectively and more vigorously.

The study was of a descriptive survey type. Ten different categories of sample were drawn, viz. (i) School science teachers of Assam, (ii) School science teachers of Meghalaya, (iii) Heads of schools of both Assam and Meghalaya, (iv) Education officers, scientists, teacher educators and retired persons, (v) Trained teachers, teacher trainees and untrained teachers, (vi) Schools for field study, (vii) College teachers of Meghalaya, (viii) Meghalaya colleges teaching science, (ix) Examination results in arts and science subjects in four big colleges in Shillong, and (x) Tribal and non-tribal college pupils in Meghalaya. Questionnaires, interview schedule, rating scale, checklist, observation schedule, Flanders’s Interaction Analysis Category system (FIACS), Kuppuswamy’s Socio-Economic Status (SES) Scale (Urban), etc. were used. A field study was also carried out.

The major findings of the study were:

1) Assam and Meghalaya respectively had 70.65 percent and 86.85 percent of teachers eligible to teach science in secondary classes.

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2) The average teaching experience of science teachers in Assam and Meghalaya stood at 6.04 and 8.57 years respectively.

3) All the teachers qualified to teach science taught other subjects as well.

4) The economic condition of science teachers was poor. Most of the teachers had, besides salary, other sources of income. Private tuition was the most common source.

5) About 54 percent and 46 percent of the teachers of Assam and Meghalaya were prepared to give up teaching for other better jobs. The headmaster’s job was also not very attractive.

6) The Bengali, Assamese, tribal and other teachers did not differ in teacher effectiveness. Male and female teachers did not differ significantly in teacher effectiveness. The trainees and trained teachers and the married and unmarried teachers ranked about the same in teacher effectiveness but the untrained did very badly.

7) On Flanders’s tool the married teachers became the obvious choice.

8) Science was more popular among the non-tribal in the pre-university courses. The wastage of tribal’s and non-tribal in science education differed significantly. The tribal pupils’ attitude towards science education was influenced by their general aspiration level and also affected their enrolment in science.

9) Science education in the schools and colleges in Assam and Meghalaya had defects. Assam and Meghalaya together had
laboratories in 79.96 percent schools. The position of Meghalaya was better.

10) The number of books in the school library varied from 200 to 2,500 and the average came to 1240 books. The schools had hardly any freedom for purchasing books. Most of the schools did not subscribe to science journals. None of the schools had a trained librarian.

**Shinde,** 1982 The objective of the enquiry were (i) To study the involvement in non-formal scientific activities of secondary school pupils, (ii) To develop a scale to study the scientific attitude of pupils at the secondary stage, (iii) To study the scientific attitudes of secondary pupils (iv) To inquire into the relationship between the extent of involvement in scientific activities scientific attitude and achievement in science, and (v) To study the science teachers role in encouraging non-formal science activities. The sample comprised 1600 secondary pupils of Maharashtra Selected on a random basic from all the regions of the state. It also included 300 experts. The tools used were a scale to measure involvement in scientific activities, scientific attitude scale, and a checklist. Descriptive statistics were used for data analysis.

The study revealed the following (1) The means of non formal science activity scores achieved by adolescents differed from region to region. (2) The boys were better than the girls in their non-formal science activity involvement (3) The correlation between the scientific attitude scores and non formal science activity scores was negligible and not significant. Thus scientific

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attitude of the secondary student was not related to their involvement in non-formal activities. (4) The boys and girls did not differ in their scientific attitudes. (5) Girls showed a better relationship between scientific attitude and academic achievement than boys. (6) Scientific attitude of the pupils differed from region to region.

Gadkari$^{42}$ (1982) The major objectives of the study were: (i) To identify pupils who were deficient in general science with reference to specific units, (ii) To discover the area of difficulty (iii) To prepare a remedial teaching programme based on the analysis of errors committed by the pupils, and (iv) To measure the outcomes of the remedial teaching programme.

