CHAPTER II

REVIEW OF LITERATURE
# CHAPTER - II

## REVIEW OF LITERATURE

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CHAPTER II

REVIEW OF LITERATURE

2.1 INTRODUCTION

Study of related literature implies locating reading and evaluating reports of researches as well as reports of casual observations and opinions that are related to the investigator’s planned research project. The review of literature is a task that continues throughout the duration of the Thesis. It begins with a search for a suitable topic. Once a topic has been decided upon it is essential to review all relevant material which has a bearing on the topic. Good Bass and Seates (1935) state that as the competent physician must keep abreast of the latest discoveries in the field of medicine, the research worker and investigator should become familiar with the location and sources of educational information.

2.2 NEED OF RELATED LITERATURE

A review of the previous investigations relevant to the present investigation is necessary to gain better perspective of the problem. The review of related studies is necessary to show whether the evidence already available solves the problem adequately with investigation, to avoid the risk of duplication, to provide idea, explanations, or hypothesis, variable in formulating the problem, to suggest methods of research appropriate to the problem, to get an idea about the current trend in the field and so on.
According to Monly (1964), the survey of literature is a crucial aspect of the planning of the study and the time spent in such a survey invariably a wise investment. Hence, an attempt was made to review the studies conducted in India and Abroad.

2.3 CLASSIFICATION OF STUDIES

The literature available so far conducted in India shows that very few studies have been conducted on Computer Assisted Learning. But it was observed that a good number of studies have been conducted as Computer Assisted Learning abroad. An attempt is made in this chapter to present the summary of literature related to the research topic under two broad categories such as studies conducted in India and abroad. The studies conducted in India are presented in the following paragraphs.

2.4 STUDIES CONDUCTED ON CAL IN INDIA

Since the use of computer in the classroom instruction has been gradually increasing, besides provision of computers and softwares to the schedules by the Government, few studies on CAL are available in India. The investigator makes a review of those studies. The investigator was able to locate 16 studies of which four are from Mathematics, three from General Science, two each from Physics and Chemistry and one from Botany and the remaining four are from General Discipline. Those 16 studies are presented below under three classifications.
2.4.1 Studies Conducted on CAL in Mathematics

Among the four studies identified in Mathematics, one study was conducted on Computer Assisted Instruction on learning Mathematics for X level by Sharma (1979). The objectives of the study were to find out the effectiveness of Computer Assisted Instruction for school children and to study the relative effectiveness of Computer Assisted Instruction. The study found that there was a significant difference in achievement between experimental and control group. The experimental group performed better than control group. It was also revealed that there was a significant difference between the learning achievement produced by variations in the strategy of instruction.

In an identical study, Palaniappan (1989) made an attempt to find out the effectiveness of Computer Assisted Instruction in learning the Triangles in Mathematics for +1 students. One group of sample was allowed to learn through Computer Assisted Instruction and another group was allowed to learn through the traditional method of teaching. The study revealed the following findings. (i) The performance of the students learning through Computer Assisted Instruction was better than that in the traditional method. (ii) No significant difference between the high achievers of both group. (iii) the performance of the low achievers in Computer Assisted Instruction was better than that of the other.
Similar result was found when it was conducted on Computer Assisted Instruction Programme for learning properties of triangles for X std. level by Sivaraj (1988). It revealed that Computer Assisted Instruction was more effective than the conventional method.

In an identical study taken up by Stella (1989) on the development of Computer Assisted Instruction for number sets for VIII standard level, it was found that there was significant difference between experimental and control groups. The experimental group scored more marks than the control group.

Among the studies located in Mathematics, three studies (Shama, 1979, Sivaraj 1988 and Stella 1989) revealed the significant difference of CAI over the traditional method of instruction. At the same time one study (Palaniappan, 1989) revealed that though CAI produced significant difference as a whole, there was no significant difference between the high achievers of both the groups.

