

CHAPTER 2

REVIEW OF RELATED LITERATURE

2.0 INTRODUCTION

A brief review of the literature dealing with different aspects of Biological Sciences and Multimedia might be helpful in developing insight into the problem. The Review of related literatures is based on the researches that took place in the field of Biological Sciences, Multimedia approaches to teaching, and the use of technology in education. During the study, the investigator has gone through the research works done in the related fields. The gist of the research work conducted by different researchers is given below. This review of related literature can be grouped mainly under the following two headings. 2.1. Literature related to innovative methods of teaching and 2.2. Literature related to teaching of Biology (Life Sciences).

Educational technology is an important aspect of educational system. It is extensively used to provide effective teaching and learning process in the classroom. Realizing the importance of CAI and multimedia as an instructional tool various researches were conducted and its effectiveness was tested. In this section the investigator has provided available related literature keeping the present study in view. A total of 63 studies have been reviewed to develop a complete and holistic perspective of the objectives and findings of these studies and to arrive at the implications to support the present study.

The order of arrangement of review of related literature as follows:

1. Review of studies related to innovative methods of teaching and
2. Review of studies related to teaching of Biology (Life Science).

2.1 Review of Studies Related to Innovative Methods of Teaching:

Shah (1966) developed auto-instructional programmes in Algebra for standard VIII and to find out their effectiveness in relation to different variables. The purpose of the study was to examine the potentialities of the auto-instructional programmes as a practical solution. And the findings: (i). The total mean score achieved by the experimental group was higher than the total mean score achieved by the control group. (ii). The average time taken by the experimental group was less than the average time allotted to the control group.

Sharma (1966) A comparative study of outcomes of teaching of Algebra by conventional classroom method and method of programmed instruction, in Government Johari higher secondary school, Ladnun in Rajasthan. The sample consists of 80 students of class IX. Besides usual pre-test and post-test, a delayed post-test was also administered to study the effectiveness of the two methods in terms of retention. The findings of the study showed that the mean achievement of the experimental group taught through PLM was 2.5 higher than that of the control group taught by the teacher through the lecture method. Also the delayed post-test showed better retention by the experimental group.

Patel (1975) developed Auto-instructional Programmes in Geometry for Std. IX and to find out their effectiveness in relation to different variables. Fourteen classes of fourteen rural and urban high schools formed the sample of the study. The tools used in the study were (i). The Desai's Intelligence Tests etc. The findings of the study were: (i). The PLM proved to be more effective than conventional method (ii). Low IQ groups of students performed better with PLM than with conventional teaching (iii). The average time taken by the group learning through PLM was less than that of the group taught by the traditional method (iv). Students from different strata of the society performed better with PLM than with conventional teaching.

Jones and et al (1980) studied teaching of Chemistry by means of video cassettes by employing computer graphics. The results indicated that the instructional videotapes,

employing computer animated graphics could be used to teach Chemistry if presented under conditions which are conducive to learning and if subjected to developmental testing, to assure students' learning. The abstract atomic scale concepts of Chemistry might also be related to their concrete, macroscopic representations by the combination of live action scenes and computer animation. The algorithms involving chemical calculations might be taught via these media, where they were used to model mental processes for the students.

Kolz and et al (1980) evaluated the effectiveness of several CAI programmes in General Chemistry. He tried to find out whether two sets of Computer Assisted Instruction (CAI) programmes - one in Chemistry and the other in Mathematics had any effect in students' performance. The analysis of Covariance indicated that there was no significant difference in students' performance in Chemistry through CAI.

Adeshera (1981) has developed an innovative technique of micro-teaching in teacher training programme. The study focuses on traditional training coupled with auto-instructional material, micro-teaching training in simulated condition and micro-teaching training in real situation with co-variants as sex, socio-economic status, intelligence, anxiety and need for achievement. It was found that the most effective method was micro-teaching training in real situation, as general teaching competencies were higher.

Tauro (1981) made a study of academically superior students' response to a particular computer assisted programme in chemistry. The purpose of this study was to determine if classroom instruction which utilized computer-assisted programme, was more effective than instruction based on a traditional approach to teach Chemistry and to document the students evaluation to a particular computer assisted programme in introductory chemistry. It was found that the students exposed to the CAI method of instruction, scored higher in the university final chemistry examinations. Students exposed to the CAI method of instruction had a greater positive attitude towards the study of Chemistry. The study also reveals that: (1) CAI programmes in Chemistry were an effective mode of instruction. (2) CAI programmes in Chemistry increased their enthusiasm for the study of

Chemistry. (3) Drill and practice with CAI helped them to solve numerical problems in Chemistry.

Golani (1982) conducted a study on “The Use of Audio-visual Aids in the Secondary Schools of Thane District” with the objectives to know the existing situation and to create awareness among teachers and headmasters, and concerned teachers about the measures for providing better and improvised materials on audiovisual education. The tools of investigation were questionnaires, visits and observations. Findings revealed that (1). Schools (run) conducted by rich societies in urban areas possessed audiovisual aids. (2). At many places the audiovisual aids were in a broken down condition and awaited repairs and at many places the hardware was purchased but was not used, as proper software was not available. (3). Audio-visual aids were useful in teaching but were not used due to lack of properly trained personnel and lack of accommodation in the schools. Only a few teachers used audio-visual aids in teaching. (4) The state institute for audio-visual education could not provide training to personnel and could not supply proper learning materials.

