CHAPTER – II

REVIEW OF RELATED LITERATURE

2.1 INTRODUCTION

The review of related literature is a crucial aspect in any research. No research begins in vacuum. Knowledge of what has already been done or being done is essential for doing research in any field. Researcher takes advantage of the knowledge, which has accumulated in the past as a result of constant human endeavour.

Review of related literature allows the researcher to acquaint himself or herself with the current knowledge in his or her field and it will be an effective search for specialized knowledge possible.

“Practically all human knowledge can be found in books and libraries. Unlike other animals that must start a new with each generation, man builds upon the accumulated and researched knowledge of the past”

— John W. Best (1988)

A familiarity with the research on any problem area helps the researcher to discover what is already known, what others have attempted to find out, what methods of attack have been promising or disappointing and what problem remains to be solved. It provides a background for the research process and makes the researcher aware of the status of the issues. It enables the researcher to know the recommendations of previous researchers listed in these studies as for further research. It also provides ideas, theories and explanation in formulating the problem.

Review of related literature provides valuable guidance in order to comprehend the problem holistically and the extent of advancement in research field
on the topic. It envisages and explores the innovative insight for appropriate methodology and research design. According to Fox (1969) review of related literature encompasses the following functions;

- Gives conceptual frame of reference for the contemplated research.
- Helps in understanding of the status of research in the problem area.
- Provides sufficient insight to the research approach, method instrumentation and data analysis.
- Evaluates the probability of success of the contemplated research and the significance or usefulness of the findings and
- Guides specific information needed to state the definitions, assumptions, limitations and hypotheses of the research.

The review of related literature involves the systematic identification, location and analysis of documents containing information related to the research problem. The review tells the researcher what has been done and needs to be done (Gay, 1990).

In order to throw light on these issues a probe into the past knowledge was very necessary. Therefore, the investigator carefully reviewed research journals, surveys, books, encyclopedias, dissertations, theses, and also browsed through various websites like www.ericresearch.com, www.google.com, www.yahoo.com, www.altavista.com, www.rediffmail.com for the study.

The research studies related to present study have been presented in the following pattern.

Part – A: Studies related to Science Education

Part – B: Studies related to Multimedia (Instructional Materials)
PART – A

2.2 STUDIES RELATED TO SCIENCE EDUCATION

2.2.1 Studies Conducted at Elementary Level

Ansari (1984) studied on Construction and Standardization of Achievement Tests in General Science for Standards, V, VI and VII for children studying through Hindi as the Medium of Instruction in Greater Bombay. The objective of the study was to compare the achievement of boys and girls in science. The major findings were that the performance of boys was better than that of girls.

Lambhate M.V. (1986) developed instructional materials for teachers’ teaching science to class VI in rural areas of Madhya Pradesh his findings were:
a. The use of instructional material by the teachers of experimental group has contributed towards the improvement of their performance. b. The teachers of experimental group had performed better than the control group on i) Selection of organization of context ii) use of proper scientific terminology and teaching aids and experimentation. iii) Maintaining the classroom discipline by sustaining the attention of students with the help of instructional material. c. The experimental instructional material could not equip teachers to enable their pupils to think critically. Promotion of critical thinking in students is an important dimension of science teaching. Hence, suitable inclusion is to be made in instructional material to take care of this dimension.

Rioriya Renuka (2008) compared the advanced organizer model with traditional method for teaching science to class VIII students with different residential background. Her findings were: 1. Advanced organizer model was found to be effective and suitable for teaching science to class VII students belonging to rural as well as urban area. 2. The attitude towards science was found to influence significantly and positively to students achievements in science.
Begum, K.H. (1990) studied the problems of teaching new science syllabus for Standard VII in Andhra Pradesh and their impact on pupils achievement. Her study revealed that more than 60% of the teachers found the content in the recent syllabus, new as well as overloaded. Dictation of notes by teachers was the dominant method of getting exercises done by the students. Lack of facilities for science teaching continued to bother teachers a lot. It was observed that achievement in science favoured significantly those students, whose teachers had attended an in service education programme. It is proposed that school conditions need to be improved through supply of science kits and hand books for teachers so that pupils may participate in the teaching learning process by practicing processes of science such as classifying, inquiring and experimenting etc.

Jain and Manju (2004) conducted a qualitative study of the reasons for poor status of science teaching at secondary stage. The study delves deep into problems and reasons for the quality of science teaching and learning in elementary schools. The major reasons were poor maintenance of facilities for science teaching and lack of facilities, non interactive method of teaching science, teaching to lower stage learner (both primary and upper primary) was found to be perceived as a casual and unplanned exercise, and domination of one way interaction in classroom. Teachers were found to be using the textbook method (reading) or question answer method.

2.2.1.1 Conclusion

From the studies conducted at elementary level the investigator observed that the students achieved better in science education. Jain and Manju (2004) in their study revealed that the poor status of science learning is due to lack of facilities and interactive method of teaching.
2.2.2 Studies Conducted at Secondary Level

Giri (1976) conducted a research on measurement of Aptitude for the Study of Physics of the High School Science Seniors of the State of Bihar with special reference to the Students of Chota Nagpur Division. 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 (Part I, II, III, IV A 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 items 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 Sighbhum by adopting the purposive incidental sampling technique. The scores on the full test battery were available for 177 students. Central tendency, variance and nature of distribution of scores were computed. Reliability was calculated through split half KR formula 20 and Flanagan’s formula. Content, criterion related and factorial validity were determined. Scales and norms (standard scale, T-Scale, 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.

Shinde (1982) conducted a study of Non – formal Science Activities in Secondary School of Maharashtra State with special reference to their impact on Scientific Attitude and Achievement in Science. The objective of the enquiry was to study the scientific attitudes of secondary students. The sample comprised 1600
secondary students of Maharashtra selected on a random basis 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: a. The boys and girls did not differ in their scientific attitudes. b. Students with high academic achievement had high scientific attitude, students with average academic achievement had average scientific attitude, and the low achievers had a low scientific attitude. c. Girls showed a better relationship between scientific attitude and academic achievement than boys. d. Scientific attitude of the students differed from region to region. e. The boys and the girls from the same cultural group did not differ significantly with respect to their scientific attitude.

Dighal K.C. (1985) developed improved method of teaching biological sciences in schools of Tripura and West Bengal. The findings were as follows: a. There was a significant difference in the effectiveness of ‘self activity method’, life science club method’ and ‘audio – visual method. b. Two or three methods when combined formed an improved one on the basis of their similar nature. Combination of methods could be made according to the needs of a teacher. c. Preparation of charts and models, collection of specimens through local excursions, organization of science exhibition by the students, arrangement of film shows by the school, and orientation programmes for life science teachers brought better results.

Ghosh N. (1986) and Shibani (1989) investigated on Critical study of Scientific Attitude and Aptitude of the students at secondary level and Determination of some Determinants of Scientific Aptitude. The main purposes of the study were: (i) to ascertain the aptitude of the students in science with the help of specially developed scientific aptitude test, (ii) to appraise the extent of scientific attitude of the
students with the help of a specially developed attitude test, (iii) to find out the extent of academic motivation of the students with the help of a standardized test, and the SES of the parents of the students with the help of an SES questionnaire, (iv) to find out sex-wise and strata-wise differences, if any, in the scientific aptitude and scientific attitude of the students, (v) to determine relationships between the scientific aptitude and variables such as scientific attitude and academic motivation of the students, and (vi) to develop a regression equation of the scientific aptitude on the independent variables identified by the researcher. A scientific aptitude test was standardized on 620 boys and girls of Class IX studying in 13 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 Pareek’s (Rural) SES scales were used. Central tendency, variability, ANOVA, correlation, F-test, and t-test were used. Some of the major findings were: a. Urban students did not show better performance in the scientific aptitude test than rural students. b. Boys did not possess more scientific aptitude than girls. c. Boys did not possess better scientific attitude than girls. d. There was a positive relationship between scientific aptitude and scientific attitude; scientific aptitude and academic motivation, and scientific attitude and academic motivation. Scores in the scientific aptitude test could be predicted from scores in scientific attitude, academic motivation, and socioeconomic status of parents through multiple regressive equation. e. Students having high scientific attitude were superior to those having low scientific attitude with respect to their scientific aptitude. f. Urban students belonging to high SES group had more scientific aptitude than urban students belonging to low SES group. g. Rural students belonging to the high SES group did not show better scientific attitude than rural students belonging to the low SES group.
Bajracharya R.K. (1986) studied the science education in the secondary schools of Nepal with a view to evolving a functional model for improving the science education. He found that a. The objectives were not achieved as there was no practical work in the curriculum for the pupils. b. The existing curricular content of grades IX and X was theory-oriented and far from the pupils’ daily lives. Some topics in the content were below and some were above the grade level. c. The techniques of teaching science which were practiced in most of the school were traditional. The only teaching aid used in the classroom was the blackboard and chalk. d. Some methods such as discovery and free choice activity were not known to many teachers. e. Most of the secondary schools (except residential schools) did not have a science room or laboratory, adequate materials and science teachers. Some schools had certain materials most of which were irrelevant to the course content. Aids such as aquarium, microscopes, films, slides, tapes, etc. were absent. f. In most the schools there was no provision for replacement of expendable materials in science. g. Teachers’ guides and manuals were not available in most of the schools. h. The prescribed textbook contained inappropriate topics and diagrams. It reflected only reading skill and did not provide for practical skill and concept development. i. Teaching time per day for one class was 40-45 minutes. All science teachers had expressed that this was not enough of demonstration and other activities in the class. There was a need for more time per day. j. Most of the science teachers felt that they were overloaded with teaching and the classes were crowded, so they did not get time to prepare the lessons properly. k. The school supervisors were not efficient. Science teachers did not get professional help from them. l. Science teachers felt the need for in-service training in construction of apparatus from local materials, techniques of teaching curriculum development and test construction. m. From the class teaching it
was seen that teaching in most of the schools was very dry. There was no interaction between students and teachers which could help pupils to develop their interest in and attitude towards science learning. The study had its implications for educational planners and administrators that proper study materials and appropriate facilities should be provided to the science teachers’ science educators and students.