In order to collect the relevant data the method of simple random sampling was used for the selection of the sample. The investigator constructed 11 sub-tests for the pre-pilot testing on the basis of the analysis of errors of answer-books of 500 pupils of the terminal/annual examinations and unit tests of standard V in general science. The pre-pilot tests were divided into two groups. The first group consisted of five sub-tests and the other of six sub-tests. Each group of tests was administered to 50 pupils. Items having ambiguous structures were modified and then pilot tests were administered to 370 pupils for item analysis. After analysis, the final tests were prepared. The final tests were administered in two groups. The five tests of the first group were administered to 1289 pupils of standard V (653 boys and 636 girls) from 14 different schools from Kalyan, Dombivali and Thane region. The six tests of the second group were administered to 1335 pupils of standard V (675

boys and 660 girls) from 13 different schools of the same region. The remedial teaching tests were also prepared and administered to 165 pupils who failed in the annual examination in general science on the basis of the findings of diagnostic test. The booklets (Answer sheets) of the final tests were assessed and analyzed with the help of statistical techniques, viz. mean, standard deviation and percentages.

The major conclusions of the study were:

1) Pupils of standard V had developed wrong concepts in the subject of science.

2) The wrong concepts were identified with the help of diagnostic tests in science which were constructed by the investigator. Diagnostic tests helped to find out the nature of errors, on the basis of which the remedial teaching programme was framed for each unit.

3) The effectiveness of the remedial teaching programme was evaluated by finding out the significance of difference between the pre and post-remedial test scores of pupils who were found to be weak in the subject and on whom the programme was administered. The difference was found to be highly significant for each unit. It showed that the remedial teaching programmed helped to improve the teaching-learning process and thereby the correct or rectify wrong concepts formed by the pupils.

Anasari (1984) the objectives of the study were (i) To construct and standardize a battery of achievement tests in general science for pupils of classes V, VI and VII studying through Hindi as the medium of instruction in

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Greater Bombay, (ii) To compare the achievement in science of children studying in municipal and non-municipal schools in the city of Greater Bombay, and (iii) To compare the achievement of boys and girls in science.

For standardization of achievement tests, the test items were tried out on different samples. The tryout sample was 1200 pupils. Item statistics were calculated. The final sample for fixing the norms included 1702 pupils of class V, 1462 pupils of Class VI and 1391 pupils of Class VII. The norms were expressed in stanines, percentiles and standard scores.

The major findings were as follows:

1) The performance of boys was better than that of girls.
2) The pupils of non-municipal schools had a better performance in general science than those of municipal schools.
3) These findings held good for all the classes, viz. Class V, Class VI and Class VII.

Waggoner (1985) surveyed parents of elementary school pupils, teachers, and administrators in elementary schools in Missouri to compare their attitude toward science and found significant difference in the three groups' attitudes toward science.

Canon and Simpson (1985) studied relationships among attitude, achievement motivation and achievement and found that science attitude and achievement motivation declined through out the year. Simpson and Oliver (1985) studied attitudes toward science and achievement motivation of 4000

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pupils from grades 6-10 in a large school system. Results showed that, science attitude and achievement motivation declined across grades and from beginning to the end, each school year.

Hasan (1985)⁴⁶ studied the influence of selected instructional, student, and home variables on 313 grade 11 Jordanian pupils' attitudes toward science. Pupils' perception on their own science ability was found to be the only variable, affecting attitudes of subjects. Banu (1985) studied attitudes toward science held by secondary school pupils of Gonola State, Nigeria, and found that male pupils generally have more positive attitudes toward science than do female pupils. Banu (1985) studied attitudes toward science held by secondary school pupils of Gonola State, Nigeria, and found that male pupils generally have more positive attitudes toward science than do female pupils. Bridgeman (1985) and her associates determined the relationship between family environment and attitudes of seventh and tenth grade pupils toward science and significant correlation was registered between family science support and science attitudes among pupils.

Beall's (1985)⁴⁷ study revealed that no significant difference exist among, high, normal, and low science achievers in terms of science curiosity and attitudes toward science. He noted a significant relationship between achievement and attitude towards science. Harty (1985) also found significant relationship between elementary school pupils' science achievement and attitudes toward science. Kyle et.al. (1985) compared the attitude towards science of science curriculum improvement study (SCIS) pupils with those of

pupils in non-SCIS classes pupils (N = 456) and the findings indicated preference for SCIS process approach science.

