CHAPTER-II

REVIEW OF THE RELATED LITERATURE

Research in any field implies a step ahead in exploration of unknown concepts. The investigator should be well prepared to explore the concepts which are not known during research process. For any efficacious research to conduct, which can occupy due place in development of a discipline, the investigator must be familiar with both the concept and the previous researches conducted in the area of interest. For assuring this familiarity the literature related to the research area should be explored. It helps the investigator to have knowledge about the work done in the areas of his/her interest. The review of related research provides a clear picture of the study to be taken as a prerequisite to the proper planning of the problem and conducting the research. Also it supports the investigator in attaining thorough understanding of knowledge generation in desired area of research and avoids replication. It further prepares the base of the hypotheses. The knowledge that what has already been done in the area of research, after having a thorough study of the related literature, regarding the method, procedure, source of data, technique of data collection, statistical techniques to be used for analysis etc. keeps the investigator systematic in his/ her own investigation. It also provides insight regarding the strong points and the limitations of the previous studies so as the weaknesses can be avoided and the strong points can be incorporated in the current investigation. In this way, it enables the investigator to improve his/her exploration for arriving at the proper prospective of the study. Any research without such a review of related literature is likely to be a building without any foundation.

2.1 MEANING OF REVIEW OF LITERATURE:

The phrase ‘Review of Literature’ is composed of two words: Review and Literature. Here, the meaning of the term Review, is to organize the knowledge of the specific areas of research to evolve the edifice of knowledge to show that this study would be an addition in this field. In the field of research, the word Literature conveys different meaning from the traditional. It refers to knowledge of a particular area of investigation of any discipline which includes theoretical, practical and its research
studies. Function of review of related literature is highly tedious and creative because the various studies related to the field of research have to be thoroughly studied to gain knowledge, and the acquired knowledge has to be applied for giving rationale of the present study in the light of the findings of the various empirical studies.

According to J. W. Best, “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 recorded of the past”.

By review of related literature, investigator can develop greater understanding of the problem and its critical aspects, which ensures the evidence of unnecessary duplication.

In the words of Scat and Mortimer, “Review of related literature may serve to avoid unnecessary worn out problems and may help to make to progress towards the selection of new ones”.

According to Good (1959), “A Survey of related literature is necessary for proper planning, execution and right concept of the problems and solutions. It provides guiding hypotheses, suggestive methods of investigation and comparative data for interpretative purpose”.

Thus, the review of related literature not only provides conceptual frame of reference for the contemplated research but also suggests method, procedures, sources of data and statistical techniques appropriate to the solution of the problem selected for the present study. The researcher is able to formulate the hypotheses on the basis of review of literature which presents the rationale of the study.

Review of literature can be conducted in two phases:

i. During first phase the investigator identifies all the published material relevant to the problem area and develops the foundation of ideas.

ii. The second phase involves writing this foundation of ideas into various sections.

In the present study the researcher has used various books, dissertations, handbooks, articles, journals, theses, and web sites as reference material.

2.2 OBJECTIVES OF REVIEW OF RELATED LITERATURE:

A literature review is not only limited to the search for information but it actually goes beyond and includes the identification and articulation of relationships between
the previous studies and the present study. Following are the objectives of the review of related literature:

i. To provide a context for the research.

ii. To understand the various aspects and scope of the research thoroughly.

iii. To study the previous studies thoroughly.

iv. To study the flaws in the previous studies.

v. To decide about appropriate objectives, hypotheses, methodology and statistical techniques to be used in the present study.

vi. To have a proper idea about the implementation of the practical work related to present study.

vii. To have appropriate guidance to complete the current research.

viii. To generate a vast outlook regarding the topic of research.

ix. To avoid the repetition of research work done in the area.

x. To find out novel ideas related to current study.

xi. To broaden the horizon of knowledge related to present study.

xii. To outline research gaps in the previous researches.

Published literature is a fruitful source of hypotheses framing, it also stimulates the research worker to derive hypotheses of his own. As investigator reacts to the design, findings and conclusions of the other investigator, he can get insight which can be incorporated into an improved research design. From the above discussion it can be concluded that the study of related literature helps an investigator to know what has been done previously in a particular field of study and what is to be or should be done further.

A summary of writings of recognized authorities and of previous researches provide evidence that the researcher is familiar with what is already known and what is still unknown. For any worthwhile study in any field of knowledge, the research worker needs an adequate familiarity with the available literature related to that field of study. A survey of related study equips the researchers with an understanding of previous work done in the field.
2.3 THEORETICAL BASIS FOR THE REVIEW

Technology is playing increasingly important role in every aspect of teaching and learning in this modern world. The process started with the use of ‘visual aids’ in the support of child centered teaching.

We can see that slowly and gradually the teaching technology is taking different shapes and its obvious inclination towards computer technology is quite evident from various studies. Computer has emerged as a strongest tool for learning; and has been proved a boon for the modern age learners. Kinnaman (1990) identifies that, “The ‘information age’ has clearly arrived and in the 90’s the educational use of computer technology will surely continue to grow”. Today, we see it clearly being true. Starting from the Skinner’s Teaching Machines it has come a long way to its current and most modern form i.e., ICT, Multimedia, Interactive Multimedia and E-learning etc. With the invention of new technology in different aspects of instructional planning and design, a vast number of growing researches were also reported; for finding out the effectiveness of that particular technological aspect under various conditions so that its usefulness can be supported. Many educators, investigators, legislators and parents have expressed concerns about the educational effectiveness of using computers in schools.

Computers can be used in various ways to support instructions in the classroom for students’ better learning. Based on the use of computers in classroom for aiding the teaching and learning process there have been evolved many terms. These are as follows:

2.3.1 Various forms of Computer Technology Uses for Instruction

1. Computer Based Education (CBE) and Computer Based Instructions (CBI): These are broader terms and can be used to refer to any kind of use of computer in educational settings, including instructional management, tutorials, simulations, drill and practice etc.

2. Computer Managed Instructions (CMI): In this the computers can be utilized in educational settings in two ways: computers may be used by school staff to organize students’ data and make decisions related to instructions; or computers may be used to evaluate students’ test performance, guide them for appropriate resources and keep record of their progress.
3. **Computer Assisted/Aided Learning (CAL) and Computer Assisted/Aided Instruction (CAI):** Learning through the use of computer is often referred to as CAL/CAI. In this the computer is used as a medium of flow of information between the teacher and the taught. The information stored in the computers is made available to the learner effortlessly and immediately when needed with a faster speed.

4. **Computer Aided/Assisted Language Learning (CALL):** CALL is a relatively new term, evolving rapidly in the field of language learning. It explores uses of ICT in language learning for producing highly interactive learning environment. It provides effective support for all four skills i.e., acquisition of listening, speaking, reading and writing skills.

5. **Multimedia Learning/ Instructional Packages or Programs:** Multimedia learning packages or programs are the newest innovation in the field of education. Learning through the multimedia packages and programs can be conceived as learning through a combination of hardware and software which allows to integrate text, pictures, video, and animation, audio in form of an effective presentation on an affordable desktop computer.

### 2.4 DETAIL DESCRIPTION OF STUDIES

The detail description has been subdivided into following captions:

2.4.1 **Studies Abroad**

2.4.1.1 Studies Related to CBE, CBI, CMI, CEI,CAL, CAI & CALL

2.4.1.2 Studies Related to Video instructional package, Computer Software, ICT & e-Learning

2.4.1.3 Studies Related to Use of Multimedia in subjects other than Science

2.4.1.4 Studies Related to Use of Multimedia in Science Education
2.4.2 Studies in India

2.4.2.1 Studies Related to CBE, CBI, CMI, CEI, CAL, CAI & CALL

2.4.2.2 Studies Related to Computer Software, ICT & e-Learning

2.4.2.3 Studies Related to Use of Multimedia in subjects other than Science

2.4.2.4 Studies Related to Use of Multimedia in Science Education

2.4.1 Studies Abroad

2.4.1.1 Studies Related to CBE, CBI, CMI, CEI, CAL, CAI & CALL

Haley (1991) conducted a study entitled “Effects of Computer-Assisted Instruction in Micro-Economics Education: An Experimental Course Design”. Objective of the study was to determine the effectiveness of using computer assisted tutorials and examinations as supplements to the basic lecture and discussion course in microeconomics. The secondary consideration for this study were included college grade point averages, scores on the American College Test (ACT) and sex as possible determinants of student learning. This experimental with pre-test post-test study was conducted at Cumberland University, Lebanon, Tennessee during the fall semester. The sample was taken from two section with 41 students each, one was assigned experimental group and another control group. Computer Assisted Instructional materials were prepared in microeconomics and the experimental group was taught through them whereas the control group with conventional method. Students understanding on microeconomics was measured by four instructor generated examinations and the ‘Revised test of understanding in College Economics, Macro form B’. The secondary data was collected through questionnaires. Ordinary Least Squares Regression model was used to determine the relationship between the dependent and independent variables. Finding of this study revealed that students’ cognitive achievement in Microeconomics did not show any significant positive relationship with their use of computer-assisted instruction whereas it was constantly positively related to college grade point average. Males found to be superior to females in terms of cognitive achievement in microeconomics.
Toet (1991) conducted a study entitled “A Comparative study of two instructional modalities on the achievement level of under prepared Community College Students.” Major objective of this study was to determine if an Integrated Computer Assisted Instructional (ICAI) system would show superior results measured by increased cognitive gain, when compared to traditional instructions. The experimental method was used with pre/post protocol experimental group control group design. The sample was randomly selected from a large population of nearly four thousand students who took Motto Community College’s placement test. Out of these only those students were chosen who were recommended to take remedial classes in Maths, English and reading improvement and were assigned to experimental and control groups. The experiment was conducted over two full semesters, control group was taught traditionally through text books whereas the experimental group in Computer Assisted Instruction Laboratory. The students were pretested with standardized tool Nelson Denny Reading or T.A.B.E. The findings of the study showed a significantly higher cognitive gains only in Basic Maths. The analysis of retention rates for both the methods showed that teaching through ICAI has statistically significantly higher retention rate in all the subjects except Basic Maths.

Gao (1992) conducted a study entitled “Factors affecting use of Computer-Assisted Instruction by selected Chinese University educators.” Major objective of this study was to examine whether identified factors (Attitude towards CAI, Language factor, Lack of adequate CAI courseware, lack of availability of CAI educators training, and lack of availability of computer system) have an effect on use of CAI by selected Chinese university educators. The study also examined the current status and attitude towards the use of CAI; and the relationship between the various demographic variables of educators like, age, gender, university rank, computer experience etc. with the use of CAI. The sample for the present study was consisted of 124 university educators from 24 different institutions of China. Among them 35 attended Beijing Workshop on CAI in China and rest 89 attended 5th National CAI Conference, Nanjing, China. A questionnaire was developed for data collection. Collected data was analyzed through ANOVA, General Linear Model (GLM), Correlation coefficient and Scheffe’s test etc. Results of this study indicated a significant development of CAI in recent years. Most educators showed positive attitude towards CAI and more than half of them used CAI
in their teaching. The study also found out that there is statistically significant differences between use of CAI; and age and English level. The use of CAI was also correlated with the age, rank and computer experience. All the five factors were also found to be significantly positively correlated to use of CAI.