Joshi Anuradha (1986) tried to evolved and instructional strategy for teaching elements of science to class IX students of Madhya Pradesh State. The developed instructional strategy was found to be effective, significantly superior to traditional method in terms of development of higher mental ability. The intelligence significantly effected academic achievement of students, high as well as low intelligent. Students could be benefited equally through the developed instructional strategy. Extroverts were found to be benefited significantly more through developed instructional strategy as compared to introvert. Highly adjusted students were found to be benefited significantly more through developed instructional strategy as compared to low adjusted students. Majority of students belonging to different level of intelligence, personality and total adjustment expressed their favorable reactions towards majority of the components of instructional strategy and instructional strategy as a whole.

Darchingpui (1989) studied science achievement, science attitude and problem solving ability among secondary school students in Aizawal. This study examines the relationships among variables such as achievement in science, attitudes towards science and problem solving ability under certain conditions such as location, socio-economic status, parental education, occupation and typology of school among secondary school children. The objectives of the study were i) To study the science achievement, attitude towards science ad problem solving ability of high school
students. (ii) To find out the interrelationship of science achievement, attitude towards science achievement, attitude towards science achievement, attitude towards since vis-à-vis problem solving ability and, (iii) To examine the relative effect of sex, socio-economic status, parental education, parental occupation, family facility and type of school on science achievement, science attitude and problem solving ability. The study sample comprised 812 students of class IX selected randomly after giving weightage to outside factors such as location and typology of school attended. The tools used to collect the data were the science test developed by the investigator. The Science Attitude Scale developed by Grewal and problem solving ability test developed by the investigator. The findings of the study were a. There is a significant relationship between scores on scientific attitude and achievement in science. b. Significant sex difference in achievement in science and problem solving ability existed. c. High Socio – economic status, family facility and type of school attended favoured achievement in science, scientific attitude and problem solving ability.

Phalachandra, B. (1989) analytically studied some correlates in the acquisition of science concepts in school children. The study revealed that the boys were found to be achieving better than girls in all the four concept achievement tests. Viz., physical and chemical change, composition of substances, plants growth and its process, animal parts and their functions. The relationship between intelligence and concept achievement was significant. Step-wise multiple regression analysis indicated that out of the 10 independent variables considered parental qualification alone accounted for about 6 to 16% variation of performance in different concept achievement tests.

Kar D.K. (1990) conducted a study of relationship between attitude towards science and achievement in general science of class IX students of Cuttack City. The sample of the study comprised 700 students studying in class X from 10 High Schools
of Cuttack City, and also included 74 science teachers and some science experts, Professors, educationists and Head Masters of the schools, who were selected through random stratified sampling method. The tools used to collect the data were questionnaire, interview schedule, achievement test in science and attitude scale. The collected data were analyzed statistically using measures of central tendency, variability and correlation coefficient. The major findings of the study were a. It was found that the distribution of the attitude score was negatively skewed. b. Boys were found to be more favourably disposed towards science than girls. c. There was positive relationship between attitude and achievement.

Kumar U.S. (1991) conducted research on the teaching of general science and the development of scientific attitude in secondary school students in relation to achievement in general science. It was observed that there was a significant difference between the mean scores of boys in the average effective group in respect of perception of teaching of science. The urban and rural pupils of average group differed in respect of perception of teaching of science. There was no significant difference between the mean scores of scientific attitude of secondary school students of boys and girls in the high effective group in respect of perception of teaching science. There was no significant difference between the mean scores of perception of teaching of pupils of urban and rural areas in the high group.

Mukhopadhyaya (1991) conducted a cross sectional study on the Effect of Academic Motivation and Scientific Attitude on Science Aptitude of secondary school students. The study revealed that Scientific Attitude showed a highly significant positive relationship with scientific aptitude.

Geethakumari (2011) conducted a study titled “Relationship between ability to apply science in daily life and attitude towards science of 9th standard students. The
main objective of the study were to develop scientific attitude and development of understanding of inter-relationship of science and society. By this study researcher found out that the 9th standards have the low ability to apply science in daily life situation and they have somewhat favorable attitude towards science.

2.2.2.1 Conclusion

From the above studies, the investigator observed that there is a positive relationship between scientific attitude, Scientific Aptitude and Academic achievement according to Kar D.K. (1990), there is a positive relationship between attitude and achievement and boys were found to be more favourably disposed attitude than girls.

2.2.3 Studies Conducted at Senior Secondary Level

Ghosh and Chatterji (1972) conducted an investigation into the validity of a scientific knowledge and aptitude test. The main aim of the study was to find out the validity of a scientific knowledge and Aptitude test (Foron 1964) It which was suitable for use at the higher secondary level was selected. The test was already standardized on the basis of the data collected from the students who have just passed the secondary examination Eight Bengali medium schools – four boys and four girls schools were selected from a list of such schools after dividing them area wise. The test was administered on 476 students studying in Class XI in these selected schools. The test was validated against the school examination marks. The findings were: a. the test was quite valid and test scores were highly related with the academic success for girls science group b. The co-relation between the test scores and the total marks obtained by the boy science group was significant at 5% level. c. The co-relation between the test scores and the higher secondary total marks varied from 0.12 to 0.56 in the case of four girls schools and one boys school (N=250).

Sharma S.R. (1975) conducted a comparative study of the Achievement of Boys and Girls in General Science at higher secondary level in Rajasthan, SIERT,
Rajasthan. The main objective of this study was to compare the achievement of pupils 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 were 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 coefficient of concurrent and congruent validities of the tests were obtained by correlating test scores with marks of pupils made by their respective teachers on a predetermined five-point rating scale. The coefficient of correlation technique taking the entire sample of 1708 pupils into consideration. In order to find out the variance in attainment of different strata of samples, analysis of variance was used. They study revealed that there was a significant difference between the performance of boys and girls on the test in general science. The girls were superior to the boys in the subject.

Bandyopadhyay (1984) studied Environmental influence, Academic Achievement and Scientific Aptitude as Determinants of Adolescents’ Attitude towards Science stream. The objectives of the study were (i) to assess adolescent students’ attitude towards science, and (ii) to find out the 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 socioeconomic 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 pupils 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 students, 221 boys and 199 girls, from 21 schools of Calcutta. The tools used were a researcher-made information schedule to know the respondents’ generalities, leisure activities, family background, relations with parents, peers and teachers, and social influences, and sub-test of the DAT battery on numerical ability, mechanical reasoning and space relation. Achievements in school subjects were obtained from the annual examination records for last three years. The scientific attitude was measured by Science Attitude Scale of Avinash Grewal (published). The data were represented by charts and tables, and analysed by applying t test, ANOVA and chi-square test. The major findings of the study were: a. Pupils having a high positive attitude towards science and a negative attitude towards science were different with respect to the independent variable either in isolation or in interaction. b. The obtained causal factors were environment, attitudinal achievement related. Parent education, and SES led to favourable attitude towards science. Teachers’ influence, peers’ influence, vocational value of science and future aim of life were other contributor factors. The pupils who had a favourable attitude to science possessed higher ability in mechanical comprehension and visualization of objects in space. They were higher achievers in physical and life sciences. c. There existed significant interactions between (a) source of inspiration and achievement in physical science, (b) source, achievement in physical science and space relations, (c) source, achievement in life science and space relations.

Srinivasacharyulu S.A. (1989) conducted a study on the Relation of Anxiety and Superstitious beliefs to Scientific Attitude of higher secondary students. He found that there was a significant negative correlation between the scores of scientific
Attitude and Anxiety. He also found that there was a significant positive correlation between the score of anxiety and superstitious beliefs.