2.4.2 Studies conducted on CAL in General Science

The investigator located nine studies in Science. Among the nine, three are from General Science (Chandra, 1987; Nachimuthu, 1989 and Reddy and Ramar, 1995) two from Physics (Mohan 1987 and Panda and Chaudhry, 2000), two from Chemistry (Singha, 1988 and Madhur Gupta, 1989) and one from Botany (Govindaraj, 1999).
A comparative study was carried out by Chandra (1987) on using Computer Assisted Instruction and Close Circuit Television for Instruction in Science for ninth standard pupils. The sample consisted of 10 boys and 10 girls. Pre-test, Post-test experimental design was followed. From the analysis of the scores obtained by the students, it was found that 95 percent of the students had answered 85 percent of the Computer Assisted Instruction questions correctly.

Development of Computer Assisted Instruction Program on 'Leaves' was made by Nachimuthu (1989). It was reported that the CAI package was validated on a target population of 9th std. students, all students participated enthusiastically and scored well.

An investigation was made by Reddy and Ramar (1995) to assess the "effectiveness of computer assisted instruction in teaching science to slow learners". The main objectives of the study were:

i) To find out whether there is any significant difference between the pre-test and post-test mean scores of the slow learners in the control group.

ii) To assess whether there exists any significant difference between the pre-test and post-test Mean scores of the slow learners in the experimental group.
iii) To find out whether there is any significant difference between the post-test Mean scores of the experimental group and the control group.

iv) To assess whether there exists any significant difference between the post-test Mean scores of the slow learners in the control group and the students in the normal group.

The main findings of the study was that significant difference was found between the post-test Mean scores of the experimental group slow learners and the normal group students. The achievement of normal group students was higher than the achievement of experimental group slow learners, the gap between both the groups was reduced to a great extent. This can be ascribed to the effectiveness of CAI.

Among the three studies reviewed in general science, it is understood that there was significant difference in favour of students who learnt through CAI. Chandra (1987) found that 95% of the students have answered 85% of the CAI questions correctly. Similarly Natchimuthu (1989) revealed that CAI students scored significantly well and participated enthusiastically. Reddy and Ramar (1995) studied that the larger gap between both control and experimental groups was reduced in favour of the experimental group which was due to the effect of CAI.
Out of two studies located in Physics, a study on the effects of different modes of Computer Assisted Instruction on achievement in Physics students of the higher secondary schools were measured by Mohan (1987). The sample consisted of 77 students, 39 boys and 38 girls. Three different modes of Computer Assisted Instruction, Drill and Practice, Tutorial and Concept Attainment were chosen for experiment in this study. It was found that drill and practice has a similar effect on students belonging to different levels or prior achievement in Physics.

Panda and Chaudhry (2000) conducted a study on the effect of CAI in achieving higher cognitive skills in Physics. The major objectives of the study were to determine the degree of attainment of cognitive skills through CAL compared to traditional approach to teaching. The pre-test, post-test matched group experimental design was followed in the study. The total sample consisted of 40, of which 20 were control and 20 were the experimental group. The study found that both control and experimental groups gained significantly but the findings necessarily point to the superiority of the CAL.

The findings of the two studies conducted in Physics are found to be contradictory. The study conducted by Mohan (1987) revealed that drill and practice mode of CAI has no significant effect, as the students belonged to different levels or prior achievement in Physics whereas the study of Panda and Chaudary (2000) found that both control and experimental groups derived significantly but the findings necessarily point to the superiority of the CAI.
One among the two studies in Chemistry was conducted by Singha (1988) on two strategies of Computer Assisted Instruction in Chemistry in high school. Analysis of co-variance results showed that Computer Assisted Instruction enhanced students' achievement significantly for both male and female students.

Another study was made by Madhur Gupta (1989) on the topic "Two strategies of computer assisted Instruction in Chemistry". The main objectives of the study were:

i. To design two strategies of computer assisted instruction.

ii. To study the relative effectiveness of two strategies of CAI in chemistry.

iii. To compare the retention scores of two strategies of CAI in chemistry.

The study concluded that the students under first strategy scored significantly higher than the students under strategy II in terms of their Mean gain scores and Mean retention scores in the criterion test.

The only one study located in Botany was conducted by Govindaraj (1999) on effectiveness of CAI and Video Instruction on achievement of under achievers in Botany. The main objective of the study was to find out whether there is any significant difference between the pre-test and post-test Mean scores of experimental CAI group and Video group under achievers over the
traditional method of lecture group. There were two experimental and one control groups. The study found that there is no significant difference in the post-test performance between the control group under achievers and CAI group underachievers. At the same time, there is a significant difference between the control group underachievers and experimental video group underachievers.