Park (1993) conducted a study entitled “Co-operative Learning and Individual Learning with Computer Assisted Instruction in an introductory University level Chemistry course.” The objectives of this study were; to assess the effect of cooperative learning and individual learning with Computer Assisted Instruction (CAI) in a university level introductory Chemistry course, and to assess the cooperation on group work and positive attitude towards using computers in classroom. Two factor experimental design was employed. The sample consisted of 109 students enrolled in an introductory course (CH 301). The two factors were: learning group and learning ability. The learning group factor consisted of two groups: Cooperative working groups and individual working groups with a computer. The ability level factor included two levels: high ability and low ability groups. All participants attended a lecture first and then worked for minimum one hour per day with Chemistry computer programs in lab. Results of the study revealed that students of cooperative Learning group performed better in achievement test than the students of individual learning group with CAI. High ability students and low ability students in cooperative learning group showed improvement in their performance as compared to high ability or low ability students of individual working group. There was no significant difference on students’ attitude of using computers for study of cooperative and individual learning groups. The majority of students in the university level class showed positive cooperation on group work and positive attitude towards using computers in the classrooms.

Burton (1995) conducted a study entitled “The effects of Computer-Assisted Instruction and other selected variables on the academic performance of adult students in Mathematics and Reading (CAI).” This study was conducted to examine the effectiveness of CAI on academic performance of adult students on mathematics and reading sections of the Test of Adult Basic Education (TABE). It also investigated the independent influence of various demographic variables like age, gender, income, marital status, educational level, ethnicity and employment status on the academic performance of students on the overall sessions of TABE. Mixed method was used for
this investigation, with a combination of non-equivalent control group and experimental group design and a casual comparative design. The sample consisted of two hundred adults from Vocational Technical Adult Basic Education Center of south Mississippi. The “Test of Adult Basic Education” having good content validity was used to collect data. The collected data was treated through ANOVA, ANCOVA and Scheffe’s follow-up test. A significant difference was found on the basis of the type of instruction received on achievement of adult students. Age and gender showed no influence where ethnicity had some influence on academic performance of adult students on the total sections of TABE.

Rivet (2001) conducted a study entitled “Students achievement in middle school Mathematics: Computer Assisted Instruction versus traditional Instruction.” This study examined changes in students’ achievement and retention in middle school mathematics on operations involving fractions when taught through two different strategies (CAI and Traditional). A quasi-experimental pre-test post-test design was used. The sample consisted of four intact sections of class 6th from two middle schools (two sections from each). In each school one section was randomly assigned as experimental group and another as control group. The experimental group was taught through CAI involving mathematical concepts all pertaining to the content area of fractions and the control group through traditional method. After six months of study, post-test was taken and scores obtained were examined to test the hypothesis established. The overall improvement scores were found to be significantly higher in experimental group than the traditional group in spite of variation in performance in individual typed of fraction operations. In spite of achievement difference in schools, the CAI sections performed better in each school. Further it was revealed by the results that the students from traditional sections showed an improvement of 3 points on 30 point post-test whereas the students from CAI section improved 4 points. This 33% achievement benefit can be attributed to the utilizing CAI in the classroom.

Hodge (2002) conducted a study entitled “The effect of Math anxiety, Math self-efficacy and Computer Assisted Instruction on the ability of undergraduate nursing students to calculate drug dosages.” The major objective of this study was to study the effect of Math anxiety, Math self-efficacy and CAI on ability of undergraduate nursing students to calculate drug doses. The population of the study consisted of 122
undergraduate nursing students at Mountain State University. The sample included 40 students enrolled in Math topics for nursing course in the spring semester of 2002. The tools used for the data collection were; Math Anxiety Scale (MAS) created by Fennema and Sherman (1976), Math Self-Efficacy Scale (MSES) developed by Betz and Hackett (1989) and Drug Dosage Calculation Exam developed by the investigator himself along with a panel of experts. All students attended a lecture on oral and parental drugs dosages calculations and on intravenous flow rates. After each of three lectures the students either attended a traditional classroom or a computer lab to reinforce these concepts. The results of the study revealed that Math anxiety as a factor in nursing students’ ability to calculate drug dosages was not statistically significant. Math self-efficacy and CAI showed statistically significant relationships with undergraduate nursing students’ ability to calculate drug dosages. So, findings of this study indicate Math anxiety, Math self-efficacy and method of instruction affects the drug dosages calculation ability.

Hsu (2003) conducted a study entitled “The effectiveness of Computer Assisted Instruction in Statistics education: A meta-analysis.” This study investigated the effectiveness of the Computer Assisted Instruction (CAI) in college level statics education in the United States. This study employed meta-analysis to integrate the findings from twenty five primary studies meeting specific set of criteria. The studies included were selected from journal articles, ERIC documents and dissertations. The results of meta-analysis pointed out that a small to medium positive effect is there in applying CAI in teaching college level introductory statistics on students’ achievement. The results of analogous analysis of variance revealed that various modes of CAI program produces significantly different effects on students’ achievement in learning statistics. Expert systems and drill & practice were found to be most effective modes, followed by multimedia, tutorials and simulations. The least effective modes found out to be computational statistical packages and web-based programs. Also, the teacher made CAI programs were significantly more effective as compared to the commercially developed CAI programs. The effectiveness of CAI program in teaching statistics was unaffected by study characteristic of the year of publication, publication score, educational level of participants, interactivity level of the program and sample size.
Suwana (2004) conducted a study entitled “Effectiveness of Computer Assisted Instruction for Primary School Students: An Experimental study”. The main objective of this experimental study was to compare the relative effectiveness of the CAI developed by ONPEC for primary school students to learn English language and the CAI developed by the investigator for primary students to learn Thai language. It also evaluated both types of CAI packages on the basis of collected responses from the experts and primary school students. By purposive sampling technique the investigator selected two schools. Total 120 students were selected randomly from both the schools. A CAI was developed by the investigator on selected five units of Thai language learning for the students of Pratom-3 and five units of Thai language learning for the students of Pratom-6. The CAI developed by the investigator was found to be significantly more effective as compared to the CAI developed by the ONPEC in learning Thai language.

Cannon (2005) conducted a study entitled “Student success: A study of Computer –Base Instruction versus lecture based instruction in developmental Mathematics at a Tennessee Community College”. This study examined the effects of incorporating computerized instruction in developmental mathematics courses. It also studied achievement, retention, persistence and success of students who began in elementary algebra, progressed into Intermediate Algebra and subsequently obtain their goal of completing an initial college level Mathematics course. The sample of the study consisted of two groups of Elementary Algebra from Chattanooga State Technical Community College, randomly assigned as experimental (Computer group, N=208 ) and control group (Lecture group, N=175). The control group was taught through lecture method whereas the experimental group was taught using a computerized instructional approach. The achievement was measured through elementary algebra final exam grades and overall course grades of the students enrolled in elementary algebra in the fall 2002 semester. Retention of the students was studied using those students who began in fall 2002 semester in elementary algebra, and finding their status whether they were enrolled in a mathematics course during spring 2003 semester. Persistence was studied by taking into consideration those students who began elementary algebra in the fall 2002 semester and continued and persisted till registering themselves for a mathematics course in summer 2003. Student success was measured
by considering students who enrolled for the said course in fall 2002 semester and successfully completed the course by fall 2003 semester. The grades (A, B or C) were taken into account while determining the number of successful students. Only one area that shows a significant difference among various other areas was the achievement. The achievement rate of the lecture group was significantly higher than that of the group received computerized instructions. Whereas success, persistence and retention did not affect the groups significantly.

Rosales (2005) conducted a study entitled “The effect of Computer Assisted Instruction on the Mathematics achievement of ninth-grade high school students in the lower Rio Grande valley.” Major objective of this study was to describe the effect of a CAI program on Mathematics achievement of ninth class high school students in the lower Rio Grande Valley as measured by the state assessment. Quasi-experimental pre-test-post-test control group design with matching pair was employed. Ninth class students from two schools were taken as sample and were paired by ethnicity and percentage of socio-economic disadvantaged. The experimental group was treated with a commercially available CAI in addition to instructions as described in Academic Excellence Indicator System (AEIS) and according to district curriculum guidelines. The control group was instructed only according to AEIS and district curriculum guidelines. Spring 2003 eighth grade Mathematics State Assessment, Texas Assessment of knowledge and skills were considered as pre-test scores whereas spring 2003 ninth grade Mathematics State Assessment, Texas Assessment of knowledge and skills were considered as post-test scores for both the groups. ANCOVA was used for statistical treatment. Results of this experimental study showed that there was a significant difference between the mathematics achievement of ninth class high school students of experimental and control group favoring experimental group thus indicating superiority of CAI over traditional instructions.

Barnett (2006) conducted a study entitled “The Effect of Computer Assisted Instruction on the reading skills of emergent readers.” The major objectives of this study were; to examine the effect of CAI in reading skills of emergent readers in kindergarten classes and to analyze teachers’ attitude towards the computer affected student reading achievement. Pre-test post-test treatment and comparison group Experimental design was employed and experimental and control schools were chosen
from School district of Palm Beach Country, Florida. These groups were compared using Dynamic Indicators of Basic Literacy Skills (DIBELS), which tests letter naming ability, initial sound identification, phoneme segmentation ability and nonsense word decoding. Two more tools used were; The Word Recognition and Reading Running Record Assessment Form from the School District of Palm Beach Country, and Reading & Writing Assessment System Grades K-1 protocol booklet for testing the identification of 25 sight words and ability to read continuous text. Findings of the study showed that CAI group scored significantly lower on initial sound fluency measure. To compare DIBELS scores, pre-test post-test comparisons and interaction of treatment with test scores for the CAI compared with the comparison group factorial ANOVA was used and found that the treatment group and comparison group did not differ significantly on these measures. Students’ acquisition of reading skills did not affected by the teachers’ attitude towards computer.

**Deck, Collins and Mc Crickard (2008)** conducted a study entitled “Computer Aided Instruction: A Study of Student Evaluations and Academic Performance.” This study was conducted to study the impact of using CAI on student evaluations of both the course and the instructor and on students’ grades. CAI program was prepared for the Principles of Microeconomics and Principles of Financial Accounting courses. Data was obtained from student course evaluation, homework scores and final exam scores. Findings of the study suggested that CAI had a significant positive impact on final exam scores; i.e. use of CAI improves final exam scores. Over the time CAI gives more positive outcome when instructor is present.