Rao K.N. and Gupta M.K. (1990) conducted a comparative study of Scientific Attitude, Scientific Aptitude in Higher Secondary Schools. Pupils is average and there was no influence of sex on Scientific Attitude. It is an attempt to compare scientific attitude, scientific aptitude and achievement in biology at the higher secondary school level. The objectives of the study were i) To find out the scientific attitude and scientific aptitude possessed by the higher secondary school pupil along with their achievements in biology. ii) To find out the association among scientific attitude, scientific aptitude and achievement in biology of higher secondary school pupils, and iii) To compare scientific attitude, scientific aptitude and biology achievement of boys versus girls. English medium versus Telugu medium schools, private versus government schools, residential versus non – residential schools and rural versus urban schools. The sample of the study comprised 600 pupils studying in class IX, who were selected through stratified sampling method. The tools used in the study included scientific Attitude Scale of J.K. Good and R.P. Sandhya (1986) and Kerala University Science Aptitude Test of Nair, et al. (1989). The statistical techniques used in this study were mean, S.D. ‘t’ test, critical ration and correlation. The findings were a. Scientific attitude in higher secondary school pupils were average. There was no influence of sex on scientific attitude. But the pupils studying in private schools, rural schools, English medium schools, and residential schools held relatively better scientific attitude than their counterparts. b. The scientific aptitude in secondary school pupils was also average. The Pupils of private schools, urban schools, English medium schools and residential schools held a bit more scientific aptitude. c. The achievement in biology was average. The rural schools, government
schools, English medium schools and residential schools were better in achievement.

d. There was a highly significant and positive association among scientific attitude scientific aptitude and biology achievement.

Goel V.P. and Agbebi, E.A. (1990) conducted the study on learning Physics through lecture demonstration method (LDM) and individualized instruction method (II) among higher secondary school students. A significant difference was observed between the groups which followed the individual laboratory method and the lecture demonstration method. The group of students following the individual laboratory method achieved significantly better on the psychomotor skills than did the lecture demonstration group. Students who followed the lecture demonstration method achieved at a higher level related cognitive skills than did the group of students, which followed the individual laboratory method.

Prakash, Brahma (1990) tested effectiveness of concrete materials to enhance learning in physical science by conducting an independent study. It was found that the performance of student’s learning by concretized instruction was better than those learning by traditional instruction. The average increments in marks of experimental group of students on concrete level items was 8.8% and that of formal level items 8.4%. As the tests comprised of items based on difference logical operations and of concrete and formal operational level, the responses of such tests may be used to diagnose learning difficulties of students. remedial help can also be provided to them accordingly. Use of concrete materials such as charts, models, analogies, more lucid examples and other manipulable materials based concrete thoughts and sequencing of instruction in a three stage cycle were found to help the concrete level operators in understanding the formal level concepts more effectively. The three stages of learning cycles were introduction concept formation and concept application.
Dani D.N. (1991) conducted a study on the scientific attitude and cognitive styles of Higher Secondary Students. The study concluded that boys and girls did not differ in scientific attitude.

Neeliappan (1992) in his study on Scientific Attitude and interest among Higher Secondary Biology students in relation to their Learning Environment found that there was a strong relationship between high and low learning environments of higher secondary biology students and their scientific attitude and scientific interests.

Paulose (1995) conducted a study on the Influence of Scientific Attitude of University Entrance on their Process Outcomes in Physics taking sex and residents of the subjects as control variables. The study revealed that the Scientific Attitude exerted a significant influence on process outcomes in physics. It was concluded that all good instructional strategies for teaching physics should attempt to provide conditions, which will augment the scientific attitude of students.

Rao (1996) conducted a study on the Scientific Attitude and Scientific Aptitude of the Pupils of Higher Secondary level of Guntur District. The study revealed that the Scientific Attitude among the students was average and the distribution of Scientific Attitude in the tenth class pupils was normal. The association between Scientific Attitude and Scientific Aptitude was highly significant by positive.

Rani (2000) conducted a study on the Educational Aspirations and Scientific Attitudes possessed by Urban Secondary and Senior Secondary Students. The study revealed that level of scientific attitude was higher and it was not normal. Sex has an influence on overall educational aspiration level and it was higher with boys than that of girls. But it was not influenced by medium of learning, level of schooling and age.

MacDonald (2005) studied on retaining girls in science at higher secondary level. Purpose of this study was to explore effects of Operation Minerva programme
across educational sectors (public, Catholic alternative) with respect to intervention experience, course and career plans and factors influencing female science retention.

Rao (2007) conducted a study on the Scientific Attitude in Higher Secondary School Pupils. The major finding of the study was that the Scientific Attitude in both boys and girls had no difference in the level of Scientific Attitude possessed by them.

Francis and John (2008) conducted a study on the Scientific Attitude and Reasoning ability of computer illiterate students of higher secondary level. The study revealed that there was no difference in the Scientific Attitude of computer illiterate and computer literate pupils. Boys and girls were also found to have similar Scientific Attitude Scores. It was also concluded that the correlation between scientific Attitude and Reasoning Ability of computer illiterate boys was found negligible.

Archana (2009) compared combination of concept attainment model and lecture method with traditional method for teaching science to classes VII and VIII students. She found that the combination of concept attainment model and lecture method was found to be significantly superior to traditional method of teaching chemistry to class VII students and physics to class VIII students when groups were matched in respect of intelligence, attitude towards science and previous years achievement in science.

Sushma (1987) tested the effectiveness of concepts attainment and biological science inquiry models for teaching biological sciences to class VIII students for her Ph.D. research. She found that a. The concept Attainment Model and Biological Science Inquiry Model were found effective at 0.01 level when the means of pretest and post-test scores were compared by applying t-test. b. The Concept Attainment Model was found more effective than the Biological Science Inquiry Model. c. The Biological Science Inquiry Model was found more effective than conventional teaching. d. When the means of pretest and post-test attitude scores were compared,
both the models had significant effects. e. The Concept Attainment Model changed the attitude more favorably than the Biological Science Inquiry Model. f. No significant difference was found between the gain scores of attitude with the Biological Science Inquiry Model based teaching and conventional teaching.

Awasthi Vibha (2009) developed the training strategy for science teaching by using concept attainment model. The findings of her research were: a. The two training strategies viz. the Continues Demonstration with pair practices (CDP) practice and the Intermittent Demonstration with Quadro practices (IDQ) practice are equally effective as is evident through the understanding of theory of the mode. b. The trainees attained higher teaching competency scores when trained through the IDQ practice strategy as compared to the trained through the CDP practice strategy. c. The teaching competency scores of the trainees at school stage occasions are significantly higher as compared to the lab stage occasions. d. Both the groups of the trainees had expressed low level of willingness towards implementation of the Concept attainment model CAM in the schools. e. The CDP practice and the IDQ practice are equally effective in terms of pupils’ reaction. f. IDQ practice groups achieved significantly higher scores that the pupil taught by the trainees of the CDP practice group.

Malhotra, V.K. (2011) conducted a critical study of the existing facilities of science teaching and construction of evaluation instruments for its supervision in different types of senior secondary schools in Delhi. It was observed that the three types of schools differed significantly in the following cases: a. Existing facilities for science ‘based co-curricular’ activities. 2. Existing human facilities. b. The supervision of the theory classes. 4. The supervision of the practical classes. c. The supervision of science-based co-curricular activities. d. Supervisory practices of the
faculty meetings. 

f. Related facilities for the supervisory practices.  
g. Welfare of the students. 
h. The public schools scored high uniformly.

Sundarajan S. (2012) evaluated the teaching of biology at higher secondary stage in Tamil Nadu. The study revealed that hierarchy of the objective related to the teacher gave more importance to the knowledge followed by understanding application and skills. Generally teachers were found to follow only the expository type of teaching strategies in their teaching of biology. They did not encourage discussion among the students and other student centered teaching techniques. The higher secondary biology syllabus was related only to the students’ abilities and to their real life. It was not conducive to the students learning of the scientific method, the development of scientific interest and a favourable attitude towards the study of biology in them and their appreciation to the contribution of biology to human civilization. The biology laboratories were in a bad shape. A full compliment of chemicals and equipment was not found in many schools and they did not have essential teaching aids, too. Objective type question were not asked in the final higher secondary examinations conducted by the government of Tamilnadu and there were no questions testing the ‘Application’ objective in biology even questions testing the ‘Skills’ objective were few. All the questions seemed to encourage rote memory of the students. Boys in urban schools did not have a more favourable attitude towards the study of biology than the girls of urban schools and the boys of rural schools. But the boys in rural schools and the girls in urban schools had a more favourable attitude towards the study of biology than the girls of rural schools. There existed a positive relationship between the higher secondary students attitude towards the study of biology and their achievement in it.
Bose, A.J. (2012) conducted the study on investigation on non formal science education and development of expensive resource materials. The study revealed that several participants were actually utilizing their knowledge in the preparation of daily food of the family even several months after the termination of the programme. It was found that the growth rate increased for leafy vegetables, varying from marginal to 30% depending on the type of plants and the extract used. It also established the general methodology of basic agricultural studies. It was found that traditional methods which emphasized familiarity gained through practices was in no way inferior to the methods proposed in the project. On the other hand, persuasion of scientific methods of structural industries at a still higher level would be only rarely needed in actual practice and this did not encourage enthusiastic participation in the programme. A positive correlation was established between the onset of pulmonary diseases and the presence of nitrous fumes among workers in jewellery manufacturing shops. However, the remedies suggested were not acceptable because they hampered production.