2.4.3 Studies conducted in General Discipline

Among the four studies located, one was studied by Anandan (1992). It studied the effect of CAI on achievement in Indian Economics among Higher Secondary Students. The major objective of the study was to find out the effectiveness of CAI in Indian Economics of the 11th standard English medium students. The design of the study was pre-post equalent group design. The experimental group-I consisted of 19 students and experimental group-II consisted of 14 students. There were 34 students in the control group. The study found that the control group students stay behind significantly from experimental group-I and experimental group-II in their achievement in Indian Economics for the two components namely, Knowledge and Comprehension. But for the component of Application, no significant difference was observed between the pairs of the sample groups of students.

Sivakumar, Arunkumar and Sundaramurthy, (1994) conducted a study on "effectiveness of computer assisted instruction, laboratory-centered instruction and conventional classroom teaching in technical education". The
objective of the study was to compare the relative effectiveness of CAI, LCI and classroom teaching in terms of the achievement of Polytechnic students.

The main finding was that direct learning experience given through laboratory centered instruction is far superior to self-instructional strategy and conventional classroom teaching. As students remembered the experience gained through the direct experience for a longer period of time, it was recommended that the teachers adopt such strategies in regular classroom teaching.

An investigation was made by Singh, J.K., (1993) on the topic 'Integrating Computers in Education'. The main objectives of the study were:

i. To provide prospective teachers with basic information about the range of computer applications.

ii. To identify ways the computer may improve the teaching-learning process.

iii. To introduce and build on the concept of integrating computers in the classroom.

iv. To emphasize the idea of co-operative learning culture within a technological environment.
The study concluded that it is important that technology be used to help children think critically and creatively and to promote a co-operative learning environment. By teaching the education students to use technology wisely, it is hoped that future teachers will successfully incorporate technology into their classrooms.

**Stella (1993)** conducted a study on "effectiveness of computer assisted instruction" with special reference to underachievers. The following were the objectives of the investigation:

i. To find out the effectiveness of the CAI software with special reference to underachievers.

ii. To find out the impact of the teacher support system on the achievement of underachievers.

iii. To find out the relationship between the achievement of the experimental group and the variables like sex, local study habit.

iv. To find out the interaction effect of treatment and the variables noted in objective i - iii on the achievement of the experimental groups.

The study concluded that the teacher effectiveness is an important criterion that would effect the success of the teacher support system since the study asserted the significant impact of teacher support system on the underachievers. CAI may further be used for those with poor study habits, and
low and average IQ, since the study has shown a favourable result with regard to these.

The review of the four studies is quite interesting. Though CAI has produced significant difference on the learning objectives of Knowledge and Comprehension, it has made no significant effect as developing ‘Application’ (Anandan, 1992). Similarly Sivakumar et al., (1994) found that no significant effect was made by self instructional, strategy over laboratory centered instructions. While Singh (1993) revealed that technology be used to help children to think critically and creatively, Stella (1993) found that teachers support system was better than CAI to underachievers.

2.4.4. Synthesis of the Related Studies in India

Since the use of computer in the classroom instruction has been gradually increasing, a few studies on CAL are available in India. The investigator made a review of those studies. The investigator was able to locate 16 studies of which four studies are from Mathematics, three from General Science, two each from Physics and Chemistry and one from Botany and the remaining four are from General Discipline. Those 16 studies are presented below under three classifications.

Among the located 16 studies conducted in India, seven studies took sample from High Schools (Sharma, 1979; Singha, 1988; Sivaraj, 1988; Stella, 1989; Nachimuthu, 1989; Govindaraj 1999; Panda and Chaudhry, 2000), six studies chosen sample from higher secondary schools (Chandra, 1987; Mohan,
1987; Madhur Guptha, 1989; Anandan, 1992; Stella, 1993 and Reddy and Ramar, 1995) and the remaining studies from College level students.

The size of the samples was around 40 to 120 among the majority of the experimental study. Moreover, the studies followed pre-post matched group design (Sharma, 1979; Chandra, 1987; Mohan, 1987; Singha, 1988; Sivaraj, 1988; Nachimuthu, 1989; Palaniappan, 1989; Stella, 1989; Anandan, 1992; Reddy and Ramar, 1995; Govindaraj, 1999 and Panda and Chaudhry, 2000).