**Ghosh** (1985) The main purposes of the study were: (i) To appraise the achievement of the pupils in physical science, (ii) To appraise the extent of academic motivation, intelligence, and socio-economic status of the pupils, (iii) To find out sex-wise and strata-wise differences, if any, in the achievement in physical science, (iv) To determine relationships among the scores of the Achievement Test in Physical Science, the Intelligence Test, the Academic Motivation Test and the Socio-economic Status Scale, and (v) To develop regression equation of the achievement in science on intelligence academic motivation and socioeconomic status.

An achievement test in chemistry was standardized on 450 boys and girls out promoted to class X reading in nine schools in West Bengal. Test-retest reliability, content, predictive and concurrent validity and T-score norms were developed Bhattacharya’s Academic Motivation Test and Group Intelligence Test Kuppuswamy’s (Urban) and Pareek’s (Rural) SES scale, were used along with the achievement test. Mean, SD, ANOVA test, Mann-Whitney U-test, correlation, etc. were used. Two multiple regression equations were developed.

Some of the major conclusions were:

1) Urban pupils did not show better performance in the Achievement Test in Chemistry (ATC) than rural pupils.

2) Boys did not show superiority in ATC over girls.

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3) There was a positive correlation between the scores in ATC and Academic Motivation Test, ATC and Group Intelligence Test, urban and rural pupils’ scores in ATC and ‘Income of the Parents’, rural pupils’ scores in ATC and ‘Education of the Parents’ as well as ‘Occupation of the Parents’.

4) Scores in ATC could be predicted from the scores in Academic Motivation Test, Group Intelligence Test and SES of the parents through multiple regression equation.

5) The ATC was reliable and valid. Norms were also satisfactory.

Hamrick and Harty (1987) determined the influence of resequencing general science content on sixth grade pupils’ science achievement, attitude towards science and interest towards science. The findings of their study revealed that pupils for whom content structure was classified through resequencing general science chapters exhibited significantly higher science achievement and significantly more positive attitude towards science, than pupils for whom general science content was not resequenced.

Brody and Benbow (1990) conducted two studies to determine (a) Whether differential educational experiences contribute to differential growth on Scholastic Aptitude Test. (SAT) score of (b) Whether such experiences must occur over a long rather than a short duration to have impact. Specific content knowledge in mathematics / science and verbal areas taught during a short time interval did not increases SAT-M and SAT-V scores even when the content was of the type required to solve SAT problems. Exposure to

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academically rigorous educational experiences over a long time period, (5 years) did relate to development of abilities measured by SAT. In addition pupils who experienced very large gains on SAT over this 5 years period, in comparison with pupils with small gains, were achieving better in a more rigorous program of high school courses in mathematics and science for the SAT-M and in verbal areas for the SAT-V. Result supports the position that educational experiences over time influence SAT scores.

Mohpatra\textsuperscript{51} (2000) studied on the Gender effect on Achievement in Science. Objectives – To find out gender difference in achievement problems related to mechanics under Indian conditions. Method – Descriptive survey method, qualitative and quantitative approaches were used for the study. The sample taken 25 boys and 25 girls of classes V, VII, IX of D. M. School Bhubaneshwar, and using probability sampling method for the study. Tools used as a questionnaire to the pupils. Findings – (1) There existed large difference in achievement in mechanics. (2) In class IX the ‘t’ value was 0.09 and D value was 0.02 which showed there was almost negligible difference in achievement in mechanics by boys and girls. (3) It found drastic change in achievement in mechanics that occur for girls but such remarkable change existed for boys. Eight references were cited in the study.

Marika K.\textsuperscript{52} (2010) investigated differences in self regulatory processes of fifty one high school juniors who were high, average or low achieving pupils


in science were studied using a macro analytic methodology. It was hypothesized sub processes of Zimmerman’s cyclical phase modern of self regulated learning (SRL), spend more time studying, and display higher test performance score than average or low achieving science pupils. Gender differences in self-regulation and learning of science were also studied. Pupils were individually given a science passage to read study and be tested upon. A macro analytic methodology was developed to assess pupils’ thoughts, feelings and behavior about science learning during forethought, performance and self reflection phase. Trend analyzed revealed twelve positive linear relations between pupils’ level of achievement and their level of self regulation, study time, and science performance. The size of each of these linear effects was large. It was concluded that pupils who are three phase model than those who are average and low achievers regardless of gender. Significant study time differences were also found with the high and average achievers spending more time studying than the low achievers.