Krishnan (1983) conducted a study entitled “Development of Multimedia Package for Teaching a Course on Audio-Visual Education” for the instructor training programme and tried to find the effectiveness of the multimedia package in terms of achievement of trainees and change in attitude of the instructor trainees towards the multimedia package, and tried to study the feasibility of the multimedia package in terms of time and cost for the instructor training programme. There were five modules containing the full course units. The components of the modules were programmed slides, programmed instructional material, non-projected visual aids, self-instructional materials with a manual for practical exercises, self-evaluating unit tests with answer keys, discussions, feedback, etc. The strategy was implemented for one academic session. The major findings of the study were: (1) 98 per cent of the trainees obtained more than 80 per cent of the marks on the final post-test. (2) The mean percentages of the post-test scores varied from 81.41 to 90.46. (3) The mean gain in the total scores for all the modules was found to be significant at 0.1 level. (4) The mean gain scores of knowledge,

comprehension and higher mental abilities, attitudinal change, achievement of the trainees and their language ability were found to be positively related and significant at 0.01 level. (5) The feasibility of the multimedia package was established in terms of cost involved in reproduction of the various resource materials and the time scheduling in an actual institutional set-up. The study was found to be quite effective. The implication of the study was that multimedia packages in modular form could be used for training programmes in vocational institutions.

Rao (1983) conducted “a comparative study of PLM and conventional learning methods in the instruction of mathematics, a psychological approach”. Objectives of the study (i) To find out the efficiency of the PLM over the conventional learning method in the instruction of mathematics in school education. (ii) To determine the variation in learning gains in the pupils in the rural and urban dimension. The design was an experimental cum field investigation. Two matched groups of students were exposed to PLM and conventional classroom teaching. The findings of the study were (1) the mean performance scores of all the PLM groups were higher than those of the corresponding conventional learning groups. (2) The performance of urban subjects was superior to the performance of the rural subjects under the PLM, irrespective of the grade.

Vardhini (1983) conducted a study entitled “Development of Multimedia Instructional Strategy for teaching science at Secondary Level”. One noteworthy findings of her study was that visual projections with teacher explanation and those with taped commentary were equally effective in terms of achievement and on the basis of her efforts and experience she concluded that, for achievement of different instructional objectives, systematically validated multimedia strategy can be implemented at school level without having to spend too much money or time.

McDonald (1984) studied the effect of supplemental microcomputer intervention on the achievement of university level students. The purpose of this study was to determine the effectiveness of supplemental microcomputer instruction in a Keller plan remedial/developmental mathematics classroom. This study further investigated the

effect of this instructional combination on the achievement of students according to their preferred learning style. It was found that there was no significant difference in achievement of control group and experimental group on the basis of learning style. But students with low scores had a better opportunity to show improvement.

Menon (1984) evolved a multimedia approach to teaching at the Post Graduate level. The instructional input of the strategy were programmed learning material, structuring lecture, team teaching, seminar, slide-tape commentary, workbook presentation, discussion, library work, assignment, feedback session, practical work and summary. The tools used for the study were the Criterion Test, Observation Schedule and an Attitude Scale prepared by the investigator. It was found that at different stages of the implementation of the strategy, the students' attitude towards multimedia approach went on increasing in a favorable direction. The educational implication of the study is that the validated multimedia strategy, with suitable software material can be used to provide instruction in educational technology of one semester duration to post graduate students in education and related disciplines.

Desai (1985) conducted a study entitled "An investigation into Efficacy of Different Instructional Media in the Teaching of Science to the Pupils of Class VIII in Relation to Certain Variables", with the help of programmed learning material, slides and laboratory experiments were designed. The major findings of the study revealed that the learning by experimental approach was the most effective of all approaches. The programmed learning approach and slides with discussion approach were equally effective. The use of instructional media indicated the possibility of improvement in the methodology of science teaching, raising the standard of science education in secondary schools and development of taste and interest in the younger generation for the subject of science. The major educational implication of the study is that there is no one single method of teaching science. The teacher should be experimental-minded and should use different approaches in the light of different objectives. Multimedia are effective in Science education.

Joseph (1985) used the new interactive medium CATI (Computer Assisted Televised Instruction) to teach techniques used in the visual art namely sculpture, plaster and related material. It was found that due to significant capacity of CATI to deliver high resolution pictures and to provide the user with interactive instruction, CATI was found to have considerable potential for art making instruction.

Parry and et al (1985) have reported from their survey on the use of computers that there were five main areas of contribution of Computer Based Instruction (CBI) in education. (1) As measured by students' achievement alone, CBI was best used as a supplement to the regular curriculum. (2) When CBI was used alone, students' achievement was almost equal to that achieved with traditional instructional mode. (3) Teachers' and students' attitude towards CBI was positive (4) CBI resulted in saving of instructional and learning time. (5) CBI was particularly effective with slow learners.

Johnson and Stanne (1986) studied the effect of Computer Assisted Cooperative, Competitive and Individualistic Instruction in terms of achievement, student interaction and attitude of eighth grade students. It was found that computer assisted cooperative learning promoted the ability to apply facts in test questions requiring higher level reasoning and problem solving and more success in complex problem solving tasks, involving mapping and navigation.

Meyer and et al (1986) carried out a comparative analysis of the value of intrinsic motivation in computer software in the mathematics achievement, attitude, and depth of involvement of under-achieving students at secondary stage of education. The study reveals that there was no significant difference in the academic achievement and attitude between the control and experimental group. Use of CAI with or without graphics did not substantially improve the achievements and attitudes of underachieving students significantly than other intensive remedial instructional technique.