### 2.4.1.2 Studies Related to Video Instructional Package, Computer Software, ICT & e-Learning

**Atawaim (2000)** conducted a study entitled as “the effect of using computer on 6th grade primary students in the curriculum of the Arabic language”. The study aimed to investigate the effect of the computer as an educational tool on students’ academic achievement in the Arabic grammar taught to the 6th grade primary students in Riyadh. The study sample consisted of an experimental group including 30 students taught by using computer and a control group including 30 students taught by the traditional
method. The study revealed absence of significant statistical differences in the level of academic achievement and application and overall test.

Salem (2000) studied “The Effect of using computer as an educational tool in teaching the curriculum of statistics on the development of statistical skills among the third grade commercial secondary school students”. The study aimed to identify the effectiveness of using computer as an educational tool in teaching the curriculum of statistics on the development of statistical skills among the third grade commercial secondary school students in the Arab Republic of Egypt. This experimental study comprised of experimental and control groups having 30 students in each group. The experimental group was taught through computer while the control group was given traditional instructions. The results showed significant statistical difference in average grades of experimental and control groups in favor of experimental group after successful completion of the programs.

Ghazzawi (2002) carried out a study entitled “The computerized software design, its effects and the effect of the movement variable on the academic achievement of 6th grade primary school students concerning some concepts of pilgrimage”. The study aimed to design educational software according to recognised standards and to study its effects and the effect of the movement variable on the academic achievement of 6th grade primary school students concerning some concepts of pilgrimage in Jordan. For this, specific educational software was prepared and applied to a sample of 107 male and female students who were divided into three processing groups, distributed on six branches to find out the influence of the educational software on students’ academic achievement and the effect of the variables of movement and gender through a verified achievement test. The associated variance analysis and Neumankloz test were used for post comparisons. The study results showed significant statistical difference in favor of the computational method which involves moving stimuli because of movement factor.

Abu Nadar (2003) conducted a study entitled as “The effective use of computer on the development of some necessary basic skills to enable the students of technology education to use video camera”. The study aimed to measure the effective use of computer on the development of some necessary basic skills to enable the students of technology education to use video camera in the Faculty of Specific Education in Tanta.
The study used experimental method and the sample consisted of 40 students from technology education divided randomly into experimental and control groups. The results of the study revealed significant statistical difference in favor of experimental group.

Faletic, Planinsic and Horvat (2010) prepared an Interactive e-learning content for physics. They focused on designing e-learning materials with emphasis on interactivity. Tools were developed that enable the user to measure distances, angles, draw vectors, polygonal and freehand lines on pictures and videos, use a star map, analyze graphs derived from data from real measurements, etc. The e-learning content on physics was found to be effective on learning achievement of the students.

Omiola et. al. (2012) conducted a study entitled “Effect of Developed Video Instructional Package on the Performance of Senior Secondary School Physics Students in Ilorin Metropolis.” The purpose of this study was to see the effect of developed video instructional package on the performance of Senior Secondary School Students in Physics in Ilorin Metropolis. The study also investigated the influence of gender and ability levels on the performance of students’ taught with developed video instructional package. Quasi-experimental design, which involved the pre-test, post-test, non-randomized, non-equivalent control group was employed for the study. Research sample comprised of one randomly selected class each from two randomly selected secondary schools. Students from the sampled class were further stratified along gender and ability levels. Physics Performance Test (PPT) was used for data collection and developed video instructional package was used as a treatment. Physics performance test was pilot tested for reliability using the test-retest method of three weeks interval and Pearson Product Correlation analysis revealed a reliability coefficient value of 0.76. The four hypotheses were tested using Analysis of Covariance. In addition, Scheffe’s test was used as post-hoc analysis to test the direction of difference along ability levels. Findings of the study indicated that, students taught with developed video instructional package were not significantly better than those taught without the use of the package. It was revealed that gender of the students was not a factor influencing the performance of students when they were taught using developed video instructional package. Based on the findings it was recommended that, the use of developed video instruction should be encouraged in teaching Physics.
Vanderlinde, Aesaerta and Braaka (2014) conducted a study entitled “Institutionalized ICT use in primary education: A multilevel analysis.” In this study the investigators used a multilayered framework of different independent schools and teachers as a sample. They studied the factors that are related to the use of ICT in learning in primary schools of Flemish (Belgium). A questionnaire was administered to a representative sample of teachers (N=433) in 53 Flemish primary schools. Factor analysis and multilevel hierarchical regression analysis were used for data analysis. The findings of the study suggested that the ‘Institutionalized ICT use’ should not only be considered as a teacher phenomenon but also a school phenomenon. Also it revealed that about 14% of the variance in ICT use of teachers is due to between school differences. The variables ‘ICT professional development’, ‘ICT competences’, ‘Developmental educational beliefs’, and ‘Schools’ ICT vision and policy’ were found to have a positive association with ‘Institutionalized ICT use’.

2.4.1.3 Studies Related to Use of Multimedia in subjects other than Science

Marrison and Frick (1993) conducted a study entitled “Computer Multimedia Instruction versus Traditional Instruction in Post-Secondary Agricultural Education” in an introductory Agriculture Economics course at a major land-grant University. Findings suggested the multimedia instruction to be potentially effective.

Meskill (1996) examined a multi-modal processing and its implications for listening skills development in a foreign or second language can be supported by multimedia. Results of this study indicated that that listening skills development can be supported by multimedia technology.

Callaway (1997) conducted a study to find out the impact of using the computerized program of a multimedia structure on students’ cognitive traits and the educational methods which were ignored in the traditional method. The results showed a statistically significant difference in the average marks of the experimental group and the control group with experimental group which was taught by using multimedia, on higher side.

Algerioy (1999) carried out a study on the impact of using multimedia on the academic achievement of the first grade secondary school students in Mathematics in Riyadh. Experimental method was used with the study sample comprising of 62
students, divided into two groups. The experimental group studied on its own using multimedia whereas the control group was taught through traditional method. The results revealed that there was no statistical difference between the average achievement of the experimental group students and control group students in remembrance, understanding and application level.

**Boeglin and Campbell (1999)** developed and studied the outcomes of an alternative teaching learning method i.e., multimedia method. This method was implemented in the first year university-level introductory psychology course. They found that the multimedia environment fostered the development of a number of personal skills including communication, critical thinking, adaptability, and working with others.

**Hong et.al. (2001)** conducted a study which aimed at finding out the impact of multimedia software on students’ academic achievement in the main concepts of astrology, their ability to acquire the skills of solving big problems as well as the simple skills. The sample consisted of 238 students of ninth grade, who studied in a practical class near Austin City and were interested in astrology. The study sample was divided haphazardly into two groups: first was experimental group, whose students studied using educational software (called The Astrological Village; which included main concepts of astrology and some contemporary problems in astrology) and second was control group taught through conventional method. Pre and post-tests were designed and the results showed that the students of experimental group scored significantly higher on achievement test as compared to the control group. It was apparent that the software (The Astrological Village) is an effective tool which helps students to acquire the special skills of solving problems as they become able to apply the problem-solving techniques on new similar environments and situations.

**Jesshope (2001)** developed an audiograph multimedia CD and conducted an experimental study to find out effectiveness of online education over conventional mode of education. The duration of experiment for this study was three year degree course. The first year of the degree course, ie 1998 was the control year (N=31) in which face-to-face lectures based on power Point Presentations were delivered; whereas 1999 and 2000 (N=33 in both the years) were the experimental years in which treatment was given in form of the audiograph, web-based multimedia material. The finding of the
study revealed that the intervention was proved to be helpful in substantial improvement of the average marks, i.e. 4.0/8 in 1998, 4.7/8 in 1999 and 5.55/8 in 2000. Also, in both experimental years i.e. 1999 and 2000, all students received a C grade or better, whereas in 1998 the failure rate was high about 12%. The result of this experiment revealed that conventional lectures can be replaced by online audiograph multimedia material for better learning outcomes. Further it was suggested by the findings of the study that educators should adopt new technology like multimedia to explore new approaches to education.

Obaid (2001) conducted a study entitled as “A program using multimedia bags to develop the necessary competence of the mathematics in head teachers in high schools. This study aimed to identify the effectiveness of a program using multimedia bags to develop some necessary educational competencies whose number was 41 educational competencies of the mathematics in head teachers of the high schools in the Arab Republic of Egypt. The experiment was conducted on one experimental group consisting of 30 resident mathematics head teachers. The academic achievement test was conducted on the students before and after the test. The study results showed significant statistical differences between pre and post-tests in favor of post-test suggesting the effectiveness of the multimedia program.

Werner (2001) examined the usefulness of multimedia applications in art education by constructing four different presentations of 12 representational paintings. There were 64 participants in this experiment. Various visual effects, such as fading, dissolving, zooming, motion and spoken test were used to modify the learners’ mode of understanding. Adequacy of visual effects and the additional presentation of verbal information were the two experimental conditions. Findings of the study suggested that sophisticated multimedia applications support the learner in adopting a more elaborated mode of learning. It was also revealed that ‘flashy’ multimedia element did not have any instructional value.

Wilson and Mires (2001) studied the effectiveness of computer assisted multimedia learning programme on medical and midwifery students. Audio and Graphics were included in the material. Teaching session was run in which both medical and midwifery students (N=178) were with the computer in four two-hour sessions. Students were tested before and after using the programme. The average
knowledge gain score increased by more than 100%. The enjoyment rating was > 90%. Gain score improvement did not correlate with computer expertise, attitude toward computers, age or enjoyment of the programme.

**Abdul-Majid (2002)** conducted a study entitled “The effect of a proposed program using enhanced multimedia along with computer in teaching Analytical Geometry on acquisition of knowledge and developing the divergent thinking and decision-making skills of the first grade high school students”. The research sample included two classes from the first grade high school students, Neda Secondary School for boys and girls in Sohag. The results showed that experimental group scored significantly higher grades in academic achievement test and in the test of developing the divergent thinking skills suggesting effectiveness of the multimedia program.

**Albalooshi and Alkhalifa (2002)** prepared a multimedia module and a verbal module to assess the effectiveness in relation to conceptual versus procedural knowledge. The sample (N=46), was divided into three experimental groups: First group had only lecture mode, while second group had both lecture and module learning and third group opted only for module. The results indicated that combining two media leads to a cognitive interaction that promotes students’ learning with no less than 40% from their post classical classroom session levels.

**Alldredg and Som (2002)** conducted a study for the comparison of multimedia educational materials used in an introductory statistical methods course. They designed an experiment to evaluate the use of Active Stats- Multimedia Educational Software (on CD) and Cyber Stats-Introduction to Statistics (on the web). It was noted that the combined scores for male and female students, that used Active Stats had significantly higher mean scores for all exams as well as total course points, as compared to the students in Cyber Stats laboratory. However, the results obtained in this study indicated that the effectiveness of multimedia packages varied depending on the gender and dimension of belief.