While all the studies were made on the normal students, four studies were conducted on the effect of CAI on slow learners (Palaniyappan 1989; Stella, 1993; Reddy and Ramar, 1995; and Govindaraj, 1999). While two studies revealed the favourable effect of CAI for the slow-learners over the traditional method (Reddy and Ramar, 1995 and Stella 1993) the studies of Palaniyappan (1988) and Govindaraj, (1993) found that CAI did not make significant effect in Post-test performance over the control group underachievers.

### 2.5 STUDIES CONDUCTED ON CAI ABROAD

The investigator collected 55 studies which were conducted at the secondary level (from VI standard to XII standards). When analysed according to subjects, it was found that 15 studies were made on Mathematics, another 14 studies were on language, 14 studies were on Science and remaining 12 studies on General Discipline.
2.5.1 Studies conducted on CAL in Mathematics

Among the 15 studies identified under the subject Mathematics, Five studies were in Parallelograms, Graphs, Geometry and Arithmetics, two studies concentrated on Algebra and the remaining eight studies were in general Mathematics.

Each one of the following five studies was concentrated on the achievement in Parallelograms, Graphs, Geometry and Arithmetics respectively. In the first study, the impact of teaching concept and properties of parallelograms by Computer Assisted Instruction program and traditional setting was studied by Austin (1983) among secondary level students. The results of the study showed that the computer group scored higher than the conventional group. In another study carried out by Rhoads (1986), the results of test scores on skills and concepts proved that microcomputer instruction promoted skills and concepts learning significantly. The effects on learning of three factors in the Organisations of microcomputer were assessed in this study. The topic for microcomputer instruction was the effect of variations in slope, X and Y intercept on graphs of linear equations in two variables.

The students who received instruction through computer performed significantly better in their Geometry question, when an investigation was made by Kismani (1988) to study students' achievement on Mathematics tests in using computers in classrooms and classrooms not using computers. The research focussed on the four Form 1 Classrooms consisting of about 35
Students in each with an average age of 13 years. But the finding reported by *Cosmos* (1989) seemed to be different. It was reported that the learning was not significant, when he compared computer based individualised instruction with the traditional group learning the arithmetic performance of 11th and 12th grade students.

In another study, *Barnsley* (1989) studied on the effects of instructional modes in a sequence of computer-assisted instruction lessons, with an introduction to computer-aided diagnosis of arithmetic errors. Observation of subjects who were involved in the three studies suggested that computers could perhaps be used to advantage in the diagnosis of arithmetic errors in children. The study found that Mature-aged entrants benefitted more from the CAI mode than ordinary entrants.

From the findings of the studies discussed it is noticed that Computer Assisted Instruction made significant achievement in the areas of algebra, parallelograms, graphs and geometry (*Austin*, 1983; *Rhoads*, 1986; *Kismani*, 1988; *Barnsley*, 1989), but not in arithmetics, (*Cosmos*, 1989). To find the effectiveness, many studies compared Computer Assisted Instruction with Traditional method of Instruction.

Of the two studies in Algebra, the effectiveness of Computer Assisted Instruction in achievement of the 9th grade Pre-algebra Mathematics students were studied by *Robin* (1982). The changes in the experimental group was significantly higher than the changes in the control group.
A similar finding was reported in the study of Sasser (1985) on achievement in algebra. The interaction between Computer Assisted Instruction method and modality preference on achievement in three instructional methods - visual, tutorial, visual-auditory tutorial and problem solving in improving algebra skills. Seventy nine VIIth grade students were taken as sample in the study. The finding of the study showed that programming group achieved significantly higher gain scores than the visual tutorial group.

The remaining eight studies were carried out on the effect of Computer Assisted Instruction in general and the effect of Computer Assisted Instruction in General Mathematics. Burns (1981) has analysed the pedagogical effectiveness of Computer Assisted Maths Instruction and compared it with programmed learning. It was found that Computer Assisted Instruction was more effective than a programmed learning.