Rao K.M. and Karun C. (2012) studied the science laboratories in secondary schools in selected states. It was observed that in Maharashtra. Out of 111 secondary schools. 105 were reported to have science laboratories. Almost all schools 96.7% in urban areas and 92% in rural areas had science laboratories. Out of 70 higher secondary schools which responded. 59 had science laboratories. In urban areas, 94.7% were having science laboratories as against 71.9% in the rural areas. Out of the 105 secondary schools which had science laboratories. Only 26 had separate laboratories, i.e., hardly 25%. In the urban areas, the position was better than rural areas. Out of 58 secondary schools in rural areas about 60% used on to three hours per week for teacher demonstrations. 20% used four to five hours time and remaining
40% used seven hours and more for teacher demonstrations. In urban schools, the position was slightly better. About 40% schools used laboratories for one to three hours, another 20% used it for four to six hours and the remaining used it for seven hours and above. Time devoted to science practical differed in urban and rural schools. The position in urban schools was worse than that in rural areas. In higher secondary classes, 38 out of 59 schools in Class IX, i.e., 60% and 40 out of 59 in class X, i.e., 70% performed teacher demonstrations. The position in respect of students practical was highly satisfactory in class XI and 89% in class XII performed more than 15 student practical. In Rajasthan’s secondary school 92.10% rural schools had laboratories as compared to 83.3% urban schools. In the case of higher secondary schools, 94.60% rural schools had these facilities as compared to 90.90% in urban schools the facility of separate laboratories was available in 91.9% urban schools as compared to 85.7% rural schools. About 50% of schools students had the facility of performing experiments individually in Physics, 74.74% in Chemistry and 81.72% in Biology. For performing science practicals, in case of private aided and private unaided schools, only 80% and 66.7% schools respectively allotted adequate time for performing science practicals. Only 27.8% of government schools had the facility for repairing and improving of science equipment. In rural areas this facility was available in 14.8% secondary schools and in urban areas, 66.70/q secondary schools. 7.5% of government school charged 6 to 10 rupees as science fee and 75.3% in case of higher secondary schools.

Battia, N. (2013) had tried to find out differences, relationship between cognitive styles, social disadvantages and interest (3 independent variables) and predictions of influences of the predictor variables towards criterion variable of the life science on the performances of the boys and girls at the madhyamik level of
education. 689 students of four districts of Tripura were taken as sample randomly. As a result there was no difference in cognitive style and social disadvantages between boys and girls and positive relationship exit in the variables of cognitive style, social disadvantages and various items of interest with the scholastic achievement of life science.

Mirsa (2013) in their research report on what middle grade student say about learning science with multimedia reported that THE JASON Multimedia Science Curriculum (JMSC) was developed in 1989 by the JASON foundation for Education (www.jason.org.), and is a multimedia, interdisciplinary, inquiry based science curriculum that responds to the dual demands of teachers having to teach state standards while engaging students in scientific in inquiry. The JMSC encourages interaction between students and real life science and scientists while teaching scientific content and concept by selecting a unique research expedition site and topics each year, upon which print curriculum, video, live satellite broadcasts, and a variety of online activities that include digital labs and electronic journals are based. In 2002, approximately 25,000 teachers and one million students, grades four through nine, utilized the ‘JASON XIV: From Shore to Sea” curriculum to explore the features of California’s Channel Islands and study the Chumash people who once lived there. In this curriculum students use computers to do online simulations known as digital labs, internet research, and presentations. Through the curriculum, students are exposed to how scientific technologies (e.g., remote operated vehicles, thermal imaging equipment and satellite pictures) contribute to helping scientists answer research questions. They are also encouraged to understand the limits of any one technology and that multiple technologies might be needed to acquire more detailed information.
Boss, M. and et al. (2013) in their study on improving students’ understanding and perception of cell theory in school biology using a computer based instruction simulation program. A survey by the Kenya National Examination Council (KNEC) revealed that students’ academic performance and interest in secondary school biology has been generally poor. This has been attributed to the current method of instruction and the lack of instructional resources amenable to the study and proper understanding of such complex areas as cell theory. The study reported here assessed the effects of a computer based instruction simulation (CBIS) program developed for the teaching of school biology, as part of a classroom innovation for science instruction to improve students’ understanding and perception of cell theory. This article presents results of an empirical evaluation undertaken over a four week period with 102 form three students in Nakuru district. Comparisons of the pretest and post-test data of the experimental group (E(1)) and two control groups (C) and (E(2)) was used to determine the students learning gains with respect to their understanding and perception of cell theory. An analysis of the results showed that the CBIS program resulted in significant learning gains and better perceptions towards the cell divisions topic in school biology. In addition to corroborating earlier findings on the effectiveness of the use of educational media and hypermedia to improve students’ academic achievement and affective behaviours, the study concludes that the innovation has major implications for improving those areas of science that are difficult to teach and learn using the regular methods and should therefore be integrated into the existing school curriculum.

Shonk, Kevin (2006) in his study on technology for the birds: an electronic field guide of bird study incorporating sight and sound dealt with the increasing concern for the state of the environment and declining biodiversity, it is important that
students and teachers come to appreciate the value of life in all its forms. Natural history provides students with an opportunity to understand better how life on the planet interacts, as well as the place and responsibility of human beings in ecosystems. Bird study is one aspect of that larger endeavour, as the role of birds in the environment include the control of rodent populations, dispersal of pollens, seeds and fruits, pests on farms and in cities; hosts to parasites and diseases; and beautiful animals that aesthetically enhance people lives. This article describes several methods that can enhance the study of birds, including traditional field trips and the newer technology of PCs, CDs and PDAs. The author describes an electronic field guide of birds (“Dawn Chors I”), which provides a multimedia approach to learning bird identification. By combining the use of compact discs, personal computing, and handheld devices (PDAs), instructors and students can carry picture and sound recordings of the birds they may encounter in the field sample individual and class exercises that incorporate the software further solidify bird identification back in the lab.

Hennessy, Sara and et al. (2007) studied pedagogical approach technology integrated science teaching through two separate projects described have examined how teachers exploit computer based technologies in supporting learning of science at secondary level. This paper examines how pedagogical approaches associated with these technological tools are adapted to both the cognitive and structuring resources available in the classroom setting. Four teachers participated in the first study, undertaken as part of the interactive education project in Bristol; all of them used multimedia simulations in their lessons. The second study presented was part of the wider SET-IT project in Cambridge; 11 teachers in eight schools were observed using multimedia simulations, data logging tools and interactive whiteboards. Teachers
were interviewed in all cases to elicit their pedagogical thinking about their classroom use of ICT. The findings suggest that teachers are moving away from only using “real” experiments in their practice. They are exploring the use of technologies to encourage students to engage in “What If” explorations where the outcomes of “virtual” experiments can be immediately accessed, for example through using a simulation. However, this type of activity can serve just as a mechanism for revealing and indeed reinforcing students’ informal conceptions if cognitive conflict not generated or remains unresolved. The teachers in our studies used simulations, data logging, projected animations and other dynamic digital resources as tools to encourage and support prediction and to demonstrate scientific concepts and physical processes, thereby “bridging the gap” between scientific and informal knowledge. They also integrated technology carefully with other practical activities so as to support stepwise knowledge buildings, consolidation and application. Research of this kind has design implications for both curriculum related activities and emerging computer based learning technologies, in terms of helping use to understand how teachers capitalize upon the technology available in supporting students to construct links between scientific theory and empirical evidence.

2.2.3.1 Conclusion

Archana (2009) in the study of comparison of combination of concept attainment model and lecture method with traditional method found that the combination of concept attainment model and lecture method for teaching science is significantly superior than the traditional method and students could achieve more in science knowledge with that method. From the above studies reviewed, the investigator observed that the science learning can be effective at senior secondary level also.
2.3 STUDIES ON DEVELOPMENT OF MULTIMEDIA (INSTRUCTIONAL MATERIALS)

2.3.1 Studies Conducted at Secondary Level

Golani T.P. (1982) studied the use of audio visual aids in the secondary schools of district I have for his Ph.D. level research. The major finding were: a. Schools that were situated in urban areas and the ones which were conducted by rich societies possessed audio visual aids. b. Only a few teachers used audio visual aids in teaching. c. Teachers who were trained in the use of audio-visual aids were inadequate in number. d. At many places the audio-visual aids were in a broken down condition and awaited repairs. e. At many places the hardware was purchased. However, it was not used as proper software was not available. f. Audio visual aids were useful in teaching. g. Audio visual aids were not used due in lack of properly trained personnel and lack of accommodation in the schools. h. There were no incentives to teachers who used audio visual aids. i. The State Institute for Audio Visual Education could not provide training to personnel and could not supply proper learning materials.