Madhuchandra Mukherjee\(^53\) (2011) examined Effectiveness of Concept Attainment Model (CAM) in terms of achievement in science of class VIII. The study was experimental in nature. The objective of this study was to study the effectiveness of Concept Attainment Model in term of achievement of pupils in science. Incidental sampling method was adopted. A total sample of 30 pupils from two governments higher secondary schools of Indore city were selected Concept Attainment Model was found to be effective in term of achievement of pupils in science.

2.7 REVIEW RELATED TO SCIENCE TEACHING, SCIENCE FAIR, SCIENCE EXHIBITION

SCERT\textsuperscript{54} (1980) The objectives of the study were (i) To examine the science fair and educational exhibition with a view to evaluating creativity, (ii) To evaluate the science fair and educational exhibition from the point of view of organizers, teachers and participant pupils, and (iii) To assess the effectiveness of the science fair and educational exhibition from the point of view of teachers and pupils with respect to attainment of new knowledge and using innovations in teaching.

The study was conducted with a sample of ten organizers, 60 teachers and 200 pupil participants. They were administered different questionnaires. The questionnaire for organizers was used to know about the organization of the science fair. The questionnaire for teachers and pupils was used to know about the theme and use of the science fair. The sample organizers were also asked to observe the creativity level of the participants in the science fair.

The findings of the study were:

1) More than 50 percent teachers felt that the main themes selected for the science fair for high school and upper primary classes were clearly brought out.

2) Almost all participant pupils felt that the science fair was helpful to clarify their understanding of various concepts in science.

3) The organizers felt that creativity of the pupils was fully exhibited in the science fair. They also opined that creativity was more in physical sciences than in life sciences.

4) The teachers felt that the science fair was helpful in bringing out creative talent among the pupils.

5) The innovations brought out in the science fair were of high standard.

6) The teachers felt that the prizes given in the science fair were not adequate.

7) The pupil participants felt that the criteria of judgment were suitable and appropriate.

8) The organizers indicated that pupils who showed their talent in the state level exhibition should be given extra coaching by the state to compete for science talent examinations held at national level.

9) The organizers and the teachers felt that the science fair was very effective as the pupils were able to learn many new concepts which otherwise could not be easily clarified in the classroom.

10) The pupil participants felt that after the science fair the teachers used many new methods of teaching to teach concepts in science.

**Natarajan**55 (1983) The objectives of the study were (i) To evaluate the organization of district level science fairs in the districts of Andhra Pradesh and (ii) To evaluate the achievement of the objectives of the science fairs and exhibitions organized at district level.

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The study was a survey of opinions of teachers and pupils who participated in the school science fairs and exhibitions organized in 12 different districts of Andhra Pradesh. A sample of 200 teachers and 400 pupils of different schools were taken. They were administered two questionnaires. The first questionnaire for teachers was to know their opinion about the science fairs and educational exhibitions in which they had participated. The second questionnaire for pupils was to know their opinions about the benefits of the science fairs and educational exhibitions to which they had gone as observers or participants.

The findings of the study were:

1) Many pupils felt that they benefited from the books of science and made use of their own efforts in the organization of science fairs.

2) Pupils felt that these fairs not only motivated them but also motivated their teachers to use innovations in the classroom.

3) Teachers as well as pupils felt that the science fairs helped in using local resources easily.

4) With the science fairs and organization of exhibitions, the teacher-student interaction and participation of both teachers and pupils increased.

5) The science fairs and exhibitions helped in building rapport among administrators, teachers and pupils.

6) With the organization of science fairs cognitive insight of teachers and pupils increased.

7) Teachers expressed that the scheme was good and it helped them to make their teaching easier for pupils.
8) In case of organizational aspects of science fairs, 66 percent of teachers opined that winners should be given certificates but most of them favoured those participants should be provided scholarships.