A similar finding was reported in the study of Wright (1983). The study compared Computer Assisted Instruction for remidiation in Maths with the conventional method of classroom teaching. It was found that Computer Assisted Instruction produced significantly higher achievement. To examine the effect of using a computer networking system on teachers' Mathematics Instruction, Hayden (1989) conducted the study among three secondary levels contained at least two main streamed special education students. It was found that 80 percent of the students reported that they understood how to do the assignments when the system was used as compared to 25 percent when it was not.
A critical analysis of the components of Computer Based Integrated Learning System and a measure of the system's effect on Mathematics and reading achievement in middle school was studied by Alifrangis (1989). Results of the achievement tests showed that computer based integrated system improved students test scores significantly. Lee (1985) studied the effect of feedback on rule learning in Computer Based Instruction in Mathematics. Ninety one high school students were used in the study. The students were blocked on maths ability and then randomly assigned to one of the three feedback groups. All students received the same learning material except, different feed back, Group 1 and control group, received "right / wrong" feed back only. Group 2, received "right / wrong" plus if an error was made the "correct answer" (emphasizing the example). Group 3, received "right / wrong" plus if an error was made the "Correct Answer" (emphasizing the example). Group 3, received "right / wrong" plus if an error was made the "rule restated and the correct answer" (emphasizing the rule, not the example). The results yielded no significant main effects in the feedback treatment. Significant main effects were noted, however, between ability levels in four of high ability students.

In his study Fredrick (1989) found that students who had taken computer programming in high school scored significantly lower in the final exam. Eighteen students were in the experimental group and another eighteen were in the control group.
Schmidt and Susan Carol (1991) made a study a technology for the 21st century". The effects of an integrated distributive computer network system with Wasatch LIS course were on reading maths and language achievement of sixth grade students were investigated over a period of eight months. The major conclusions reached were that the integrated distributed computer network system was more effective than traditional instruction in increasing reading maths and language achievement for low achieving students. It was as effective as traditional instruction in increasing achievement for high achieving students. It has had positive effect on students motivation, attitude instructional task persistence and the organisation, quantity of student writing.

Wood, J.B. (1991) made a study on the effects of tutorial and tool applications of computer-based education on achievement and attitude in secondary mathematics. This study addressed the effects of integrating two forms of computer-based education on overall mathematics achievement. The results of the study showed that varying the instruction method resulted in no significant difference in overall achievement.

Out of the 15 studies made in mathematics, eleven studies showed that Computer Assisted Instruction helped the students to achieve significantly in Mathematics (Burns, 1981; Robin, 1982; Austin, 1983; Wright, 1983; Sasser, 1985; Rhoads, 1986; Kismani 1988; Alifrangis, 1989; Barnsley, 1989; Hayden 1989 and Schmidt 1991). It was also reported from a study that Computer Assisted Instruction helped not only normal children but also handicapped students in their assignment activities. Moreover it was also found that the feedback of Computer Assisted Instruction made significant impact among high ability students on achievement. However, insignificant difference on achievement was also reported in a few studies (Lee, 1985; Cosmos, 1989; Fredrick, 1989; Wood, 1991).

2.5.2. Studies conducted on CAL in Science

Of the 14 studies located by the investigator on the effect of Computer Assisted Instruction in Science subjects at secondary level, five studies were made in Physical Science, five studies were in Chemistry and four studies in Biological Science. Out of the five studies identified in Physical Science, one was on the use of computer to circumvent physics laboratory and Mathematical solutions were investigated among the secondary school students conducted by Swchmart (1972). Simulations of particle scattering experiments were devised. Controls on the machine enabled the user to determine scattering parameters. It was concluded that simulations of this kind helped the students in an environment difficult to achieve with conventional teaching aids. A similar study was conducted by Bork (1979) on learning computer simulations
in physics among the high school level students. It was reported that the computer simulation enriched the learning of the students significantly.

A Computer tutorial program on the laws and concepts encountered in introductory physics courses among high school students was studied by Faughn and Kuhn (1979). These programmes were written with the weaker students in mind. But the researchers found that even stronger students used them presumably to check whether or not they really understood a particular phenomenon. This success was attributed to the fact that the programs were written so that each student's incorrect answer was dealt with in a way that helped him understand why his answer was incorrect. It was felt that the novelty of using the computer encouraged student much more than the prospect of working from a study guide.