Vardhin V.P. (1983) in her Ph.D. research developed a multimedia instructional strategy for teaching science (Physics and Chemistry) at secondary level. The finding were: a. Almost all the units indicated average/high level of performance on the total test. b. 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 pretest. c. Validity of the strategy was established from reactions expressed by students for its continuance and also their improvement in science achievement. d. Intelligence and achievement using the strategy presented a significant relationship. e. A significant relationship was found between scientific
attitude and achievement for the experimental group and control group. f. Visual projections with teacher explanation and those with taped commentary were equally effective in terms of achievement. g. Programmed material and discussion sequence were equally effective, on the total test. h. The strategy was found feasible when seen in terms of its reproducibility and the cost management by individual schools.

Ryan (1984) prepared learning modules which help for developing “independent learning skills” for learners of English in Japan. It included techniques for creating or maximizing language practice opportunities. It is noticed that the course was successful for the students of secondary level.

Desai K.V. (1985) investigated the efficiency of different instructional media in the teaching of science to the pupils of class VIII in relation to certain variables. The finding were: a. The programmed learning approach was more effective that the traditional way of teaching science. b. The slide with discussion approach was more effective than the traditional way of teaching science. c. The experimental approach was more effective than the traditional way of teaching science. d. In the teaching science, the experimental approach was the most effective of all approaches. e. The programmed learning approach and slides with discussion approach were equally effective. f. The use of instructional media indicated the possibility of improvement in the methodology of science teaching, raising the standard of science education in secondary schools and development of taste and interest in the younger generation for the subject of science.

The major educational implication of the study is that there is not one method of teaching science. The teacher should be experimental minded and should use different approaches in the light of different objectives. Media are effective in science education.
Senapathy (1986) compared programmed learning material and traditional methods in terms of achievement of students studying through them. The study highlighted that the programmed learning material was effective in terms of achievement of students on criterion test at secondary level. A combined video and CAL package on Advanced level library skills for open learning students was developed by Mo Alpine (1996). Advanced level key word and subject searching of library catalogue and CD-ROMs is a skill that requires an effective strategic approach. Video and computer assisted learning (CAL) materials were developed. Key elements of instructional design and strategy that underpinned the design and development of the video and the CAL package are:

- Information theory
- Level of performance
- Expert analysis
- Knowledge type and
- Situated learning

The first stage of the project concentrated on strategies for finding references that were known to the student. The second part of the project dealt in the searching for information in situations where there is no reading or reference list provided. At this stage, users learn that there is no single correct answers and that flexibility, a range of strategies and appropriate valuation of outcomes to meet the students own individual interests and needs is the best approach to use.

Barve M.V. (1986) prepared the field and testing of filmstrips for the teaching of science a course in Standard IX, and studied their comparative effectiveness in the teaching learning process as compared to traditional practice. The findings were a. Filmstrip was more effective than the traditional method for teaching the facts,
principles and concepts in science. b. Filmstrip and the traditional methods were equally effective for teaching abstract concepts in science. c. Filmstrip was an effective teaching and for all levels of learners, i.e., low, medium and high achievers. d. Filmstrip was more effective for the learners between 13 and 16 years of age than for learners between 17 and 21 years of age. e. Filmstrip was a more effective method of teaching science for both sexes, i.e., males and females.

Indrani (1989) made an attempt to compare the retention of science concepts among the students of Std. VIII learnt through conventional method and Video recorded instructional material (VRIM). This study revealed that VRIM was better than conventional method of teaching the science concepts. The medium of VRIM resembles the real life expressions very closely, because of the combine of sound, image and colour. The retention power is by VRIM because it a) broadens and enriches the expression of children b) a verbal explanation supplemented by a visual aid is for more effective in halting attention, creating and sustaining interests than conventional teaching. Presenting a lesson through VRIM adds variety and breaks the monotony of the ordinary instruction. The VRIM lends reality to the classroom teaching and links instruction with real life. The mental images created by the pictorial aimuli and models are easy to recall because of the intense interest at the time of reception.

Bhardwaj, Himani (1989) for her M.Ed. Dissertation, developed the computer aided instructional material on microbes on microbes for class VIII. She found that: a. The null hypothesis cannot be sustained. b. From reaction scale it is evident that a. This method of instruction is more helpful and interesting than other methods normally used. b. The subject matter in the software is arranged in proper sequence. c. Capital letters used in the headings highlight the point covered. d. Graphics used in
the package are adequately balanced and integrated well with the subject matter.
e. The language used in the module is simple to understand and f. Ample interaction
between students and computer is provided. g. By this mode one can read at one’s
own pace. h. The subject matter and the explanations given were appropriate.
i. Students would like to read other topics also through the use of computers.

Bhattacharya, Madhumita (1989) critically reviewed the work done on the use
of computer as an instructional tool for teaching chemistry in her M.Phil. dissertation.
She revealed that: a. The available software in chemistry were of good quality.
However, background knowledge was inferred in most of the chemistry soft ware.
b. It was not always possible to maintain the sequence of content especially in games.
c. Most of the available software adopted Lecture cum. Demonstration method in a
class of 20-40 minutes. d. Most of the soft ware contained knowledge and discovery
I levels of teaching but they Lacked in reflective I. level. e. Computer Assisted
Instruction could be applied most effectively to an individual or to small groups.
f. The majority of the softwares could be used for concept development. g. The
software’s that have been selected for classroom teaching mainly provided simulation
of a real situation thereby assisting students in long-team retention. Most of these
softwares were in the tutorial mode. h. The students got proper feedback. i. Technical
quality of the majority of softwares were satisfactory. The majority of the softwares
can be used for concept development.

Adhikari, Rajshree (1991) in her M.Ed. Dissertation tried to develop the
computer aided instructional material on cell and cell reproduction for class IX. She
found that: a. The computer aided instructional material was found to be effective in
terms of achievement of students. b. Students show positive reactions towards the
Kalimuthu, T. (1991) developed a video program on environmental pollution in biology for secondary students for M.Phil. Level research. The findings were: a. The secondary students taught through the video program learnt more of the concepts on environmental pollution than those who were taught by the lecture method. b. The secondary students improved their achievement on environmental pollution after viewing the video program.

Mahapatra, B.C. (1991) for M.Ed. Dissertation developed and tested the effectiveness of Computer Aided Instruction (CAI) in terms of achievement and abstract reasoning of class IX students and researcher had found that: a. CAI was found to be effective in terms of achievement of students b. The developed CAI was found to be significantly superior to traditional method when the students mean achievement score were adjusted with respect to intelligence. c. The CAI is not superior to traditional method when mean adjusted reasoning score were adjusted with respect to intelligence. d. There was no significant difference in respect to the extrovert and introvert students towards CAI except on four aspects of CAI namely. e. There is enough interaction between students and computer. f. The method is used for learning than teaching. g. The figures are well integrated with the subject matter.

Singh, R.D., Ahluwalia, S.P. and Verma, S.K. (1991) in their research paper on Teaching of mathematics at secondary level: Effectiveness of Computer Assisted Instruction (CAI) and conventional method of instruction’ found: a. The students who used the computer scored significantly higher than those who were taught through the conventional method. b. The students who used the computer showed significantly highly favorable attitude towards mathematics than those who did not use the
computer. c. Achievement in mathematics and change in attitude towards mathematics were found to be independent of the sex factor.

Sinnathambi, V. (1991) at the M.Phil. level research on ‘Developing a video programme on energetic in secondary students’ found: a. The students who were taught by the video method learned more concepts on ‘energetic’ than those who were taught by lecture method. b. The students improved their achievement on ‘energetics’ after viewing the video programme.

Shinde, Laxman (1992) in his study on Development of Computer Software for assessing research aptitude of education students found: a. The mean achievement scores of Hindi and English medium students on computer based test in English do not differ significantly. b. The mean achievement scores of Hindi medium paper pencil group is significantly higher than the mean achievement scores of English medium computer group. c. The mean achievement score of Hindi medium students through paper-pencil test in Hindi is significantly higher than the mean achievement score of Hindi medium students on computer based test in English. d. The mean achievement score of English medium students on computer based test and paper pencil test does not differ significantly. e. The computer based test is reasonably reliable.

Sharma, Aabha (1998) in her study on ‘Computerization among video based instructional strategies for teaching science at class IX level in terms achievement and reaction’ found: a. Video followed by lecture instructional strategy was significantly superior to only video as well as video followed by discussion instructional strategies. b. There was no significant influence of sex on achievement in science. c. The attitude towards science was found to influence significantly the achievement in science. d. Achievement in science was found to be independent of the interaction between
treatment and attitude towards science. e. The above average students were found to achieve more in science from those of the below average. f. The achievement in science was found to be independent of interaction between treatment and intelligence. g. The achievement in science was found to be independent of interaction between treatment and sex.

Uma S. (2004) made an attempt to understand the role of computer and technology in classroom teaching and learning of science and maths among secondary school students. Ten lessons in science and maths were selected. Each lesson was to be talked and evaluating using difference methodologies. The sample of the study was 12 students who passed VII class and entering VIII class. The outcome of the study was revising through computers and increased their performance. The best scores are went computers are used.