James (1987) carried out a study to see the effect of computerized tutorial programme on high school juniors and seniors. The results of the study showed that the experimental

group scored higher than the control group. A significant relationship was found to exist between students' background in mathematics and their scores in mathematics.

Joshi (1987) studied the effectiveness of developed instructional strategy and the study of performance of students on criterion tests. In addition, the reaction of students towards various components of instructional package, as a whole, was seen. The study employed the Post-test, Control Group Design. The mean scores obtained by students taught through the Traditional Method were compared with the mean of scores obtained by the students taught through the Developed Strategy. It was found that the Developed Instructional Strategy was found to be more effective than the Traditional Method. Therefore, we can conclude that a topic taught through other interesting methods proved to be more effective.

Cutlet (1990) studied the effect of pictures in computerized instruction at university level. The primary purpose of this study was to examine the effect of the representational pictures on the immediate and delayed recall. The secondary focus was to explore the impact of pictures on the application of content and on internet in the lesson. The results of the study showed that pictures had a significant effect in immediate recall and had effect on delayed recall but did not have an adverse effect on interest.

Slick (1990) carried out a comparative study of two computer assisted methods of teaching Introductory Chemistry for problem solving. The purpose of this study was to evaluate the effectiveness of Mathematical Chemistry problem solving stages that required students to formally define and derive data (i.e. quantity unit and type of mixture or substance) in Mathematical Chemistry problems. The result indicated that the treatments demonstrated significant gain. The experimental group showed a significant gain in attitude towards Chemistry while control group showed significant gain in attitude towards computers.

Srivastava (1990) conducted a study on Programmed Learning as a function of anxiety under different motivational condition. Independent study, Unnai Dayanand Subhash

National College (ERIC funded). Problem: The study attempts to investigate the efficacy programmed learning as a function of anxiety under different motivational conditions. Objectives: (1) To study the differential effect of the motivational conditions on scholastic achievement through programmed learning devices on different types of learners – above average, average and below average in the school setting. (2) To study the comparable effects of levels and effects of anxiety on the achievement of different types of learners and (3) To study the interaction effect of motivational condition and the levels and effects of anxiety on the learner. Methodology: The sample composed 25% students from urban schools and 286 and 297 students of rural school students in class IX and X, who was drawn using stratified random sampling technique. The tools used include, DAT (Differential Aptitude Test Form LH) By Ojha, Teacher made achievement test developed by researcher, Achievement Anxiety Test by Alport and Haber, Test Anxiety Scale for children in Hindi by Nijhawan, State Trait Anxiety Inventory by Spielberger, adopted in Hindi by the researcher. The collected data were treated by applying three-way ANOVA, factorial experiment design, difference correlation and t-test. Major findings (1) The use of Programmed Learning as a teaching device, was particularly helpful for low and average achievers. (2) Knowledge of the result and praise by the teacher were good motivators. The third motivational condition-reward under competition in addition to the result was not very effective in comparison to the other two. (3) Interaction effects between anxiety and motivational condition were very effective for programmed learning. (4) The results from the interaction effects between aptitude, achievement and motivational conditions imply that the motivational conditions did affect aptitude/achievement.

Jayamani (1991) developed CAI in Physics for class XI students. The CAI was developed by using BASICA. The experimental group received CAI and after the experiment it was found that experimental group performed better on the post-test. The difference was significant in terms of sex and medium of instruction.

Mahapatra (1991) developed a software package for teaching Chemistry to the standard IX students and compared it with the traditional teaching. Results of the study indicated

the following: (1) CAI was effective in terms of students' achievement. Seventy percent students achieved more than sixty percent marks on criterion test. (2) The CAI material was found to be effective in terms of achievement as compared to the traditional method of teaching by taking intelligence as covariate. (3) Abstract reasoning score of the students studying through CAI was not found to be significantly higher than the traditional method of teaching by taking intelligence as covariate. (4) The extrovert and introvert students have no significant change in their reactions towards CAI.

Raghavan and Dharmaraja (1991) have found from their studies that the use of computer software produced a significant difference in the students' achievement between the experimental and control group. There is a need to test computer educational software packages in school before releasing them for publication. Teachers must evaluate the usefulness of package before buying or recommending them for school.

Bhatia (1992) studied identification and remedy of difficulties in learning fractions with programmed instructional material. The study tests the effectiveness of programmed instructional material as a remedial teaching tool. Objectives: (1) To develop programmed instructional material on fractions for students of class V. (2) To use programmed instructional material as a remedial tool. (3) To test the effectiveness of programmed instructional material in class room teaching for students of class V and (4) To test the significance of difference between the traditional method of teaching and teaching through PLM. Methodology: A sample of 50 students was selected from two M.C.D primary schools of Karol Bagh, New Delhi, 25 students from each school; four criterion tests were administered as tools to collect data. The collected data were treated by using mean, SD and t-test. Major findings: (1) Teaching and learning through PLM could definitely help both students and teachers. (2) Students receiving the PLM did better in post-test as compared to the other group. (3) The PLM worked effectively as a remedial tool. (4) PLM not only helped the students to learn better but also helped the teacher to know how the students learn better.

Douglas (1992) studied the effectiveness of hypermedia-based, Learner Controlled (LC) instruction on atomic structure at junior high school level. In this study, students were assigned one of the two treatments. First was Programme Control (PC) instruction. It was modeled on typical CAI design. Second was Learner Controlled (LC) which gave freedom of forward and backward branching, common to hypermedia designs. The results of the study suggested that a structured instructional approach was more appropriate for junior high school science students, particularly when subject matter places a higher cognitive load on students.