**Gold and Chief (2002)** developed a multimedia program for a print based Economics Statistics course (ES project) for a distance education project for the objective of introducing technology into the development and delivery phase of an existing course. The team developed nine multimedia programs those were edited together to produce two hours of professional quality video tape for delivery to students.
This video tape containing multimedia program related to Economics Statistics received an encouraging response from the students. Major findings of the study suggested that computer-based presentations are more flexible, more feasible, attractive and effective.

**Jenses et. al. (2002)** assessed the effectiveness of multimedia instructional modules prepared for a basic engineering class at the U S Air Force Academy through the use of visualization. Results showed that the visual multimedia modules are more supportive in enhancing understanding as compared to a traditional lecture format.

**Song and Lee (2002)** studied the effectiveness of Virtual Reality Modeling Language (VRML) to visualize 3-D objects for Middle school geometry classes in a networked environment. VRML is the standard file format for 3-D multimedia and shared virtual worlds on the internet. Class was divided into two groups: Experimental; group using networked VRML materials, and the Control group taught in traditional way. Results of the study showed that the application of VRML based 3-D objects have a positive effect on students’ learning for learning Geometry topics. VRML based Geometry classes provided a virtual reality of figures and objects that cannot easily be described verbally.

**Ibrahim (2003)** conducted a study entitled “Using multimedia technology to present computer basics subject in a way that leads to the availability of adequate skills and information related to the computer domain.” The two groups (Experimental and Control) of the study were selected randomly from the second year students, Art education division, Faculty of specific education, with fifteen students for each group. Pre-test and post-test were conducted to see the effect of multimedia technology. The results of the study showed significant statistical difference at significance level of 0.01 between the average grade of the experimental group in the post application and the delayed post academic achievement test indicating effectiveness of multimedia program.

**Macaulay (2003)** investigated the effectiveness of multimedia on learning performance of non-English speaking third world children by an experimental study. The performance scores of the two groups (Experimental and control) of eighteen children were recorded immediately before and after the instruction. Results clearly
indicated that the children that used multimedia scored significantly higher as compared to control group students suggesting the effectiveness of the multimedia program.

**Muda (2004)** conducted a study on “Mathematics Learning Package: Implementation of Multimedia in Pre-school Education”. The objective of the study were to design an ID model and to develop multimedia-learning packages for teaching and learning in Pre-school children (4-6 years old). The prototype of the package consisted of three main modules including Learning Module equipped with exercises, Singing Module and Games module. The results of the study showed that the combination of multimedia elements such as graphic, audio, animation and text in one digital environment could create an interesting and interactive learning environment.

**Abu Yunis (2005)** conducted a study entitled “the effectiveness of multimedia software to teach Geometry in the second grade of preparatory schools.” The study was aimed at identifying to what extent multimedia software helps in academic achievement of the preparatory school students in subject of Geometry and its remembrance. The sample consisted of 300 girls and boys divided into two groups, each group consisted of 150 girls and boys. The experimental group was taught by multimedia software program that contained a content of Geometry unit identified by the Ministry of Education in the Syrian Arab Republic. The results of the study showed significant statistical difference in the average of academic achievement of control and experimental groups in favor of experimental group.

**Gentry e.t. al. (2005)** prepared a multimedia CD-ROM to generate stories for deaf children and to assess the relative effectiveness of sign and pictures in the transfer of reading by four methods. A multimedia in this CD-ROM was with sound, still/animated pictures, text, and computer data along with drill and practice, tutorial, simulation and problem solving skills. 27 children participated in this study and the results showed that 'print plus pictures" was the most efficacious of all treatments.

**Nasr (2005)** carried out study entitled “Effectiveness of the use of multimedia computer technology on teaching Geometry to the third preparatory grade students on students’ academic achievement and the development of innovative thinking”. Experimental method was used based on the design of two equal groups: Experimental group; which studied the two units through interactive multimedia technology program in the ‘Unit of the Circle’ whereas Control group was taught the same content in the
traditional method. Pre-test and post-test was conducted in each group for academic achievement test as well as innovative thinking test before and after the experiment. The results revealed that Experimental group scored significantly higher average grades in both, academic achievement test as well as innovative thinking test suggesting effectiveness of the program in developing innovative thinking. The percentage of the program efficiency was 72% in developing students’ academic achievement in Geometry and 71% in developing thinking skills in Geometry.

**Kingsley and Boon (2006)** investigated effect of a multimedia based American History Software Programme on students’ achievement of 7th grade middle school students using experimental method and pre-test post-test design. An interactive multimedia programme was developed using various media like, video, animation, song, text etc. to develop critical thinking skills while acquiring knowledge of required content. Experimental group was taught with the help of the interactive multimedia program whereas the control group was taught through traditional method. The results revealed that both experimental and control groups increased their scores from pre-test to post-test conditions, but the control group increased their mean test scores an average of 6.1%, while students in experimental group increased their mean test scores an average of 12.2%, and this difference was statistically significant. So, the findings of the study supported the use of multimedia program in teaching History.

**Da’alj (2008)** conducted a study entitled “The effect of using Mathematics software produced locally on second grade intermediate female students’ academic achievement in Riyadh”. The study aimed to identify the effect of using multimedia software produced locally on second grade intermediate female students’ academic achievement in mathematics. The study sample consisted of 70 female students divided equally into two groups: Experimental group studied by locally produced software and a control group studied through traditional method. No significant difference was found between the post-test mean scores of the experimental and control groups suggesting ineffectiveness of the locally produced multimedia software.

**Murray et.al. (2009)** tested the effectiveness of a multimedia health Sciences educational programme called Health Education and Discovering Science While Unlocking Potential (HEADS UP), in non-Asian minority inner-city students. The modules included video role-model stories featuring minority scientists and students,
hands on classroom activities, and teacher resources. A quasi-experimental, two group (Intervention and comparison group) pre-test post-test design was used to assess program effects on students’ performance, interest, and confidence in their ability to perform well in Science; fear of Science; and confidence in their ability to pursue Science related careers. The intervention school as well as the comparison school was selected from inner city school district. Both the schools had similar institutional and community demographics and academic performance levels. The pairwise matching was done based on low socio-economic status as indicated by inclusion in the free/reduces lunch program, ethnicity, gender and fifth grade AST10 scores in Science. Asian minority students were excluded from the study analysis. This group of matched pairs was followed from 6th to 8th grades (2004-07). At 8th grade, students from intervention school scored significantly higher on the Stanford 10 Achievement Test in Science and reported higher interest in Science than their matched pairs from the comparison school suggesting effectiveness of the HEADS UP programme.

Nusir, Alsmadi, Al-Kabi and Shardqah (2010) designed an Interactive Multimedia Learning System for the children of primary schools in Jordan. The primary aim of this study was to propose and evaluate the possibility of enhancing the early education system with multimedia technologies. A program was developed to teach students young age basic skills. This study showed a good impact of the developed multimedia programme on students’ abilities to understand new knowledge or skills.

Aloraini (2012) conducted a study entitled “The impact of using multimedia on students’ academic achievement in the college of Education at King Saud University”. For this, an experiment of two equivalent groups (Experimental and Control) was designed, each of them consisted of 20 female students. The experimental group was taught using a multimedia presentation program, while the control group was taught by conventional method which uses the dialogue and discussion technique. Both groups were subjected to pre & post-tests in the subject. The results of the study revealed that the experimental group scored significantly higher on achievement test than the control group suggesting that the using multimedia affected students’ achievement positively.

Ayob (2014) conducted a study focusing on main objective; to identify the effect of multimedia hypertext and interactive text on students’ achievement in comprehension. To achieve these objectives, quasi-experimental design with one group
pre-test and post-test was adopted through purposive sampling. The sample of the research consisted of thirty Form-4 Science-1 students of the secondary school in Perak, Malaysia. Students were undergone a course of using multimedia hypertext and interactive text that was organized by the school computer club. Pre-test and post-test were used to identify students’ achievement. Findings of the present study suggested that Multimedia hypertext and interactive text were able to help students to improve performance in comprehension.

Chen et.al. (2014) conducted a study entitled “Effects of type of multimedia strategy on learning of Chinese characters for non-native novices”. The purpose of this study was to investigate the effects of multimedia strategies on non-native novices’ Chinese character learning performance and cognitive load. Two types of multimedia presentations i.e. Radical-highlighted (RH) and Stroke-pronunciation (SP) were developed and implemented with two types of practices i.e. Visual cues (ViC) and Voice cues (VoC). 81 non-native novices constituted the sample of the study and randomly assigned to one of the four experimental groups, viz. Radical-highlighted Visual cues, Radical-highlighted Voice cues, Stroke-pronunciation Visual cues and Stroke-pronunciation Voice cues. An internet base e-learning course was delivered as experimental instruction using a Moodle platform. The SP strategy of showing strokes with pronunciation was found to be better than the RH strategy, enabling the novices to show better performance in identifying Chinese radicals. A significant two way interaction was found suggesting that, SP presentations should be delivered with the Voice cues practice for eliciting better performance in writing and in identifying characters and strokes; and RH presentations should be delivered with Visual cues to elicit better performance in character writing. Furthermore, the level of perceived cognitive load was found to be similar towards the stroke based task and radical based task.

Broek et. al. (2014) conducted a study entitled “Effects of text modality in multimedia presentations on written and oral performance.” This study questioned the generalizability of the modality effect that audio-visual material with picture and spoken narration leads to better learning outcomes as compared to visual only materials with on screen text. The sample consisted of 84 university students. They were divided into two groups. The first group was exposed to learner paced visual only multimedia
presentations and the second group was exposed to audio-visual multimedia presentations. The students of both the groups were assessed through written and oral retention and transfer questions twice; immediately after the presentation and after one day. No significant difference was found between the performance of the two groups immediately after the presentation but after one day the visual only group scored significantly higher than the audio-visual group. Both the groups scored higher on written test rather than oral. The visual only group had shown faster pace in studying the slides and repeated more slides. The results of this study contradict the recommendations of common multimedia design and suggest that on screen text should be included in learner-paced presentations.

Magana (2014) conducted a study entitled “Learning strategies and multimedia techniques for scaffolding size and scale cognition”. Size and scale cognition is a critical aptitude associated with reasoning with concepts and systems in Science, Technology, Engineering and Mathematics (STEM). Participants of this quasi-experimental design included 224 undergraduate students who experienced one of three different multimedia for learning tools, and then were assessed through five tasks whose design was based on the FS2C framework. Results suggested that learning strategies prompted students to compare objects of different sizes, may increase their abilities in ordering and classifying objects. Having students to interact with a logarithmic scale may also have increased participant posttest performance scores in the numerical proportional and absolute measurement tasks. This study proposed that the use of multimedia for learning affordances like 3D interaction, zoom in and zoom out, and direct interaction with a scale metaphor may help students make explicit connections and become familiar with objects of different sizes and scales.