Navdeep Kaur (2013) conducted a study on “Effectiveness of Multimedia Approach in teaching of Arts at secondary stage. In this study the investigator found that the performance of students with multimedia materials were higher than the scores of conventional method and the students of experimental group were looking well and more motivated and ready to learn each day of experimental duration of CAI treatments than the students of the control group. This study thus shows that the multimedia approach plays an important role in improving the achievements of students and so a teacher should use multimedia approach in teaching in the classroom which can make her task easier and students can achieve better.

2.3.1.1 Conclusion

From the above studies reviewed the investigator observed that there is relationship between the teaching method and attainment of Knowledge and development of Attitude towards science. It is shown us majority of the studies reviewed above.
2.3.2 Studies Conducted at Senior Secondary Level and for Teachers

The “multimedia package training” courses were conducted during SITE (1975–1976) to train in-service primary school teachers for training teaching science. The programmes were developed and organized by the centre for educational tech. (ET) NCERT, New Delhi. It consisted of print media, interpersonal discussion, radio, TV and actual experimentation. There were nine important messages in this package of training. These include experiments, problem solving, language by doing, class participation, games, GP work and field trips. This training was conducted twice during SITE first in October 1975 for 12 days and second in July 1976 for 15 days. These two studies conducted to evaluate the effectiveness of the training programmes were those Agarwal (1978) and Shukla Singh and Batra (1977). Another small study was conducted by Sanjaya (1977) in Karnataka cluster Shukla, et al. (1977) found statistically significant gains in the result of multimedia package training though there were inter-cluster differences. In a similar observation made in Karnataka cluster by Sanjaya (1977) majority of it reported that they would be able to use the scientific method in their class room.

Bailkeri (1983) studied the effectiveness of self instructional micro-teaching course used in the in-service, learning of secondary school mathematics teachers. The self learning materials in print form and an audio cassette were developed. The study concluded that the self instructional micro – teaching course was very effective to improve the general instructional competence of mathematics teachers.

The effectiveness of multimedia approach for instruction of secondary level pupils was experimentally studied by Siemankowsky (1969) and Vasanthakumari (1986). The studies showed that multimedia approach is found to be effective in improving competency of students. This approach seemed to benefit both high and
low achievers and it tends to increase the interest of learners. The rate of achievement also seemed to be higher than that of teaching using traditional methods.

A package of training materials for use in a professional development programme for teachers was prepared by Sharpe (1993). The package consisted of nine booklets and a course outline for each course. The package contained the following topics. The teaching learning cycle, a functional view of language, language used for describing, language used for recounting, language used for explaining and language used for challenging.

A self instructional package for senior secondary school biology teachers for their in-service learning was developed by Nath (1998). The sample consisted to two hundred biology teachers of senior secondary level selected from the four revenue districts of Kerala. The data were collected through the achievement tests and questionnaire developed by the researcher. The findings states that majority of the teachers had achieved marks at the range of 61-80. The study showed that the performance of teachers in the achievement tests was very good, the rate of achievement also was high and error rate comparatively low with the use of the package. The qualitative analysis showed that various aspects of the self instructional package was very much effective. The study further proved that self instructional materials can be developed with high effectiveness for the target GP fixed.

Nancy, Pegogh and James (2000) conducted a study of the effectiveness of self study interactive computer programme over the traditional methods. The finding stated that self instructional electronic texts provided more efficient study tools and increased the students retention of materials.

Hanap Sharad Govind (2001) studied the effect of multimedia program package/teacher made software on pronunciation skills of secondary students of
English for his Ph.D. level research. The major findings were a. It was found that the multimedia program package (MPP) proved to be more effective. b. It was found that the MPP helped the student teachers to develop and improve upon the pronunciation skills. c. The utility of the multimedia PP, it is strongly recommended for the classroom teaching of phonetics.

Kannade H.L. (2001) revealed the trends in CIET’s educational television programmes over a four year period, 1982-1986 through CIET project, NCERT. The findings were: a. In all, 321 programmes with an overall duration of 100 hours were produced in the CIET during the four year span. Out of these, 132 programmes were for the 5-8 year age groups, 140 for the 9-11 year age groups, and the rest for teachers. b. These programmes were prepared in different phases spreading over but years’ time. c. The ET cell had produced adequate length of material for transmission. As far as the children’s programmes were concerned, no program was to be repeated at least within the same year. d. Some of the listed programmes had become technically unusable or content-wise outdated. e. Three important series, viz., story time series, Bal Jagat and our Body and Health were dominant ones among the 5-8 year age group programmes. f. Three important series, viz. Air. Story of Man, and Delhi; Our Capital, ran for a considerable period of time for the 9-11 age group children. g. The programmes classified under different categories were knowledge (73.5 percent), Attitude (25.4 percent) and the rest under skill. In most cases stories were integrated with biographies to strengthen the moral base. h. Among the teachers programmes the major thrust had been on low cost teaching aids and experimentation, population education and on programme dealing with concepts of science and mathematics.
Prabhakar K. and Shivaji M. (2002) for his M.Ed. dissertation, developed the software for computer aided instruction and its comparison with traditional method for teaching semiconductors at plus II level. He found that: a. The CAT material was found to be effective in terms of achievement of students belonging to classes XI and XII. b. The CAI material was found to be effective in terms of reaction of students belonging to class reacted favorably to the various aspects of the package. c. The CAI material was found to teach semiconductor topic equally well is both classes XI and XII students when pre test was considered as covariate. The same results were obtained when intelligence was considered as covariate. d. The CAI material was found to be significantly superior to the traditional method but no significant difference was observed when the groups were matched with respect to intelligence. e. The sex did not influence the achievement of students. f. There was no significant effect of interaction between treatment and sex no achievement of students. g. Both classes XI and XII students were found to have equally favorable reaction towards CAI material when the groups were matched with respect to post test.

Nagarjun, Nirmal (2003) studied the effectiveness of computers in teaching mathematics in schools at M.Phil. level research. He found that a. Computer Assisted Teaching (CAT) of mathematics benefited both teacher and learner. b. CAT encouraged individualization and practice without burdening the teacher with repetitive and monotonous activity. c. CAT helped the learners to use their creativity by exploring new areas not covered by the syllabus. d. Computer awareness was not sufficient in schools for CAT. e. In India, we have gone in for the theoretical rather than the practical aspects of computer based education. Project CLASS was not able to reach the child especially. f. There were not enough computers in schools and not enough awareness regarding the computer. The computers that were available were
not being put to the best possible use. Teachers had a great mistrust of the computers and perceived it as an inconvenience rather than as an aid. Their negative attitude was a great hindrance in popularizing the use of computer literacy in the educational system, especially at the secondary level of education.

Chetana (2003) produced and validated the video teaching material in home science for senior secondary students of Delhi. The study made it clear that video technology had not only their effect upon the achievement and retention of the content in home science, but also these two treatments low intelligence students to achieve higher as compared to conventional teaching. The implication for the learner lies in the convince and availability of video cassettes/video lessons along with modules when and where require. The study has implications for media persons. They can produce syllabus – based video cassettes along with modules.

Tao, Ping Kee (2004) in his articles reports a use of computer based collaborative learning instruction design to help students develop understanding of image formation by lenses. The study aims to investigate how students, working in dyads and meditated by multimedia computer assistant learning (CAL) programmes, construct shared knowledge and understanding. The subjects were a class of 36 secondary four (year 10) students working in dyads throughout the instruction. The instruction comprised three stages (namely pre-test, computer based activity and post-test) during which students within dyad interaction were audio recorded and transcribed for analysis. Three months after the instruction some selected students were interviewed individually. The pre-test result showed that many students held the “holistic conceptualization” of image formation (rather than the physicist point to point mapping model), which they applied to give alternative answer/explanation to the questions in the test. The post-test and interviews showed that overall students
improved their understanding of image formation although the improvement ranged widely. The rich qualitative data of peer interactions showed that students experienced conflicts and co-construction that fostered their intensive engagement with tasks and with each other. The data also show the mediating role of the CAL programme and the teacher that helped students develop understanding.

2.3.2.1 Conclusion

From the above studies reviewed, the investigator reached at the assumption that at the senior secondary level the effectiveness of multimedia approach is higher than the traditional method of teaching science many studies show the same result.

2.3.3 Studies Conducted at M.Ed. Level, Teacher Educators and for Specially Abled Students

Ludlow and Barbara (1998) developed an interactive multimedia modules to train rural special education personnel. Multimedia instructional materials represent an important resource for teacher education programmes in special education. They enable prospective special education to observe and study important aspects of professional practice and expense of actual field experiences Computer assisted multimedia is especially appropriate for the design of self instructional modules.

Bambara and Linda (2001) conducted a study to assess effects of a self instructional package on complex problem solving skills by three adults with intellectual disabilities. The training package was effective in producing generalized, complex correct problem solving skills in training and normal routines.