9) Pupils, teachers and the organizers were of the view that there was a need for separate committees for arrangement of science fairs and a different committee was required for speedy judgment.

Vardhini⁵⁶ (1983) The objectives of the study were: (i) To develop a validated multimedia instructional strategy for teaching science (physical and chemistry) in Standard VIII, (ii) To study the relationship between achievement using the strategy and intelligence and scientific attitude, (iii) To develop alternative instructional inputs and study their effectiveness, and (iv) To study the feasibility of the strategy in terms of time and cost.

The instructional strategy was validated on a single group of 45 pupils of class VIII of an English medium school of Baroda City. The control group consisted of 47 pupils of another section of the same grade who were not exposed to the strategy. The inputs of the strategy were introduction, lecture, discussion sequence, discussion, guided discovery, audio-visual and biographical accounts, summaries, glossary, diagrams, exercises and assignments, criterion tests and feedback. The experiment was conducted for one academic year to cover 19 units of the subjects chosen for study. The instruments used in the study were: (a) Criterion test and comprehensive tests prepared by the investigator, (b) Scientific attitude scale prepared by the researcher, (c) Madhokur Patel’s Intelligence Test, (d) A reaction scale

prepared by the investigator and (e) The examinations conducted by the school. Descriptive statistical techniques and the test were used for analysis and hypothesis testing.

The major findings of the study were:

1) Almost all the units indicated average/high level of performance on the total test.
2) The strategy was found valid against the criterion of scientific attitude in that significantly higher performance was noted for the group in the post-test over the pre-test.
3) Validity of the strategy was established from reactions expressed by pupils for its continuance and also their improvement in science achievement.
4) Intelligence and achievement using the strategy presented a significant relationship.
5) A significant relationship was found between scientific attitude and achievement for the experimental group and control group.
6) Visual projections with teacher explanation and those with taped commentary were equally effective in terms of achievement.
7) Programmed material and discussion sequence were equally effective on the total test.
8) The strategy was found feasible when seen in terms of its reproducibility and the cost management by individual schools.

The educational implication of the study is that for achievement of different instructional objectives, a systematically validated multimedia
strategy can be implemented at school level with suitable cost and time components.

Desai (1986) Setting up 16 objectives, the study proceeded to investigate into aspects of science teaching touching the sufficiency of science teachers’ qualifications, understanding of the course content, effect of teachers’ workload, practical work competence, methods and aids of teaching evaluation procedures, co-curricular activities, teacher reaction to the syllabus and its efficiency, sufficiency of laboratory and library facilities, in serving training, effect of handbook, problems of syllabus implementation and suggestions for improving science teaching.

The study used two specially constructed questionnaires addressed to headmasters and assistant teachers as tools in the collection of data mainly in the form of opinions. The sample consisted of 348 headmasters and 667 assistant teachers belonging to 460 higher primary schools from the four educational divisions of Karnataka, viz. Belgaum, Bangalore, Gulbarga and Mysore. The analyses of the data were presented in 104 tables following the, frequency percentage method.

Finding separately 36 opinions from the headmasters and 21 from the teachers as having considerable percentage strength, the investigator presented a list of eight opinions in which both agreed. The opinions were:

1) Teachers had the practice of writing lesson plans.
2) Schools did not have science clubs.
3) Schools had no laboratory.
4) Experiments performed by teachers were helpful in learning.

5) There was no help from higher authorities to improve the laboratory.

6) Scientific knowledge in the science text was suitable in day-to-day life.

7) Teachers were not specialized to teach science subjects.

8) The science textbook was attractive.

2.8 CONCLUSION

The investigator came across through the all researches and decided to study the Scientific Aptitude of tenth class pupils studying in Nashik District. In all the past researches researcher studied for the particular variables only like, Boys, Girls. In the present research researcher taking different condition of living, then school types etc. Researcher taken the opinion of expert in the education and then decided to use. The standardize scientific aptitude test i.e. Kerala University Scientific Aptitude test is used. This test includes the testing of different like numerical, logical, Intellectual thinking of student. The test content five different subtests.

Test 1 Number Series. Test 2 Science Information.

Test 3 Formulation. Test 4 Spatial ability.

Test 5 Verbal comprehension and Interpretation.