Surjono (2015) investigated the effect of multimedia preferences and learning styles on achievement of undergraduate students in an adaptive e-learning for electronic course at the Yogyakarta State University, Indonesia. For this study randomized pre-test post-test control group and experimental group design was employed. A total 67 students constituted the sample of the study and were randomly assigned to experimental (N=34) and control groups (N=33). An Adaptive e-learning system (AES) for experimental treatment was developed for electronic course for undergraduate students. Same learning material was developed for traditional instruction, called as
NON-AES. The participant students had to fill a questionnaire for Learning style and multimedia preferences. The experimental group was exposed to AES whereas the control group was provided exposure to NON-AES. The findings of the study showed that students scored significantly higher in which their multimedia preferences and learning styles matched with the way of multimedia material presentation as compared to those in which their learning modes were mismatched.

2.4.1.4 Studies Related to Use of Multimedia in Science Education

Gunn and Maxwell (1996) carried out a study to find the effectiveness of multimedia. In this study, first year human anatomy course students were engaged. Student who learned through computer based multimedia performed better.

Allen (1998) conducted a study to find out the efficiency of multimedia software in academic achievement of students in microorganism curriculum. It also assessed their knowledge retention, and their attitudes toward using multimedia computers in teaching the microorganism course. The study sample comprised 76 students of Texas University, divided equally into two groups, Experimental and control groups. The 16-weeks study results uncovered statistically significant differences, in the academic achievements, knowledge retention & attitude towards computer, in favor of the experimental group which studied using the multimedia method over the control group which studied using the traditional method.

Watkins (1999) carried out a study which aimed at finding out the efficiency of teaching by using the multimedia software stored on a CD in the academic achievement of a sample of students from the University of Arizona (49 students) and their attitudes toward Sciences. The study used the semi-experimental method as it divided the study sample haphazardly into two groups: one was experimental whose students studied using educational software while the other was control whose students studied some subjects of Sciences using the traditional method. An achievement test is applied in this study in addition to an attitude scale. The results showed the excelling of the experimental group over the control group, which studied using the traditional method in an attempt to reach an academic achievement. They also showed no statistically-significant differences in attitudes between the two groups.
Frear and Hirschbuhl (2000) investigated the effect of Interactive Multimedia
Instructions upon achievement and problem-solving skills of students in Environmental
Science course. A quasi-experimental design was used with pre-test post-test treatment
group and control group. A sample of 152 students was drawn and divided into
treatment group (N=39) and control group (N=113). Interactive Multimedia Modules,
which promoted participation and interaction were prepared. The control group was
given traditional instructions whereas the treatment group was given treatment in form
of Interactive Multimedia simulation for five weeks. A computerized test, Group
Assessment of Logical Thinking (GALT) was designed to measure students’ cognitive
development. GALT was administered upon 48 students of control group and 26
students of treatment group at pre and post-test stages. The difference of GALT scores
at pre-test stage of treatment group (9.08) and control group (8.92) was only 0.16, which
suggested that there was no difference of cognitive level of knowledge between the
groups. Further post-test analysis revealed that; in both the groups those students who
scored a score of 11 or above performed significantly better in the environmental
Science course than those with a GALT score less than 11. Also a significant difference
was found in pre and post-test scores for the treatment group. Thus this study supported
the effectiveness of Interactive Multimedia in increasing achievement and problem
solving skills of students’ in environmental Science.

Susanne et. al. (2002) developed a student-centered multimedia based
instructional module focusing on how mutations in proto-oncogene and tumor
suppressor genes can lead to uncontrolled cell proliferation and used it in this
experimental study having Cell Biology students as sample. The results of the
experiment found multimedia module very effective.

Hasenekoglu and Timuein (2004) developed a Computer Assisted Biology
Instruction (CABI) material using multimedia on the basic concepts of “Nucleic acids
and protein synthesis” a unit of high school Biology curriculum. Teachers’ responses
regarding CABI were collected through questionnaire. The results of analysis of data
showed that most (94%) of the teachers thought that material would be helpful in
increasing students’ interest, in construction of knowledge and will provide self-
assessment opportunity. The teachers that thought, that the presentation includes
embedded learning gains, were 81%. 75% teachers accepted the suitability of material
for group activities. 81% teachers found it effective for eliciting Biology knowledge and logical conclusion. Overall the survey regarding quality of CABI, 91% of teachers evaluated it as suitable and effective for using in classroom setting for increased achievement and interest of the students.

**Koroghlanian and Klein (2004)** prepared a multimedia program for high school biology and investigated the effects of mode of instruction (audio vs. text), mode of illustration (animation vs. static) and spatial ability (high vs. low) on practice and post achievement, attitude and time. Spatial ability was found to be significantly related to practice achievement and attitude. The students having high spatial ability had shown better performance on practice items than those with low spatial ability, whereas students with low spatial ability had shown more positive response to attitude items, than those with high spatial ability. Also, it was found that animated illustrations were able to hold the students for longer duration of time on the program as compared to the static illustration.

**Russell et.al. (2004)** developed an interactive multimedia package containing two practical and three theoretical modules, with graphic design and animation for photosynthetic electron transport for tertiary level students in Biology. The results of the study revealed that modules improve learning outcomes by providing students access to the content related to theory as well as the practical through an interesting multimedia package.

**Moreno and Mayer (2005)** carried out an investigation whether in an interactive multimedia game Science learning would be facilitated by guidance and reflection. College students were taken as a sample of the study. They learned how to design plants to survive in different weather conditions. The experimental group was either guided with corrective and explanatory feedback or corrective feedback alone, given by a supervisor. Guidance in form of explanatory feedback produced higher transfer scores, fewer incorrect answers and greater reduction of misconceptions during problem solving whereas, the learning was not affected by the reflection in form of having students given explanations for their answers. Findings of the study supported appropriate use of guidance and reflection for interactive multimedia games for better learning in Science.
Finkelstein et. al. (2006) investigated the effects and utility of multimedia simulations developed under Physics Educational Technology project for undergraduate Physics students. Fifty research based multimedia simulations of introductory Physics were designed; which were highly interactive, engaging and could provide animated feedback to the user and could run through internet or downloaded for offline use. Based on the samples (N=100), the control group weighted average was 41% and the treatment group which was treated with the simulations, showed weighted average 63%. The results of the study revealed that the treatment group scored significantly better as compared to the control group suggesting the high effectiveness of multimedia simulations in teaching Physics.

Yenilmez and Tekkaya (2006) examined the effectiveness of a combination of conceptual change text and discussion web strategies on the students’ understanding of some topics of Science viz. respiration and photosynthesis in plants. The sample of the study was consisted of 233 eight standard students from six intact classes of an urban school. The experimental group comprised of 116 students, who received multimedia web and conceptual change text instruction, whereas the control group comprised of 117 students who received traditional instruction. Achievement was measured through two-tier diagnostic test and significantly higher achievement was shown by the experimental group as compared to the control group proving the effectiveness of the multimedia program in removing misconceptions regarding the specific concepts of the Science.

Krishnasamy (2007) conducted a study to examine the effects of a multimedia constructivist environment on students’ achievement and motivation in learning of ‘Chemical formulae and equations’. A quasi experimental 2×2 factorial design was employed. Two types of courseware viz. Multimedia Objectivist Instruction (MOI) and Multimedia Constructivist Instruction (MCI) were developed by the investigator. The sample consisted of 169 students; 80 students were taught through MCI whereas 89 were taught through MOI. The moderator variables of this study were; students’ ability level (High ability: HA or Low ability: LA), Cognitive styles (Field independent: FI or Field dependent: FD) and gender (Male of Female). Results of this study revealed that; the students of MCI group achieved significantly higher scores and were more motivated than the MOI group students. Overall findings of this study supported that
the multimedia constructivist environment has a significant effect on the learning of chemical formulae and equations.

McLaughlin and Arbeider (2008) conducted a study to evaluate multimedia-learning tools on Biology concepts and environmental stewardship based on authentic research data. High school Science teachers and students need interactive, multimedia research-based learning objects that (i) support standards-based teaching, (ii) enforce complex thinking and problem solving, (iii) embrace research skills, (iv) include appropriate assessments to measure student performance, and (v) show real-world uses. To meet these five criteria, the CHANCE modules were purposefully designed to allow students to “learn how things work” using real-world research data. These modules were found to be effective as they pace students through images and text that help them to interpret biological and ecological principles.

Korakakis et.al. (2009) conducted a study entitled “3-D visualization types in multimedia applications for Science learning: A case study of 8th grade students in Greece”. 212 eighth grade students were taken as the sample of the study. It was aimed to determine whether the use of specific type of visualization (3D illustration, 3D animation, and interactive 3D animation) combined with narration and text, contributes to the learning process of 13 and 14 years old students in Science course. Three different versions of an interactive multimedia application were developed. The results of the study indicated that multimedia applications with interactive 3D animations do in fact increase the interest of the students and make them more and more engaged with the content. Also, the findings suggested that 3D illustrations leave the time control of learning to the students and thus decrease the cognitive load.

Anboucarassy (2010) studied effectiveness of multimedia in teaching Biological Science to IX standard students. For this study a multimedia package was developed in Biology for IX standard students. Mean of the experimental group was found to be significantly higher than the mean of the controlled group suggesting that multimedia package for teaching Biology was effective.

Sangodoyin (2010) investigated the effects of computer animation on academic achievement of Nigerian senior secondary school students in Biology. The moderating effects of mental ability and gender were also investigated. The pre-test post-test control group quasi-experimental design with 2×2×2 factorial matrix was adopted for the study.
189 senior secondary school 2nd year Biology students from two randomly selected Federal Government Colleges in two states of south western Nigeria constituted the sample of the study. Findings showed that there was a significant main effect of treatment on students’ achievement in Biology. The computer animation was effective in improving students’ achievement, therefore computer animation was recommended as a means of teaching Biology to students in Nigerian secondary schools.

Adegoke (2011) investigated the effect of multimedia instructions on senior secondary school students’ cognitive achievement in Physics. The sample was constituted by selecting 198 students (92 girls and 106 boys) from four senior secondary schools of Isokan and Ayedeade local government areas of Nigeria; and were randomly assigned to one control and three experimental groups. Three courseware were developed viz. (animation + onscreen text), (animation + narration) and (animation + onscreen text + narration) were developed. The three experimental groups were given treatment through the developed three different courseware and the control group was taught through traditional lecture method. Cognitive achievement was measured through achievement test and the notes taken by the students during the lesson were also assessed. The results of the study showed that the (animation + onscreen text + narration) group showed greater cognitive achievement as well as the students of this group took better quality notes. Findings of this study suggested that multimedia instructions can be used to enhance learning outcomes in physics.