Rose Antony Stella (1992) tested the Effectiveness of Computer Assisted Instruction (CAI) with special reference to underachievers. The study throws light on the application of CAI and the Teacher Support System (TSS) for the optimum development of underachievers (UA). Objectives: (1) To develop CAI software. (2) To find out the effectiveness of CAI with TSS and CAI without TSS with reference to the learners variables viz. sex, IQ and achievement level and (3) To find out the interaction of the learner variables and the treatment on the achievement score. Methodology: The randomized block design was followed in the selection of the samples, with IQ as the blocking variables. The samples consisted of three groups of size 32 each composed of students of Std. IX selected from Tamil Nadu State Board schools covering one rural and two Urban. The underachievers in the sample were identified by using the regression analysis. The tools used included CAI software in the language of sets, achievement test, and cultural fair, intelligence test by Cattell and Cattell, study habit inventory by Patel, and Mathematics study attitude scale by Sunderrajan, Mean, S.D, t-test, Chi-square, one way and two-way ANOVA were used to treat the collected data. Major findings: (1). Both the CAI strategies were superior to the traditional method of instruction, and CAI with TSS was more effective than CAI without TSS for underachievers (UA). (2) Except achievement level, all the other learner variables combined with the treatment had no interaction effect on the achievement score. (3) There was no relationship between the post-treatment scores and the variables like sex, locale and achievement level of the experimental group. In the case of the variables IQ, study habits and attitude towards maths study, the positive relationship between those variable and achievement at the pre-

treatment level was found to be cancelled at the post-test. Similar results were obtained for UA.

Williamson (1992) found the effects of computer animation, emphasizing the particulate nature of matter, on the understandings and misconceptions of Chemistry students at College level. The experimental group was compared to a control group. The four dependent variables were conceptual understanding, number of misconceptions, course achievement and attitude towards computer instruction. It was found that experimental group had higher conceptual understanding score and fewer misconception than the control group. No difference was found with course achievement or attitude. The results of the study suggested that the treatment with animation may increase conceptual understanding by promoting the formation of dynamic mental models of phenomenon. Static mental models may fail to provide adequate understanding of these chemical processes.

Agarwal (1994) reported that introducing computers in school was not to teach about computers as a separate subject like Physics, Mathematics, languages etc. but could be used as an integrating tool for combining Mathematics, Social Studies, languages etc. in one lesson.

Waddick (1994) studied the use of computer learning environment as an alternative to traditional lecturing methods in Chemistry. It was found that the students could work at their own pace and constant feedback could be provided on progress. It helped in increasing the mastery – especially in case of weaker students. It increased attainment of students in experimental group in comparison with the students in control group.

Agarwal (1995) for his Ph.D work undertook a comparative study of conceptual understanding by Programmed Learning and CAI and the both were very effective; however PL was found to be better than CAI for students with lesser IQ. CAI was found to be better than PL for students of higher IQ and for students of higher socio-economic strata.

Wilson (1995) examined the relationship among learning style, attitude and outcomes of Computer Assisted Instruction (CAI) university level. The findings of the study revealed that attitude of student towards CAI was positive and no significant relationship was found between attitude towards CAI and gained scores. These findings suggest that significant learning occurs regardless of students' attitude towards CAI. However, one does not find any significant impact that CAI makes on certain characteristics of learners such as their attitude, attendance, writing quality, type and frequency of revision used, logical reasoning, inductive/deductive reasoning, problem analysis, skills etc. While on the other hand, it was found that anxiety increased and it cured depression and poor results (this happened with those who were relatively unfamiliar with computers).

Karandikar (1996) evolved a Video Instructional Package to teach the students of standard VII and tried to study its effectiveness in terms of students' achievement and came out with a conclusion. Video Instructional Package has positive effect on the achievement and motivation of the students and Instructional Video Technology has high potential for imparting education effectively. He suggested that teacher must make use of such facilities so that students come in touch with advanced technology.

Rangaraj (1997) for his Ph.D work studied the effectiveness of computer assisted instruction in teaching physics. He found that CAI as Support System (CAISS) was much better than CAI as individualized instruction. Retention also was higher when taught through CAISS.

Das (1998) conducted a study entitled "Exploring the effectiveness of computer assisted learning materials in rhymes in different mode". The design of the study was developmental cum experimental in nature. Treatment tool and testing tools were used. The findings of the study revealed that computer as a potential medium significantly contributed the realization of the objectives of the study and CAIM ensure higher learning in the area of language development.

Khirwadker (1998) Developed a Computer Software for Learning Chemistry for students of Standard XI studying GSEB syllabus and studied the effectiveness of multimedia package in the terms of instructional time and achievement in relation to students Intelligence level, Motivation level, Attitude towards the package, effectiveness of the CAI (Computer Assisted Instruction) with regard to aspects of the package such as content of package, preservation, examples and illustrations, graphs, figures, maps, evaluation items, and utility of package. Findings revealed that the experimental group achieved significantly higher than the control group. CAI was time effective. Learning through software was more interesting due to the presence of graphs and figures, in software. Learning becomes quicker and clear with regard to understanding of some achievement of students of experimental group was very much positively affected by the variables like IQ, academic motivation and attitude. CAI was found to be an effective mode of instruction and increased their enthusiasm for the study of chemistry.