Mohan Kumar and Rajaguru (2001) prepared a multimedia instructional strategy for learning disabled children. To develop multimedia software for teaching algebra to disabled children was the main objective. The findings point out that the multimedia instruction facilitated the children in learning algebra concepts that their counterparts in conventional teaching group.
Babitha (2004) developed a self instructional package on basic grammar in English for upper primary school pupils. The study revealed that the self instructional package was an effective material for the upper primary school pupils.

Krishnan. (2005) developed the multimedia package for teaching a course on Audio visual Education. The major findings were; a. Ninety eight per cent of the trainees obtained more than 80 percent of the marks on the final post-test. b. The mean percent – ages of the post – test scores varied from 81.41 to 90.46. c. The mean gain in the total scores for all the modules was found to be significant at 0.01 level. d. The mean gain scores of knowledge, comprehension and higher mental abilities were found to be significant at 0.01 level. e. The mean attitude change was found to be significant at 0.01 level. f. The achievement of trainees and their language ability were found to be positively related at 0.01 level of significance. g. The feasibility of the multimedia package was established in terms of cost involved in reproduction of the various resource materials and the time schedule to an actual institutional set up.

Menon K.B. (2005) tried to evolve a multimedia approach to teaching at post graduate level for his Ph.D. research. The findings were: a. In the initial year, around 90 percent Ph.D. students and M.Sc. students scored 60 per cent and above marks on the Comprehensive criterion test, and more than 50 per cent M.Ld. students scored 60 per cent and above marks. b. In the subsequent year around 90 per cent students scored 75 per cent and more marks. c. An improvement trend was witnessed with regard to discussion sessions. d. At different stages of implementation of the strategy, the students’ attitude towards the multimedia approach went on increasing in a favourable direction. e. During the period of try-out of the strategy for two years, the relationship between intelligence and academic achievement was found not significant. The relationship between English comprehension and academic
achievement was found significant at 0.01 level. The unit cost varied from Rs. 471 to Rs. 321 for a range of 25 to 50 students if software suitable to be presented through hardware was to be incorporated. The strategy worked within prescribed periods of time.

The educational implication of the study is that the validated multimedia strategy, with suitable software material can be used to provide instruction in educational technology of one semester duration to postgraduate students in education and related disciplines.

Mirash Renuka (2007) in her M.Ed. Dissertation tried to develop the computer based evaluation software on educational technology for M.Ed. Her findings were: a. The computer based evaluation (CBE) is objective, accurate, valid, reliable and comprehensive. b. CBE is effective and well organized. c. A computerized test can be used again and again. d. The non English medium students face difficulties while responding in English medium through computers. e. A limited numbers of computers may be an impending factor in testing a large number of students. f. An students may not trained in handing the computers for evaluation through computers. g. The scoring on the items and evaluation data processing is done very fast.

Dhanasekaran, M. (2008) in their study on the ‘Relevance of the course on audio-visual education in the B.Ed. programme to the present day educational technology requirements’ found: a. Under the different optional and elective subjects of the B.Ed programme the objectives of introducing the elements of audio-visual education were not totally achieved. These were achieved only among 32% of subjects. b. All the universities in Tamilnadu did not give equal emphasis to audio-visual education in the B.Ed. programme. c. Out of 52 audio-visual aids identified the preparation and use of ‘Improved Aids’ has been recommended in all
the universities and in one autonomous college of education. d. The students did not receive sufficient practice in the preparation, production, operation, and use of educational technology hardware and software. e. The practical training given to the student – teachers, in general, was not up the level required under the B.Ed. programme. f. Though sufficient hardware and software were available in the colleges of education, they were not utilized properly to the optimum level. g. Though teachers, teacher – educators, and heads of schools differed in their assessment of educational technology requirements, they invariably expected higher educational technology requirements. h. While students, teachers and teacher-educators opted for a higher level of knowledge and comprehension, the heads of schools opted for the component ‘skills’ under educational technology requirements. i. There were gaps found in the audio-visual education of the B.Ed. programme mainly (a) in achieving the objectives of audiovisual education, (b) in giving practical training to the student-teachers in audiovisual education and (c) in achieving modern educational technology requirements.

Joseph, B. (2009) at the M.Phil. Level research on ‘Development of computer software for assessing adjustment, GMA and research aptitude of university students’ found that Computer based adjustment test, research aptitude test and general mental ability is reasonably reliable.

Mridula (2010) carried out effectiveness of study and critical evaluation of a computer assisted instructional package development for teacher educators. The incidental sampling consisted of 25 teachers educators. Single group experimental design used to carry out this research. The finding both qualitative and qualitative, reveal that the presentation was effective in bringing out learning. It was also effective in evoking positive reaction towards use of CAI in teaching.
Patron (2011) in his study revealed that a review of the literature yields many intriguing applications of interactive multimedia technology that can be seen through a series of “snapshots” describing current projects and initiatives for deaf education. The five main categories chosen to represent these activities are: instructional design, communication bridges, skill development simulations, distance learning practices, and discovery learning. Throughout the discourse on these projects, the reader will be supplied with relevant data regarding bandwidth, digital divide, feedback, digital rights management, and distribution issues. Attention will then turn to the secondary goal of connecting the lessons learned and the resources available in these arenas to the specific topic of public address training. The author concludes that a survey is necessary to identify the perceptions about technology in regards to its ability to aid in public address practice or performance among deaf students.

2.3.3.1 Conclusion

From the above studies reviewed the investigator could observe that the effect of multimedia was significant for advising scientific knowledge and specially abled children could achieve higher by the instructional material.

2.4 OTHER STUDIES RELATED TO MULTIMEDIA

Madeleine Atkins and Gill Blistt (1989) in their research paper discussed ‘How to use animation in Computer Assisted Learning’. The animation has been used in some form since the beginning of microcomputer based instruction. Given the current number if high quality animation software packages, it is becoming increasingly easy to develop computer based training and multimedia materials which include a significant animation component with past research concerning the effectiveness of this type of instruction has been somewhat mixed. Many students support its use both because of its overall capacity to motivate students and of its
contribution to appropriate content. Thus animations can be effectively used in the lessons.

Mahajan, S. (1991) had developed the computer software for automation of the Diploma course in Computer Education for Ph.D. level research. Researcher had found that: a. Science group scored significantly higher than art group in CET when pre B.Ed. entrance test was considered as covet. b. Males and females did not differ significantly on achievement in computer based entrance test when pre B.Ed. Entrance test was considered as covariate. c. Maths and non Maths groups did not differ significantly on achievement in computer education when pre B.Ed. Entrance test was considered as co-variate.

Allan Clarke (1992) in his research article on ‘How are graphics used in computer based learning?’ pointed out that the graphics still appear to be used as an additional extra rather than being a central part of instructional design. The low use of analogical illustration suggests that designers do not understand their potential and this suggests that they do not understand graphics in general.

Kapadia, A.M. (1992) at the Ph. D. level research on ‘The impact of television on students learning: An exploration’ a. Significant improvement had been achieved after the treatment with the telefilm. It was found effective for self learning in both the groups. It showed a significant gain in the spot test as well as in the retention test scores. b. The telefilm was found more effective in both the groups than the tape-chart programmes in terms of achievement scores as well as retained knowledge. c. It was found that television had an impact which affected study habits. It was also found that television was not considered as an obstacle in the study. d. Seventy seven per cent of the students opined that television motivated self learning. e. Television had no adverse impact on the attendance of the students in the school. f. The social relations
of majority of the students had been disturbed by television. g. Majority of the students felt that their educational interest was satisfied by television. h. Students suggested and increase in educational and agricultural programmes in Hindi or in Gujarati.

Rose, A.S.V. (1992) for her Ph.D. work on ‘Effectiveness of Computer Assisted Instruction with special reference to underachievers’ found: a. Both the CAI strategies were superior to the traditional method of instruction, and CAI with TSS was more effective than CAI without TSS for underachievers. b. Except achievement level, all the other learner variables combined with the treatment had no interaction effect on the achievement score. c. There was no relationship between the post treatment scores and the variables ‘sex’ ‘local’ ‘and’ achievement level’ of the experimental group. In the case of the variables IQ, ‘study habits’ and ‘maths study attitude’ the positive relationship between those variables and achievement at the pre treatment level was found to be cancelled at the post-test. Similar results were obtained for UA.

Diana Laulillard (1995) conducted research on multimedia and the changing experience of the learner through guided discovery attempts to maintain a clear value of a narrative line, while allowing a fair degree of learner control. The principal design features that constitute this form of guided discovery are a. Learners are kept aware of the denouement or goal, all the way through. b. They are advised of what is an appropriate way to approach the task. c. They may construct their own approach and deviate from the line suggested. d. There is always easy access to the narrative line. e. They must construct their own analysis before being able to access the experts. f. There is always an expert analysis for them to check their feedbacks. g. While having access to guidance and a checking mechanism that pre-empts them wandering
aimlessly through an unfathomable database. In this way the adaptive capability of the computer is harnessed to the database capacity of the multimedia system and provides support for the learner with this approach to design multimedia can support a form of guided discovery learning.