Nkweke, Dirisu and Ndubuisi (2011) carried out a study to determine the effects of synchronized multimedia on motivation and academic performance of students in Biology. Quasi-experimental design was employed. Four senior secondary schools were selected through purposive sampling technique and stratified random sampling technique was used to select 50 students from each school. In all the sample consisted of 10 Biology teachers and 200 students. Two true representative equivalent groups (experimental and control) were prepared on the basis of intelligence having 100 students in each group. The experimental group received treatment in form of synchronized multimedia program (developed by investigator) recorded in VCD along with lecture to further illustrate and explain the topic. The control group was taught through lecture method only. Biology Achievement Test was used to access the academic achievement of students’ in Science. Results of the study indicated that there
is no correlation between use of synchronized multimedia and students’ motivation, while the experimental group scored significantly higher on BAT as compared to the control group suggesting the effectiveness of multimedia supported instruction.

**Ercan (2014)** studied the effect of multimedia learning material on students’ academic achievement and Science attitude. The study employed control group pre-test post-test quasi-experimental design. Convenient sampling was used to select 62 5th grade students. A multimedia learning material was developed by the investigator for 5th grade Science course on the topic ‘Food and healthy nutrition’. The experimental group was exposed to multimedia learning material and the control group was given traditional instructions. An achievement test and an attitude scale was used for data collection. After analyzing the data it was revealed that the experimental group scored significantly higher in achievement test at posttest level, than the control group and the difference may be attributed to the multimedia intervention. It was also found that there was a significant difference between post-test scores of male and female students favoring female students. Science attitude of experimental group was significantly higher. Thus, this study concluded that; learning through multimedia caused effective learning and improved attitude of students’ towards Science.

**Gambari et.al. (2014)** conducted a study “to examine the effect of video based multimedia instruction on senior secondary students’ achievement and retention in Biology”. Experimental control group, pre-test post-test design was employed for the study. The sample was selected through multistage sampling technique. At first stage by purposive sampling four co-educational schools were selected from Gwagwalada Area Council, Nigeria. Then, by simple sampling 120 students (60 boys and 60 girls) were selected and randomly assigned into four groups (three experimental and one control group), with 30 students in each group. Three types of Video Based Multimedia Instructional (VBMI) packages were developed: (Animation+ Narration), (Animation+ Onscreen text) and (Animation+ Narration+ Onscreen text). The three experimental groups were taught using one type of VBMI package and the control group was taught through traditional method. Biology Achievement Test (BAT) containing multiple choice items was used for data collection. The data was analyzed using t-test, ANCOVA and Scheffe’s post-hoc analysis. The results revealed no significant difference among the experimental group, whereas multimedia intervention produced
better achievement as compared to the traditional method. However, the students in traditional teaching group showed better retention as compared to all the experimental groups which used VBMI packages.

**Shah and Khan (2015)** studied comparative effectiveness of multimedia-aided teaching (MAT) on students’ academic achievement and attitude at elementary level in teaching of Science. A quasi-experimental pre-test post-test experimental group and control group design was used in the present study. Teaching of Science is compulsory at elementary level in Pakistan so, all the 8th grade students studying in English-medium private schools of Karachi City constituted the population. Two sections (each having 30 students) of Fazaia Inter College Malir, Karachi, Pakistan were selected randomly from the available six sections as a sample. One section was randomly assigned as the experimental group while the second section formed the control group. The experimental group was taught with the help of multimedia presentation whereas the control group was taught traditionally for a period of 20 weeks. The instruments developed and used for this study were: (a) Scores on Science Achievement Test 1 (SAT1) for pre-testing; (b) Science Achievement Test 2 (SAT2) for post-testing; and (c) Attitude Towards Science Scale (ATSS). SAT1 and SAT2 were developed and validated to collect data from both groups about their academic achievement. Items were finalized after item analysis. Reliabilities of SAT1 and SAT2 were estimated at 0.82 and 0.84 respectively. The independent sample t-test was used to analyze the data. The findings showed that MAT is more effective to improve students’ academic achievement and develop positive attitude towards Science. A significant difference in the mean scores of the experimental and control groups in both academic achievement tests and ATSS after treatment was found suggesting that treatment has a positive impact on students’ academic achievement and attitude. So it can be concluded that MAT is an effective tool to develop positive attitude towards Science.

**2.4.2 STUDIES IN INDIA**

**2.4.2.1 Studies Related to CBE, CBI, CMI, CEI, CAL, CAI & CALL**

**Jeyamani (1991)** investigated the effectiveness of the simulation model of teaching through Computer Assisted Instruction (CAI). The sample of the study consisted of XI standard students of two selected schools. An experimental pre-test
post-test design was employed for the investigation. Computer Assisted Instruction (CAI) was developed on the topics selected from XI class Physics. The experimental group was treated through CAI whereas the control group was given traditional instructions. An achievement test in Physics was developed by the investigator and administered at pre-test and post-test levels. The analysis of data revealed a significant higher mean score of the experimental group than the control group. Effect of gender and medium (Tamil or English) was insignificant on the achievement of the students in Physics.

Singh, Ahluwalia and Verma (1991) conducted a study entitled “Teaching of Mathematics: Effectiveness of Computer Assisted Instruction (CAI) and Conventional method of instruction.” The researcher examined the comparative effectiveness of Computer Assisted Instructions (CAI) and of Conventional method on students’ achievement in Science and their change of attitude towards Mathematics. The sample of the study was drawn from the higher secondary schools of Bhilai (MP). Total 220 students were selected from four higher secondary schools. The students were randomly assigned experimental and control group. The experimental group received treatment in form of CAI in mathematics whereas the control group was taught through conventional method. The results of the study showed the students who were exposed to CAI scored significantly higher as compared to the conventional group, also the experimental group showed significantly higher favorable attitude towards mathematics suggesting supremacy of Computer Assisted Instruction over conventional method of teaching. Also, the achievement in mathematics and change in attitude towards mathematics, both were found to be independent of gender factor.

Rose and Stella (1992) conducted a study entitled “Effectiveness of the computer assisted instruction with special reference to underachievers”. The sample of the study consisted of three groups of equal size (N=32) having students of class IX selected from three Tamilnadu State Board, two urban and one rural schools. Regression analysis was used to identify the underachievers from the sample. A CAI software was developed on the topic ‘the language of sets’ from IX class mathematic text book. The first group was given treatment in form of CAI only, the second group was given treatment in form of a combination of CAI and Teacher Support System (TSS) and the third group was the control group which received traditional instructions.
The analysis of the data revealed that, students in only CAI and CAI with TSS achieved significantly higher scores than the traditional instruction group. The CAI with TSS was the most effective strategy for underachievers as the students of this group scored highest.

Das (1998) conducted a study entitled “Exploring effectiveness of Computer Assisted Learning Materials on Rhymes in different Modes”. Experimental design was employed for this study. A purposive sample of 2nd standard students from an English medium school; Baroda High school, Bagikahna was selected and divided into five groups. A Computer Assisted Learning Material (CALM) was developed by the investigator on rhymes in different modes viz. text only, text-music, text-graphic, text-graphic-music, and text-graphic-music-recital. An achievement test was administered on the students of different groups after they were exposed to the different modes of CALM. The analysis of data revealed that text-graphic mode was comparatively weaker than the other modes of rhyme presentation in learning word meaning. In developing language ability text mode was found to be most effective. Overall the study found that a blend of different modes of presentation may not necessarily support language learning.

Khirwadlker (1998) conducted a study entitled “Development of Computer software for learning Chemistry of XI standard”. Pre-test post-test experimental and control group design was used for the study. A computer assisted instructional (CAI) software was developed for three units of Chemistry curriculum for class XI. The sample consisted of 60 students of XI class studying GSTB syllabus and assigned randomly to experimental and control group, thus each group consisting of 30 students. The experimental group was taught through CAI software and the control group was taught with traditional method for one month. The analysis of pre and post-test scores revealed that the experimental group achieved significantly higher mean scores in achievement test signifying effectiveness of the developed CAI software. Furthermore, the students as well as the teachers had shown a positive attitude towards the CAI software.

Kadhiravan (1999) conducted a study entitled “Effectiveness of Computer Assisted Instruction in relation to students’ use of self-regulated learning strategies”. The main objective of this study was to investigate difference among three different
instructional strategies viz. Lecture Method (LM), Individualized Computer Assisted Instruction (CAI) and CAI with peer interaction (CAIPI) in terms of their effectiveness in improving learning achievement in Physics. A quasi-experimental design was employed in this study and the sample consisted of 105 students from three different schools of Coimbatore and Harur, Tamilnadu. A CAI software was developed on the topics like wave motion and elasticity. A criterion referenced test, and Self-regulated Learning Scale (SRS) was also developed to measure the use of self-regulated learning strategies by the students. Findings of this study clearly indicated CAIPI as most effective instructional strategy in terms of learning achievement of students in Physics. CAI and CAIPI had found to have some influence on students’ use of self-regulated learning strategies whereas LM had not.

Zyoud (1999) developed a Computer Assisted English Language Teaching program for four lessons of English to teach VIII standard Gujrati medium students. Two Gujrati medium schools were selected by purposive sampling technique. The investigator studied effectiveness of the developed programme on students’ achievement in terms of vocabulary, grammar and comprehension. The results of the study clearly indicated that the Computer Assisted English language program helped the students to achieve more in all the aspects viz. vocabulary, grammar and comprehension.

Meera (2000) conducted a study entitled “Relative Effectiveness among Different Modes of Computer-based Instruction in Relation to Students’ Personality Traits”. The main objective of this study was to investigate the comparative effectiveness of the conventional lecture method and three modes of Computer assisted instruction, viz. tutorials, drill & practice and simulation in realization of set objectives in Biology for class XI. Quasi-experimental design was employed for the study. Probability sampling method was used for selection of four groups of students with 35 students in each group. The three experimental groups were given treatment in form of three different modes of CAI and the control group was taught through conventional method. Different modes of CAI were found to have been significantly effective than the conventional method in realizing the set objective of teaching Biology. Also it was found that the effectiveness of any of the method was not affected by the personality of the learner.
Dalwadi (2001) conducted an experimental study to examine the effectiveness of developed Computer Assisted Instruction (CAI) on the topic ‘Light’ from IX class Science text book. The CAI was found to be effective individualized instructional technique for clarifying the concept of light as a significant gain was observed in terms of the achievement of the students learned through CAI. Moreover, the opinions of teachers and students was found to be favorable for the developed CAI program in Science.