Zyoud (1999) has conducted a study entitled “Development of Computer Assisted English Language teaching of VII standard students”. Objectives of the study were (1). To develop a Computer assisted English Language Teaching for VII standard Gujarati medium students. (2). To study the effectiveness of the Computer assisted English Language teaching programme on students’ achievement in terms of vocabulary, grammar, and comprehension with respect to their intelligence, motivation and attitude. (3) To study the attitude of the students towards the usefulness of the Computer assisted English language teaching program. The researcher had randomly taken the sample of students for control and experimental group from Gujarati medium School. For the purpose of the study, tools had been constructed and used and they were achievement test, JIM scale and Raven’s progressive matrices. The finding of the study revealed that developed package helped the students in vocabulary and grammar and no effect in comprehension. Also, IQ had an impact on students’ achievement, while motivation had not found impact on students’ achievement. Students were found to have positive attitude towards the package.

Yadav (2000) conducted a study entitled “A study of the effectiveness of the Computer Software for students of standard I”. Researcher had selected the purposive sampling method and taken the Baroda High School, Bagikhana, as sample. Researcher had selected the sample of students of standard I randomly for alphabet software and animal software. For the purpose of study, tools have been constructed and used were pre-test, semi-structure interview for teacher and informal interview and observation for students. The findings of the study revealed that developed package helped the students in vocabulary and grammar, whereas, no effect in comprehension. Also, IQ had an impact on students’ achievement, while motivation had not found impact on it. Students were found to have positive attitude towards the package. There was a significant gain in terms of mean achievement through CAL. Also CAL has evoked positive perceptions amongst teachers and students regarding computer assisted instruction.

Dalwadi (2001) conducted a study entitled “Development of Computer Assisted Instruction in science for the students of Standard IX”. Objectives of the study were (1) to develop Computer Assisted Instruction (CAI) in science for standard IX. (2) To study the effectiveness of CAI in terms of achievement of standard IX students and (3) To study opinions of the science teachers and students regarding the effectiveness of the developed CAI. The researcher had found the significant gain in terms of the achievement of students through CAI on “Light”. CAI had evoked positive perception among the students. Though there were the students who did not take interest in CAI due to coloured graphics, but they liked the more of presentation of text with graphics. Majority of students had enjoyed learning with CAI and suggested to prepare CAI on other topics too. The students were of opinion that coloured animated graphics, sound effect in CAI would enhance learning. The teacher has also suggested developing CAI in other areas of science. Both the teacher and students encouraged the computerized self-learning instead of stereotype classroom session.

Zschoke (2002) studied Instructional Web Sites Design: an object oriented approach. This study contributes to the ongoing research into the design of web-based instruction. The results were of the interest to the educators, instructional designers, and other e-

learning specialists who want to implement learning objects and improve their development of web based instructions by incorporating object orientation as the primary development paradigm and unified modeling language as the principle modeling notation tool.

Crews (2003) conducted a case study that investigates the effectiveness of CAI reading tutorial in helping poor readers to improve their ability to read. The study was undertaken with three objectives (1) To scientifically investigate if poor readers using the CAI significantly improved their reading abilities, and assuming that CAI was effective (2) To identify the instructional methods and strategies implemented in the CAI design (3) To theoretically explain the effectiveness of the CAI and thereby provide information of effective methods of designing effective CAI for poor readers. The study was conducted at a Title 1 elementary school in a large city in the southwest. Title 2 schools serve a high concentration of students living in poverty and as a result, receive funds to provide special educational services for low achieving students. The 13 participating students were fourth and fifth grade students with poor reading abilities as determined by the independent assessments and observations of their teachers. The multimedia CAI programme supports the active cognitive participation of the learner, delivers multi-sensory instruction, and provides timely, directed feedback, teacher's skills, and implements 100 percent mastery in learning. The instruction is individualized and self-paced. Results of pre-post reading comprehensive tests and interviews indicate that poor readers completing the CAI tutorial significantly improved their reading skills and the students and their teachers felt that using the CAI tutorial helped the students become better readers.

Sharma (2003) conducted a study entitled as "A study of the effectiveness of Computer Assisted Learning (CAL) in Chemistry for the students of Std XI". The objectives of the study were (1) To develop CAL in Chemistry in terms of achievement of standard XI students. (3) To study the opinion of the chemistry students regarding the effectiveness of the developed CAL. The researcher had found that CAL developed was effective for teaching Chemistry at standard XI. It helped the students to learn the topic of organic

compounds and clarified the concepts. Students were found to have a positive reaction towards developed CAL. Also, the data analyzed revealed that teacher has given favourable statements regarding content, language clarity, mode of presentation, and clarity in graphics and evaluation procedure in developed CAL.

Casanova (2004) conducted a study entitled “An analysis of Computer-Mediated Communication technologies as tools to enhance learning.” The integration of Computer-Mediated Communication (CMC) technologies into the higher educational settings require faculty to change their roles from the direct instructional model to a model based on constructivists’ ideas. CMC instructional tools have provided a change by shifting a traditional teacher centered setting into a teacher facilitator environment. Teacher’s profession has become an important task to effectively integrate technology into their courses. Questions concerning the implementation of this research study was to determine the extent to which CMC technologies promoted the achievement of stated goals and objectives for course taught in higher education. This study was directed by three research questions (1) In what way are higher education faculties using CMC technologies to deliver their courses? (2) What is the faculty’s primary instructional intent for the CMC technologies they selected for integration into the teaching process? (3) In what ways does the integration of selected CMC technologies promote achievement of stated goals and objectives in their courses? The research study population consisted of 17 higher education faculties from 21 projects at West Virginia University during the year 2004. These participants received technical training, enhanced web-designed courses, worked collaboratively and prepared instructional resources during a 7-day week period during summer 2004. The data collection was done by survey, course analysis and interview. Findings indicated that faculty was mainly using CMC technologies to support teaching practices and to improve teacher’s productivity. It was basically targeted to increase interactivity, open avenues for feedback and provide resources but less used for inquiry based on active learning. Faculty’s primary intent to integrate CMC technologies was to create different avenues to communicate with students and to offer them a learning environment that would support students outside the classroom. CMC promoted the achievement of goals and objectives with different degree

of success mainly in two different areas; content delivery and course management and less regarding collaborative activity structures.