Anuradha, K. and Bharathi, V.V. (2002) conducted study on effect of TV viewing on elementary school children’s academic achievement. The results of this study showed that certain TV viewing behavior like viewing only selective programme, viewing TV programme with parents and interaction of father or mother while watching TV improved children’s academic achievement. Parent’s education programme in this aspect may be very helpful.

Kadhiravan, S. and Suresh, V. (2002) studied the effects of Computer assisted Instruction on Self-regulated Learning. In their study, lecture method was used in instructing the control group while CAI as Individualized Instruction Strategy (CAI) and CAI with Peer Interaction (CAIPI) strategies were used in the case of experimental group under quasi experimental design. Sample size includes 3 groups of 35 students. The results of this study revealed that the instructional strategies enhance the students’ use of SRL strategies. CAIPI strategy is the most effective one in enhancing the students’ use of SRL strategies whereas CAI strategy is more effective when compared to the lecture method. In the lecture method the teaching strategy was arranged as to suit the needs of the average learner and there is no provision for immediate feedback. In addition to that there is a provision for shared understanding in CAIPI. Hence, it is concluded from the study that CAIPI and CAI strategies are more effective in enhancing the students’ use of higher order learning strategies than the lecture method.
Munneke, L. and et al. (2003) studied the role of diagrams in collaborative argumentation based learning. In this article two studies on the use of diagrams in computer supported collaborative learning were compared. Focus was on the way argumentative diagrams can be used during collaborative learning tasks, more specifically how diagrams support argumentative interaction between students when they discuss defined topics. The main goal was to discover how diagram construction before discussion, and diagram construction during discussion, influence the way students explore the space of debate during discussion. Twenty pairs of 16/17 years old students were randomly selected from 126 pairs. Ten pairs worked with a diagram before discussion and ten during discussion. The research showed that students use diagrams in very different ways, ranging from a means for talking to just a notebook. Our expectation that using a diagram during discussion leads to more depth in discussion than using one before discussion was not confirmed. Possible explanations for this finding are structure of the task and the way students interpreted the goal of the task.

Koroghlanian, C. and Klein, J.D. (2004) studied the effects of audio and animation in multimedia instruction. This study investigated the effects of audio, animation, and spatial ability in a multimedia computer program for high school biology. Participants completed a multimedia program that presented content by way of text or audio with lean text. In addition, several instructional sequences were presented either with static illustrations or animations. The study examined the effects of instructional mode (text vs. audio), illustration mode (static illustration vs. animation), and spatial ability (low vs. high) on practice and posttest achievement, attitude and time. Results indicated that spatial ability was significantly related to practice achievement and attitude. Participants with high spatial ability performed
better on the practice items than those with low spatial ability. Participants with low spatial ability responded more positively than those with high spatial ability to attitude items concerning concentration interest, and amount of invested mental effort. Findings also revealed that participants who received animation spent significantly more time on the program than those who received static illustrations.

Schnotz, W. and Rasch, T. (2005) this study found that new technologies allow the display of text, static visual and animations. Although animations are inherently attractive, they are not always beneficial for learning. Problems may arise especially when animation modify the learners cognitive load in an unintended way. In two learning experiments with 40 and 26 universities students, the effects of animated picture on knowledge acquisition were investigated. Some pictures were displayed visual formation of changes overtime, whereas other pictures could be manipulated by learners to represent different states in time. Results showed that manipulation pictures had an enabling function for individuals with high learning pre-requisite, whereas simulation pictures had a facilitating function for individuals with low learning pre-requisite. However, the facilitating function was not beneficial for learning, because learners were prevented from performing relevant cognitive processes on their own. A careful analysis of the interrelation between different kinds of cognitive load and process of learning is therefore required.

Slykhuis, David A. and et al. (2005) Eye – tracking technology allows for the determination of the exact location of the point of gaze of a subject’s eye. This study sought to take advantage of this ability to determine how students attend to science related photographs. Pre-service science teachers were shown a power point ™ Presentation with embedded photographs. The photographs were classified according to the Pozzer and Roth (2003) classification scheme. Special focus was given to the
photographs classified as complimentary, most highly integrated with the text, and
decorative, the least integrated with the text. A second variable, accompanying audio
narration, was integrated into the study design. Analysis indicated complimentary
photographs received significantly more attention from the subjects. The effect of
audio narration was to blur this distinction as students spent a greater amount of time
on the given slides. Using eye-tracking technology, this study was able to confirm that
students’ devote more attention to highly relevant photographs.

Steelman, J.D. (2005) in her research article on multimedia makes its mark
described that the high quality multimedia products make use of technology to further
the understanding of a topic in ways that traditional media cannot accomplish. This
article describes the use of multimedia in collaborative student project dealing with an
area of study in the standard curriculum for their state or country. Based on the
comments by teachers, ITFs, and students, it is evident that the incorporation of
multimedia projects developed by students has many more benefits than barriers and
when these barriers are acknowledged, they are much easier to overcome. We can
learn from other teachers’ and students’ experiences by allowing enough time for the
projects, maintaining flexibility, and developing organizational tools to scaffold tools
to scaffold students when they gather data and materials. Janet Barnstable, 2003
middle grades winner from Percy Julian Middle School in Oak Park, Illinois, states,
“It was a great experience. They had fun while creating an educational project. They
learned a lot about their community’s environmental concerns and were able to help
their school create a recycling program.” Barnstable continues, “I’ll never teach
again without being a facilitator of a project-based class in which students collaborate
and communicate with others to produce (high-) quality, multimedia rich work!”
Royals said, “Students become the teachers” when they prepare such products. Royals
encourage other teachers to use the projects in their teaching: sometimes, the creators present them to their fellow students. I found it particularly interesting that students believed that working of a sustained large scale multimedia project to analyze information on a self selected topic within the curriculum provided an in depth understanding as opposed to “easy memorization.” An inquiry based approach leading to a product emphasizing analysis and synthesis of information should be our highest educational goal. With this methodology we are teaching students to be creative, productive citizens in a democratic society. It seems that wrapping this methodology around a multimedia project can be an effective means for promoting the type of learning we strive for in students. This can be fun and exciting not only for students but also for teachers and administrators observing education at its best.

Deimann, M. and Keller, J.M. (2006) in their research article on vocational aspects of multimedia learning revealed that research on multimedia learning has produced a vast body of findings which, however, are not yet being integrated in to a comprehensive framework of reference. For a considerable time cognitive centered approaches have dominated the literature. Although motivational variables are now being taken into account, there is still a large gap in regard to an adequate representation of motivation in multimedia learning. This is an important concern given the various challenges and obstacles, such as navigational problem, distractions, and cognitive overload that learners have to face due to the very nature of hypermedia. A promising area of theory that can help concerning this matter is represented by volition, an old concept in the study of human motivation and action (James, 1902,) which has been reestablished within recent developments in psychology, such as the “theory of action control” (Kuhl, 1984). In this article, a volitional framework to supplement the mostly cognitively based research on
multimedia learning is introduced to serve as a basis for critically reviewing and reinterpreting current research findings. In particular, the volitional framework is applied to common phenomena in multimedia such as “lost in hyperspace,” “cognitive overload”, and “seductive details” together with other obstacles to persistence and learning. In addition, several future directions in research on both theory and practical strategies based on the application of volitional strategies in multimedia learning are provided.

Erhel, S and Jamet, E. (2006) the aim of the study is to evaluate the effects on learning of the spatial integration of textual information incorporated into illustrations in the form of pop-up windows that are opened by the user. Three groups of students viewed illustrated texts depicting the functioning of the heart and the replication of the AIDS virus either with textual information presented below the picture, with textual information integrated within the picture, or with textual information integrated with in the picture with popup windows. The results showed that the integrated formats were more effective than the separated format when we tested the retention of textual information, comprehension and the matching of textual elements to the appropriate illustrated elements. Furthermore, they indicated that the group working with pop-up windows performed better than the integrated groups on the retention test for illustrated information as well as when asked to find correct solutions to problems in a comprehension test. Consequently, these findings support the use of pop-up windows in learning with this kind of illustrated explanatory text.
2.5 CONCLUSION

The investigator reviewed several studies related to science education and multimedia instructional materials at various levels. From the reviewed literature, the investigator could assume the importance of use of instructional material in the science classroom teaching.

Neeliappan (1992) in the study of Science Attitude and Interest among students in relation to their learning environment found that there was a strong relationship between the learning environment and science attitude and interest. The study reveals that if we provide students a better environment for learning, the achievement of science attitude and interest.

In another study done by Kalimuthu (1991), it was found that through the video program on environmental pollution students learnt more of the concept as environmental pollution than those who were taught by the lecture method.

The investigator does not claim that the review of studies attempted in this chapter is complete. However, the review showed that research in the area of development of a multimedia approach for the acquisition of Knowledge, Skills and Attitude towards science is still at an embryonic stage. Hence the investigator felt that developing a multimedia approach and finding the effectiveness of it in science field would be a relevant and useful one.