Patel, R. (2001) developed a Computer Assisted Learning Material (CALM) on the topics ‘Solar system and magnets’ for VIII standard, and examined its effectiveness in terms of mean achievement of students. Pre-test post-test single group design was used for this study and through purposive sampling technique a group of 30 students was selected. Post-test achievement scores were analyzed and the results revealed a significant gain attributed to the CAI intervention.

Joy and Manickam (2002) conducted a study with an aim to assess the Science teachers’ knowledge of computers, attitude towards CAI and teaching competency. The sample consisted of 50 high school Science teachers from Kerela. Of these, 35 teachers constituted the experimental and rest 26 constituted the control group. No significant difference was found on competency of teachers of control and experimental group. The experimental group after training in CAI showed more favorable attitude towards use of computer in education.

Vasanthi and Hema (2003) investigated the effectiveness of teaching Chemistry for first year B.E. students through Computer Assisted Instruction. The sample consisted of 60 students of Sivnath Aditnagar College of Engineering. These students were divided into two groups; experimental and control, containing 30 students each. Experimental group was taught through CAI whereas the control group with traditional method. A significant difference was found in mean gain scores of control group and experimental group. No significant difference was found between the mean scores of experimental and control groups at pre-test and post-test levels.

Jothikani and Thiagarajan (2004) developed a Computer Assisted Instruction in Mathematics for B. Sc. Students and analyzed its efficiency over conventional method in terms of objectives and achievement in Mathematics. Two equivalent groups of students were formed in each year of B Sc (I year, II year and III year) based on their
performance in previous year. The control group was taught through traditional method whereas the experimental group was given CAI treatment. The mean scores of post-test of control groups were found to be significantly greater than the experimental group with reference to the objectives as well as their achievement in all years suggesting efficiency of conventional method exceeds that of CAI.

Joy and Shaiju (2004) conducted a study to examine the effect of Computer Assisted Teaching Material in History developed for the students of higher secondary level. A CAI program was developed on the topic United Nations Organization for XI standard students. Based on the locality and management of the schools, three schools were chosen, and out of these 162 students (72 boys and 90 girls) were selected randomly. Results of the study found Computer Assisted teaching method superior to the traditional lecture method.

Rajkumar (2005) studied the effectiveness of intervention strategies on developing competencies in teaching Science among DTE (Diploma in Teacher Education) students. The availability of computers has made it possible for the school system to exploit its potential as an aid to teaching. The results of this study suggested that with the help of suitably prepared computer software, teachers can teach and students can learn different complex concepts of various subjects more effectively.

Singh (2005) developed a Computer Assisted Instruction (CAI) for teaching ‘Tissue and cell’ topic in Biology to IX class students and investigated its effectiveness as compared to lecture method. Quasi-experimental design was used for this study and the sample consisted of 28 students of IX class from Ramanujan Public School. The sample was divided into two equal groups; Experimental group which received CAI treatment and Control group which was taught through traditional method. Findings indicated that both the methods were effective in increasing achievement level of students. While lecture method was found to be more effective for teaching ‘cell’ topic, the CAI method was more effective for teaching tissues.

Dange and Wahb (2006) developed a Computer Assisted Instruction (CAI) for class IX in the topic ‘Universe’ of Physical Science and investigated its effect on students’ academic achievement. This experimental study involved a parallal group formed by dividing a sample of 32 students of IX class from Sri. Aurobindo High School, Shimoga into two equated groups of 16 students each. The experimental group
was taught by the CAI package developed by the investigator whereas the control group was taught by conventional method. Mean gain scores of experimental group at post-test was found to be higher than that of control group indicating the effectiveness of CAI package.

Patel, K. B. (2008) conducted an experimental study in order to find out effectiveness of a Computer Assisted Instruction package developed for two units (Motion and Laws of Motion) of Physics for XI class students studying GSTB syllabus. The sample of the study consisted of 30 students in each of the experimental and traditional group. The CAI package was found to be effective over conventional method in terms of achievement in Physics regardless of gender. Also, teachers and students have shown favorable attitude towards the package.

Patel, J. S. (2009) studied the effect of CAI to teach English grammar to VIII standard students in different modes. Sample for this experimental study was selected purposively from two schools of Vadodara. 26 class VIII students from one school constituted the control group and 62 class VIII students from another school, further divided into three equal groups constituted the experimental groups. A CAI was developed to teach English grammar in different modes viz. only CAI, CAI with repetition and CAI with discussion. The control group was taught through conventional method whereas the three experimental groups were taught through the different modes of CAI. The results signified the superiority of CAI method over the conventional method. Out of three modes of CAI, the CAI with discussion was found to be significantly superior in terms of students’ achievement.

2.4.2.2 Studies Related to Computer Software, ICT & e-Learning

Phoolwala (1997) inquired about the utility and effectiveness of microcomputers for students in self-learning ‘Carbonic compounds’ unit of class X Science. In this control group experimental group pre-test post-test experimental study it was found that students learn Chemistry effectively by the use of microcomputers than the traditional method. Also, students showed a highly favorable attitude towards learning Science through microcomputers.

Mehra (2007) conducted a study to assess the attitude of school teachers towards the use of computers for teaching. Sample of this study consisted of 200
government senior secondary school teachers. Findings of the study showed that teachers ‘attitude towards computers use was positive but their computer competency was found to be very low. So, it was suggested that teachers should be provided training for using computers in classroom settings.

Rani (2012) investigated the effect of using e-content in Science classroom on the students’ achievement in Science. e- Content for lessons of Science was developed. In this experimental study the experimental group was taught by using e-content whereas the control group through conventional method. The achievement was measured through a Science achievement test developed by investigator. The results revealed that the achievement in Science was increased significantly by the use of e-content for teaching. There was no significant interaction effect of treatment and gender on achievement.

Kumud (2013) examined the effect of Information and Communication Technology (ICT) on students’ achievement in Mathematics. This experimental study used a purposive sample in form of intact sections of IX class of MM Public School, Karnal, including 34 students in each group. A power point program on the topic of ‘Surface areas and volumes’ was prepared. The treatment group was treated through ICT (Power point program) whereas the control group received traditional instructions. The results revealed that the achievement mean scores of experimental and control groups differ significantly in favor the treatment group suggesting that ICT intervention considerably increases the achievement in Mathematics.

Sahasrabudhe and Kannugu (2014) conducted a study with a primary focus of assessing learning effectiveness of different media used for presenting the content of various e- programs. The results showed that the relationship between the choice of media to present the e-learning program and effectiveness of that program is negatively influenced by learning domain of the program and learning styles of the learners.

Yadav (2015) conducted a study to develop and validate web integrated instructional package for learning disabled students. The sample of the study consisted of 100 learning disabled students of 3rd grade selected from 9 elementary schools of Delhi. The study adopted pre-test post-test control group experimental group design. Findings of the study revealed that the web integrated instructional package was
effective in improving the academic achievement of learning disabled students in English as compared to the conventional method.

2.4.2.3 Studies Related to Use of Multimedia in subjects other than Science

Premila (2001) reported the effect of learning mathematics among high school students by using a CD of multimedia package. Before utilizing the package among the high school students, for their higher education, 33.85% of sample preferred mathematics as a subject and 40.63% of sample preferred Science. After the mathematics package was implemented for high school students 53.85% preferred mathematics and only 24.62% preferred Science subject. 53.85% of students preferred mathematics due to the impact of multimedia package as it created interest among the students in selecting their subjects. There was also a significant change in their retention of learning (T value 3.76) and attitudes towards mathematics (V value 3.70), through multimedia and self-learning method. Both male and female performed better in utilizing the package.

Desai (2004) developed a multimedia package and conducted an experimental study to find out the efficacy of teaching through traditional and multimedia approach in Home Science. The treatment group showed significantly higher mean achievement as compared to control group suggesting effectiveness of multimedia package in enhancing achievement of students in Home-Science.

Patil (2006) developed a Multimedia Instructional System for B Ed students on Computer Education and conducted an experimental study with a sample of 64 students. The results revealed a significant higher performance of the group taught using multimedia than that of the conventional group suggesting the effectiveness of multimedia instructional system in teaching computer education subject.

Kumar (2007) compared three instructional methods viz. Conventional Instructional System (CIS), Audio-visual Instructional System (AVIS) and Multimedia Instructional System (MIS) for teaching Information Technology at secondary level. A purposive sample of 120 students was selected from three CBSE affiliated schools and assigned to three different groups based on their intelligence. These three groups of students were given instructions in above three different methods. Post-test scores
analysis found MIS the most effective, then AVIS and CIS the least effective method for teaching Information technology to secondary students.

Ramasamy (2007) developed a multimedia package for the teaching of history to secondary level students and studied its effectiveness over conventional method. The study was conducted for four groups in two phases. The total sample consisted of 175 students i.e. boys (N=90) and Girls (N=85). The ‘t’-value for pre-test and post-test of the experimental group was 20.55 and the highest gain score was obtained by the fourth group (multimedia group). Results of the study revealed that multimedia package is most effective in learning History since it integrates the elements like text, still and motion pictures, animation and audio when it is compared with conventional teaching. Further this experiment concluded that multimedia can prove a very effective tool for enhancing the learning achievement of students in History at the secondary level.

Khirwadkar (2008) explored the relevancy of ICT in education with a special focus on teachers’ training Multimedia Package for laboratory method in teaching of Chemistry at pre-service level. The package was developed by the researcher and tried on sample of 18 B.Ed. students of the year 2005-06 batch offering teaching of chemistry as a method. Finding of the study revealed effectiveness of the developed multimedia package in learning the concept of management of chemistry laboratory over the conventional approach.

Nagpal (2009) developed a multimedia learning package in Educational Technology for B Ed trainees. Quasi experimental design was employed for this and a purposive sample was taken in form of two intact sections of B Ed class each having 50 students. One group was considered as experimental group and exposed to the Multimedia Learning Package, while another group was taken as control group and taught through traditional lecture method. The MM package was found to be significantly effective than the traditional method in terms of achievement in Educational Technology.

Singaravelu (2009) examined the effect of Multimedia Package in learning vocabulary in Tamil. Parallel group experimental design was adopted for the study and 60 students of class V of Panchayat Union Primary School, Polluapatti, Coimbatore were selected as a sample of the study. The Multimedia package developed by the investigator was used for treatment of the experimental group. The analysis of pre-test
and post-test scores of the control and experimental group clearly indicated that the Multimedia Package was able to create a significant increase in the students’ skills of vocabulary in Tamil.

Patil and Sawant (2010) studied the effectiveness of multimedia package in teaching programming languages to undergraduate students of a distance learning program. A multimedia package was developed by the investigator for teaching common concepts of programming languages. The BCA students of Tilak Maharashtra University (distance mode) were exposed to this package. The results of this study showed the effectiveness of package in various aspects of distance learning.