Helaiya (2004) has conducted a study entitled “Developing and implementation of CAI package for teaching statistics to B.Ed. students”. CAI was developed using Visual Basic Software. The objectives of the study were (1).To develop a CAI package for teaching statistics to B.Ed. students. (2).To study the reaction of the B.Ed. students regarding the effectiveness of the developed CAI package. Investigator had observed that CAI was effective in teaching statistics to B.Ed. students than traditional methods. Students had enjoyed learning with CAI and suggested to prepare CAI in other topics too.

McLaughlin Daniel (2004) conducted a study entitled “Towards a new paradigm for teaching and learning: A case study of the process of integrating instructional design and technology at Florida Community College at Jacksonville.” The study examined the process by which administrators, faculty and instructional design staff at Florida Community College converted four traditionally formatted courses to online courses in order to integrate innovative instructional design and learning strategies with instructional technology. The study also examined the design and development of an electronic instructional design assistant that would enable the user to systematically design curriculum that incorporated learning and motivational theory. The investigator used case study design to describe the model and process the college administration used to implement the project. The purpose of this study was to explore how one institution of higher education addressed the gap that exists between online course developments. Data for the study was collected through semi-structured interview and a review of project related records, reports, guidelines and artifacts. Data was also obtained through field observations and investigator participation in training and professional development sessions with faculty and staff.

Barot (2005) conducted a study entitled, “To study the effectiveness of CAI in Sanskrit for Standard VII students”. The objectives of the study were (1) To develop a Computer Assisted Instruction (CAI) in Sanskrit for standard VII students. (2) To study the

effectiveness of CAI package in terms of mean achievement of the students in Sanskrit. (3) To study the reaction of the students regarding the effectiveness of the developed CAI package. Researcher has prepared CAI using Flash software. Findings of the study had proved that CAI can be used very well for remediation purpose. Prepared CAI in Sanskrit was found effective. The reaction of students towards the prepared CAI was found to be effective.

Hung (2005) conducted a study on “The evaluation of a technology-aided lecture accompanied by a set of macroeconomics computer interactive exercises in macroeconomics for the undergraduate business major in Taiwan”. The study examined the effects of a technology aided lecture accompanied by a set of macroeconomics computer interactive exercises and a traditional instruction supported by transparencies in students’ learning achievement. Since a significant difference in knowledge of macroeconomics existed between the experimental group and the control groups, analysis of covariance (ANCOVA) of the post-test using pre-test as the covariate, was used to analyze the research data. As comparing the effectiveness of the two different instructional methods, it was concluded that offering the courses for the unit on unemployment and inflation through the Technology-Aided Lecture (TAL), accompanied by a set of macroeconomics computer interactive exercises, or the standard instruction produced a non-significant difference, to the extent measured by the researcher developed test.

Rosales (2005) conducted a study entitled “The effect of computer assisted instruction (CAI) on mathematics achievement of ninth-grade high school students in the lower Rio Grande Valley”. This study was conducted to describe the effect of a computer-assisted instruction (CAI) programme had on the mathematics achievement of ninth-grade high school students in the lower Rio Grande Valley as measured by the state assessment. A quasi-experimental pre-test post-test control group design with matching was used. The subjects were first time, non-exempted ninth grade students from two schools paired by ethnicity and percentage of socio-economically disadvantaged. ANCOVA procedures were used to determine the statistical significance. The study tested the following

research hypothesis: There is statistically significant difference between the mathematics achievement of ninth-grade high school students in the love Rio Grande Valley who have participated in computer-assisted instruction (CAI) and the mathematics achievement of ninth grade high school students in the lower Rio Grande Valley who didn't participate in (CAI) computer-assisted instruction. The resultant analysis indicated that there were no statistically significant differences between the mathematics achievements of the two groups.

Gilbert (2006) conducted a study entitled “Effectiveness of computer-assisted instruction (CAI) blended with class-room teaching methods to acquire automotive psychomotor skill”. Here two blended learning methodologies of web-based CAI and face-to-face classroom instruction were used and investigated in the Automotive Technology Department at Southern Illinois University Carbondale. Results were determined by a psychomotor electrical diagnostic skill evaluation of two matched groups exposed to different blending methods of teaching basic electrical concepts. Analysis revealed that the blended teaching methods experienced by the experimental group demonstrated a comparatively higher level of psychomotor electrical diagnostic skill capability.

Parikh (2006) conducted a study entitled “Developing and implementing Computer Assisted Learning Material (CALM) for standard XI commerce students on subject Introduction to book-keeping and Accountancy prescribed by GSEB”. Objectives of the study were (1) To develop CALM for “Rectification of Error” chapter selected from XIth standard Introduction to Book Keeping and Accountancy text book of GSEB. (2) To study the effectiveness of CALM package in Accounts in terms of Achievement of XIth standard commerce students. (3) To study the reaction of XIth standard commerce students regarding the effectiveness of the developed CALM. In findings the CALM was effective for 2nd objective. Students had positive reactions towards the CALM and given favourable statements related to the interest, mode of presentation, content, clarity in graphics with content and the questions asked in it.

Thakkar (2006) conducted a study entitled, “To develop and to implement CAI for Organization of Commerce and management in standard XI prescribed by GSEB” with pre-test, post-test experimental and control group research design. The objectives of the study were (1) To develop a CAI for the chapter of Foreign Trade selected from the subject ‘Organization of Commerce and Management’ textbook of standard XI. (2) To study the effectiveness of the developed CAI. The findings of the study revealed that CAI was found effective in teaching Foreign Trade leading to significant gain achievement in the scores of the post-test from the pre-test of experimental group. CAI was found effective in teaching Foreign Trade leading to increase in the mean gain achievement scores of the experimental group than the control group. The overall reaction of the students towards the prepared CAI in commerce was found to be positive. CAI was perceived by majority of students to be quite interesting and motivating in learning.

Ford (2007) conducted a study entitled “Effect of Computer-Aided Instruction versus traditional modes on student PT’s learning musculoskeletal special tests” with 3 group single-blind pre-test, immediate post-test, final post-test repeated measures with qualitative survey for the CAI group design. Subjects were randomly assigned to develop CAI, demonstration or textbook learning groups. Three novel special tests were constructed. Analysis of performance on written and practical examinations was conducted across the 3 repeated measures. A qualitative survey was completed by the CAI group post intervention. Finding of the study revealed that CAI was equally as effective as live demonstration and textbook learning of musculoskeletal special tests in the cognitive domain, however, CAI superior to live demonstrations and textbook instruction at final post-testing.

Galvis (2007) conducted a study entitled “Computer Assisted Instruction (CAI) as a teaching tool for occupational therapy education: A guide to understand CAI design and effectiveness”. The primary purpose of the study was to compare the effects of CAI versus traditional teaching methods with occupational therapy students. To explore the topic, three consecutive and inter-related studies were conducted. The result of this

research can assist occupational therapy and other allied health educators to understand the advantages of CAI materials can provide if they are properly designed and implemented in the class. In its analysis the researcher found that CAI was an effective alternative to traditional classroom lecture to teach practical skills and theoretical knowledge. It was also found that CAI provides faster instruction while providing learner-centered training.

Karnati (2008) conducted a study entitled “Computer aided instruction (CAI) for out-of-school children in India: An impact study in Andhra Pradesh”. India has the largest number of out-of-school children, the majority of whom are girls. Against this backdrop, the Bridges to the Future Initiative (BFI), a computer-aided instruction (CAI) intervention program was launched in Andhra Pradesh to bring the children back to school. The BFI used multimedia software to teach basic literacy and numeric skills through interactive stories and activities, in the local language Telugu. The methodology employed in the study was a quasi-experimental design on a sample of around 140 children (age ranging from 7-19 years). The research study included the Bridges to the Future Initiative (BFI) sites which offered two hours of CAI - a day and comparison sites which provided five hours of Teacher-Based Instruction (TBI) a day. This research was first of all to explore the context of out-of-school children in poor communities and the use of CAI in Telugu (local language) to bring these learners back to school. The results support the use of ICT with marginalized sections of society in developing countries in order to improve literacy skills.

2.2 REVIEW OF STUDIES RELATED TO TEACHING OF BIOLOGY

Hopper (1982) has conducted a study whose aim was to develop six instructional modules on selected units on Biology under three branches of Biology and structure three modular approaches to find out the effectiveness of the structure modular approaches and modular courses of the study on the cognitive achievement of the learners. The instructional modules were implemented through Rotation Group Design. The experiment was conducted in three different selected schools. The sample consisted of

156 students. All the three modules, i.e., self-learning, peer-group learning and peer-group learning with teacher intervention were effective. Biology, taught through modular approach, was enjoyable. Children could learn and manage on their own through peer group learning. Thus the modular approach is a feasible proposition in Higher Secondary Sections in Schools.

Ravindranath (1982) conducted a study titled “Development of Multimedia Instructional strategy for teaching Science (Biology) at secondary School Level” with the Objectives. (1) To develop a duly validated multimedia instructional strategy for VIII standard students. (2) To study the relationship between students achievement and their intelligence. (3) To study the feasibility of the strategy in terms of, (a) time, and (b) cost. The study resulted in the development of a duly validated multimedia instructional strategy that found to be feasible if it is to be regularized in a school. Besides, the study has also paved the way for structuring alternative approaches of instruction with the strategy through the results obtained in respect of the relationship between student’s achievement and their intelligence and also through the experiment with the alternative instructional output.

Waugh and et al (1984) studied the effect of microcomputer-administered diagnostic testing in the short term and long term achievement of high school biology student with varying levels of academic aptitude and achievement motivation. The findings of the study were:

1. Microcomputer administered diagnostic testing could positively influence short term but not long term Biology achievement.
2. Students of varying levels achievement motivation did not exhibit differences in Biology achievement.
3. The effects of microcomputer-administered diagnostic testing were consistent, across the levels of achievement motivation.

Dighal (1985) in his study, made the teaching of biological science more lively and realistic. The teaching was imparted through audio-visual method and through the initiation of children into different group activities. The design of the study was a Survey

comparative nature. Two questionnaires were used as tools. The sample was 500 students from schools of Tripura and one school from West Bengal. It was found that there was a significant difference in the effectiveness of the 'self-activity method', 'life-science club method' and 'audio-visual method'. The more the students used these methods, the more interesting was the session. Field trips and learning-by-doing were found to be very effective in teaching. So, it can be concluded that improved methods of teaching can be more effective than the traditional lecture method.