Munir (2012) studied effectiveness of Multimedia in Education Literacy Program (MEL) to motivate literacy amongst pre-school children in comparison with the conventional literacy program. For this ethnographical and experimental method were employed. The sample of the study consisted of 40 pre-school children divided equally into experimental and control group. The experimental group was taught through MEL package whereas the control group by using conventional method. The investigator developed a check list to measure the effectiveness of MEL. The findings showed that the use of MEL is more effective in motivating children towards literacy than conventional literacy materials.

Yudhister (2015) conducted a study entitled “Development and validation of multimedia package for teaching Economics and its effect on learning outcomes of senior secondary students.” The sample was selected by purposive sampling method for the study. Two intact sections class XI of Major Bihari Lal Sr. Sec. School, Bilaspur Chowk were taken as control and experimental groups having 30 students in each group. The findings of the study suggested that the multimedia package developed by the investigator was effective in terms of achievement of the class XI students in Economics.

### 2.4.2.4 Studies Related to Use of Multimedia in Science Education

Sindhi (1996) constructed a multimedia package for the students of XI standard in Physics and examined its effectiveness on students’ achievement and retention in Physics. This experimental study concluded that teaching through multimedia is more
effective than that of conventional method. Also, it was revealed that teaching through multimedia ensures better retention of learning.

Kumar (1998) found the relative effectiveness of three methods of instruction called exposition method, programmed learning method and multimedia method in Science education. Multimedia method was found to be more effective than either the programmed learning or the expository method. The program learning method was more effective than the expository method.

Devi (2002) developed a computer multimedia program for teaching Science to IX standard students and studied its effectiveness over conventional method and reported that learning through multimedia showed better performance than learning through traditional method of teaching. Further, it also studied the high mean gain scores of the low achievers than that of high achievers of experimental group confirming that the computer multimedia program helped the slow learner to achieve better.

Bhutak (2004) developed a Multimedia Package for subject Science of IX standard and assessed its effectiveness through experimental study. The Multi-media Package consisted of three parts: PowerPoint Slide Show, Self-study material and Over Head Projector transparencies. The effectiveness of the package was assessed with reference to achievement test and retention of the content in Science. The results showed that the multimedia package was more effective in terms of achievement and retention of Science for the both groups of girls and boys; self-study material was more effective than slide show for girls, while slide show proved more effective than self-study material for boys.

Jayaraman (2006) investigated the relative effectiveness of Computer Based Multimedia Learning Packages (CBMMLP) on performance and behavioural outcomes of students of different age groups. Three different types of multimedia packages were developed by Jayaraman for the classes of V, VIII and XI in hard topics of Chemistry. This experimental design consisted of three experimental groups of 104 students (V class-31, VIII class-37 and XI class-36), and three control groups of 92 students (V class-31, VIII class-31 and XI class-30). Results showed that the experimental groups, who received treatment in form of CBMMLP scored significantly higher in post-test than the control groups who received traditional instruction. Also, it was seen that
higher age group students have more positive attitude towards CBMMLP than the lower age group.

Hirani (2007) developed a Computer Aided Multimedia package (CAMMP) for teaching a unit ‘Light and refraction’ of Science for 10th standard students of Gujarati medium school and examined its effect on achievement in Science. The results of this quasi-experimental study revealed that the students of experimental group, who were taught through CAMMP scored significantly higher than the students of control group, who were taught through conventional method. The students showed a favorable attitude towards CAMMP.

Edward and Shivakumar (2008) by their experimental study revealed that the interactive nature of multimedia is useful in providing immediate and comprehensive feedback to the students at higher secondary level. An interactive multimedia CD was developed for some topics in Physics and used in teaching the treatment group, while the control group was given traditional instructions. The results indicated that the interactive multimedia based learning program significantly enhances learning in Physics than the traditional method.

Ahmad (2010) examined the effectiveness of innovative and traditional methods of teaching Biology and based on this experimental study he concluded that multimedia teaching is most effective in teaching Biology which helps students in understanding various concepts of Biology with a deep understanding. Multimedia being a combination of various digital media like audio, video, text, images etc. provides multi-sensory experience to convey information to the learner. By the use of multimedia in teaching difficult or complex concepts of Biology, students are able to learn better since they use multiple sensory modalities which makes them motivated and they pay more attention to the information.

Pal, Sana and Ghosh (2012) studied the influence of Interactive Multimedia Courseware on the achievement of students of VIII standard in Physical Science. An interactive multimedia courseware was developed for a single unit of Physical Science curriculum of class VIII (Bengali medium). The sample selected was divided into two equivalent groups; experimental group (taught using interactive multimedia courseware) and control group (taught by traditional method). A significant increase in
mean gain scores was found between the experimental and control groups which clearly indicated that the interactive multimedia courseware facilitates students’ learning in Physical Science.

**Sahni and Sharma (2012)** conducted a study to find out the effectiveness of multimedia over the conventional method in teaching Blooms Taxonomy to distance mode B Ed students. 124 teacher trainees pursuing B Ed through distance mode constituted the sample of the study. Results of the study indicated that the teacher trainees who were taught through multimedia program had shown better learning and retention of content as compared to the trainees who were taught through traditional method. Also it was found that multimedia program proved to be more effective for low achievers than the high achievers.

**Kumar (2013)** studied impact of using multimedia in teaching Science to high school students. Through stratified sampling technique a sample of 200 students was drawn from Government High School, Lakkiyampatti and Government High School, Nallamalli. Two groups, including average and slow learners were prepared and named as experimental and control group. This study revealed that teaching with multimedia enhances achievement in Science and is better than traditional method.

**Dubey (2014)** conducted an experimental study to examine the impact of multimedia package on class VIII students in Biology. The sample was drawn from a large population of class VIII students studying in non-government Hindi medium schools of Raipur city. Keeping equal girl boy ratio, two groups, experimental and control were prepared each having 60 students. The experimental group was taught by multimedia package developed by investigator whereas the control group was taught through traditional method. Biology Achievement Test (BAT) was developed to assess the achievement in Science at pre-test and post-test level. The results revealed that multimedia package was significantly superior in terms of support to learning and achievement of the students.

**Hegde (2014)** developed a multimedia packages for teaching Biological Science, validated them and examined its effect on learning outcomes of secondary schools students. Four types of multimedia packages were developed by the investigator. 175 students (90 boys and 85 girls) studying in IX standard were drawn by random proportionate sampling technique from a population of Science students of
schools of Dandeli city, Haliyal Taluk. The sample was divided into one control and four experimental groups. The control group was taught through conventional method and experimental groups were taught using four different Multimedia packages - [E Group-1 (Text+ Still pictures), E Group-2 (Text+ Still pictures+ Audio), E Group-3 (Text+ Still pictures+ Animation), and E Group-4 (Text+ Still pictures+ Animation+ Audio)]. Results revealed that the students learn better through multimedia than the traditional method. The highest gain score was obtained by the E Group-4, followed by E Group-3, E Group-2, E Group-1 and the control group in descending order. Fourth type of multimedia package was found to be most effective since it integrates all the elements of multimedia like text, still and motion pictures, animations, audio, video etc.

Satyaprakasha and Behera (2014) assessed effectiveness of multimedia teaching on VIII standard students’ achievement in Biology through an experimental study. Pre-test post-test equivalent group experimental design was used. The sample consisted of 80 students of class VIII of an unaided school at Bangalore, Karnataka. From results it was concluded that multimedia teaching significantly enhanced the achievement with respect to knowledge, understanding, application and total achievement in Biology as compared to conventional method.

Satyaprakasha and Sudhanshu (2014) investigated the effect of multimedia teaching on achievement in Biology of IX class students. Two intact sections of Samhitha High School, Kurabrahalli, Bangalore were selected as sample and randomly assigned as experimental and control group. The findings of the study revealed that teaching Biology with multimedia package significantly promoted achievement of the students with respect to knowledge, understanding, application and total achievement.

Suman (2014) investigated the effect of multimedia package on cognitive and affective outcomes of elementary students in environmental Science. A quasi-experimental design was employed and a purposive sample in form of intact sections of class VI of the Gurukul Senior Secondary School, Matindu was selected and divided into two groups; experimental and control group. The experimental group was given treatment in form of instructions supported by multimedia package whereas the control group was taught by traditional method. It was found that the experimental group, which was exposed to the multimedia learning package achieved significantly higher on both achievement test and attitude towards environmental Science in comparison to
those exposed to traditional method of teaching. The results of the study suggested effectiveness of multimedia package in enhancing achievement in environmental Science as well as in developing positive attitude towards environmental Science.

2.5 OVERVIEW

As it is apparent from the above discussed studies that many investigations have been conducted so far in India and abroad related to effectiveness of computer based instructions in comparison with traditional or conventional instruction. Earlier CAI was evolved as a strong instrument to replace the traditional teaching for better academic achievement of students. Slowly and gradually software programs, multimedia packages, e-learning and ICT etc. have evolved due to the need of the present day learner; continuous development of technology and its application in the field of education. We can see that a vast number of research studies were directed to find out the effectiveness of these modern computer intervention programs like; multimedia, educational softwares, e-learning packages, ICT in education in form of CD etc. Multimedia have been evolved as a more efficient tool for the present day digital learner.


Various researchers conducted studies to find out the effectiveness of using computer, educational software, video instructional package, web-integrated instructional packages, e-learning content, ICT etc. as an intervention in enhancing achievement and skills of the students in various subjects like; Phoolwala (1997), Saleem (2000), Ghazzawi (2002), Abu Nadar (2003), Faletic, Planinsic and Horvat
Omiola et al. (2012), Rani (2012), Kumud (2013), Sahasrabudhe and Kannugu (2014), Yadav (2015) etc. and found that the intervention was effective in enhancing the academic achievement and skill development. Whereas Atawain (2000) found no significant effect of using computer on academic achievement of sixth grader students in Arabic language.


As it is apparent from the review of related studies that though a number of investigations have been carried out in this direction, but results of these studies are not conclusive. Moreover it is the need of the hour to motivate and encourage students to opt for Science, recently a trend has been witnessed by the stakeholders indicating students’ apathy towards Science subjects and preference to other subjects. If this trend is allowed to continue, how we will be able to face the challenges of the modern world. So, in order to keep pace with the modern advancements in the field of Science, Medicine and environment we are left with no option but to motivate our students to go for Science subjects by having a positive attitude towards Science. Findings of various research studies revealed that out of many reasons behind the poor academic performance of students in Life Science one distinguished reason is that in some cases our teachers are not equipped with good quality instructional material, whereas in some other cases the instructional material is there but is not being effectively utilized. So, there is a dire need of directing researches not only towards finding out the suitable and effective instructional method, according to learners’ interest and mental level but also developing innovative instructional material to aid teaching of Science. Consequently development and validation of MMIP for teaching Science subjects can go a long way in making teaching of Science subjects student centered, fun filled and activity oriented instead of difficult, dull and teacher centered.