Leila (1987) conducted a study on the use of computers in teaching Biological Sciences in selected secondary schools. The study was conducted to find out; (1) the extent of computer use in teaching Biological Sciences in selected public high schools in Los Angeles (2) the changes that had taken place in the related curricula as a result of computer technology instruction and (3) the attitude of the teachers towards the integration of computers in Biology teaching. The study revealed that:

1. There was no change in the curriculum as a result of using computers.
2. Biology educators believed that computer could not replace the teacher or the textbook in the classroom.
3. Secondary school should make use of computers in teaching Biological Sciences.

Bhardwaj (1990) conducted a study on "Development of Computer Aided Instructional Material (CAIM) on microbes for class VIII." The CAIM was developed using BASICA. The developed CAIM proved quite effective which was evident through the significant gain of the achievement of the students. Also the students found to have positive attitude towards the CAIM.

Adhikari (1992) conducted a study "Development of Computer Aided Instructional Material (CAIM) on cell and cell reproduction for class IX students" using BASICA software. The CAIM was found to be effective in terms of achievement of students. Also, the CAIM was found effective when both groups were matched on intelligence.

2.3 IMPLICATIONS OF THE REVIEWED STUDIES FOR THE PRESENT STUDY

The investigator has reviewed a total of 63 studies keeping the present study in view to develop a complete and holistic perspective of these studies and to arrive at the implications to support the present study.

The investigator has first reviewed 56 studies related to innovative methods of teaching science and other subjects other than Biology conducted by Shah (1966), Sharma (1966), Patel (1975), Jones (1980), Kolz (1980), Adeshera (1981), Tauro (1981), Golani (1982), Krishnan (1983), Rao (1983), Vardhini (1983), McDonald (1984), Menon (1984), Desai (1985), Joseph (1985), Parry, et al (1985), Johnson and Stanne (1986), Meyer (1986), James (1987), Joshi (1987), Cutlet (1990), Slick (1990), Srivastava (1990), Jeyamani (1991), Mahapatra (1991), Raghavan and Dharmaraja (1991), Bhatia (1992), Douglas (1992), Stella (1992), Williamson (1992), Shah and Agarwal (1994), Waddick (1994), Agarwal (1995), Wilson (1995), Karandikar (1996), Rangaraj (1997), Das (1998), Khirwadker (1998), Zyoud (1999), Yadav (2000), Dalwadi (2001), Zschoke (2002), Crews (2003), Sharma (2003), Casanova (2004), Helaiya (2004), McLaughlin Daniel (2004), Barot (2005), Hung (2005), Rosales (2005), Gilbert (2006), Parikh (2006), Thakkar (2006), Ford (2007), Galvis (2007), Ratwa (2007) and Karnati (2008). They have found in their studies that teaching through computers and multimedia is effective in terms of students' academic achievement and it helps in increasing conceptual understanding of the subject matter.

The investigator has also reviewed 7 studies related specifically to teaching of Biology conducted by Hopper (1982), Ravindranath (1982), Waugh (1984), Dighal (1985), Leila (1987), Bhardwaj (1990) and Adhikari (1992). They have found that teaching Biology through computers and other innovative methods is effective in terms of students' academic achievement and they could learn at their own pace.

On the whole, from the review of the related literature it can be inferred that majority of the studies indicated that teaching through Computers and Multimedia is effective in terms of students' academic achievement. Teaching through Computers or Multimedia has been found effective, not only for academic achievement but for developing interest and attitude towards Biological Sciences.

From the review of related literature, the investigator further infers the following:

- ✚ The methodology used for the teaching of Science determines the effectiveness of the method.
- ✚ In many of the studies it was seen that innovative methods were more effective than traditional methods.
- ✚ Audio-visual methods also promoted the understanding of the subject well.
- ✚ Learning capacity of the students was more when Multimedia Instructional Packages were used along with traditional methods of teaching.
- ✚ The methodology used is largely based upon the pre-test – intervention - post-test design. The tools used are Questionnaires and Reaction Scales. The data have been analyzed using the appropriate statistical techniques, such as, t-test, correlated t-test, Chi-square ANOVA and ANCOVA.
- ✚ The studies have been carried out for the teaching of mainly Science. The sample group, in these studies, consisted mainly of school children of urban areas.
- ✚ There is no one single method of teaching Science. The teacher should be experimental-minded and should use different approaches in the light of different objectives.

On the basis of review presented above, the researcher has observed that the scope of studies was quite diverse. The available studies clearly indicate that not many studies on teaching of Biology have been conducted in India.

From the review of the related literature, it can be inferred that the methodology of teaching Science has an impact in the learning process. Most of the studies mentioned

above concluded in favour of innovative methods in comparison with traditional methods of teaching.

The pressing need of the hour therefore, is to impart Education (Biological sciences) effectively. This has been the immediate inspiration behind the researcher taking up the present investigation. The investigator has been very keenly interested as to whether imparting knowledge through a new and non-traditional, multimedia instructional package would make it easier for the children to understand the different Biological Concepts in an efficient and effective manner.

As not many studies on Biological Sciences have been conducted at the higher secondary level, the researcher sought to explore the effectiveness of an innovative Multimedia Instructional Software Package in the teaching of Biology at the higher secondary level.

It is in this background that the present study seeks to improve upon the existing methods adopted for the education of the students. The present study seeks to study the impact of the Multimedia Instructional Software Package in increasing the knowledge, interest, and scientific attitude of the students regarding Biological Sciences.