In an another study, the effect of Computer Assisted Instruction and reinforcement schedules on physics achievement towards physics of high school was measured by Bannet (1986). Seventy one high school students were taken as sample. The results of this study supported that students who received Computer Assisted Instruction would achieve significantly higher physics test scores.

A contradictory finding was reported by Choi (1985), when the effectiveness of a simulated experiment was compared with the other utilising parallel instruction involving hands on laboratory experiences in the teaching of the concept of volume displacement. It was reported that computer
simulated experiences were as effective as hands on experiences among the junior high school students.

From the results of the studies discussed, it could be observed that Computer Assisted Instruction was quite effective in providing theoretical as well as laboratory experience in Physical Science secondary students (Swchmart, 1972; Bork, 1979; Kuhn, 1979; and Bannet, 1986). At the same time it was also reported that Computer Assisted Instruction programme did not make significant impact on laboratory achievement by Choi (1985).

Of the five studies located by the investigator on the effect of Computer Assisted Instruction in Chemistry among secondary school students, one was by Vazgues (1983) who conducted a study on a chemistry course. It was reported that the Computer Assisted Instruction made significant difference and also resulted in higher preference level than the conventional method.

It was reported by Ayoubi (1986) that Computer Assisted Instruction helped medium ability students to achieve significantly higher, when an experimental study was carried out on the effectiveness of computer assisted instruction on achievement in Chemistry among high school students. Data were collected from 125 students in a selected urban school. Seventy seven were in the experimental and 48 were in the control group. Pre post-test design was used in the study.
In another study two Computer Assisted Instruction programs for an introductory Chemistry laboratory of High School students were compared by Moore et al. (1980). Both sets of Computer Assisted Instruction materials contained the same material in virtually identical displays. But one set required that the student participate in the presentation by giving constructed responses of a sort that only a Computer Based Instruction could process. The other set allowed the student to advance upon giving the simpler kinds of responses typical of a programmed test. The results showed that the students using the program, forced themselves to demonstrate understanding, performed significantly better than the other group when they were required to make decision in the laboratory.

The finding of the study of Wainwright (1985) seemed different from the earlier studies in Chemistry. He found that the use of micro effective learning on the selected topics in Chemistry, when the investigator was made on the effectiveness of a Computer Assisted Instruction package in supplementing teaching of selected concepts in secondary school Chemistry. The experimental group received drill, review and reinforcement by using the micro computer for lessons three days a week for a three week period.

The study was conducted by Tarrell (1996) to determine the effect of changes in resolution and number of colors on performance of a visual search task within a computer-based multimedia environment. Students were randomly assigned to a multimedia task using one of the nine possible combinations of resolution and colour depth. Student performance, as measured by speed and accuracy of task completion was analysed for any effect
of either resolution or colour. No significant difference was found for either colour or resolution on accuracy or speed.

When the studies of Vazgues (1983), Moore, et al. (1980) and Ayoubi, (1986) advocated that Computer Assisted Instruction made significant impact on achievement in Chemistry, insignificant difference on achievement was also reported by Wainwright, (1985) and Tarrell, (1996) among the secondary level students.

Out of the four studies identified in Biological Science, a study was conducted by Anderson et al. (1980) to measure computer knowledge among a group of 340 ninth and eleventh grade students from a single high school. The study was conducted for a period of two months. The subjects interacted with a Computer Instructional package concerning water pollution. It was suggested that a relatively short 15 minute exposure to a convent via the micro computer, can result in significant learning gains in science among the ninth and eleventh grade students.

Similar finding was reported, when the effects of different amount of Computer Assisted Instruction on the biology achievement and attitudes of high school students was studied by Dalton (1986). One hundred and seventy one tenth grade students participated in the study. Analyses of covariance procedures were used to analyse the data. It was found that the Higher retention was achieved through either total or two thirds of Computer Assisted Instruction than conventional instruction.
The achievement concerning the use of a micro processor driven energy simulations among middle school students was determined by Zielinski (1981). The study intended to measure achievement as a result of a short interaction with the environmental simulations. It was reported that no significant differences were found between the experimental and the control groups on either the pre-test or the post-test.

Nishiho (1994) undertook an exploratory investigation to determine the effects of a multimedia computer-based science learning environment and gender differences on achievement and attitudes and interests of students in an eighth grade science classroom. This study employed an exploratory investigative approach which utilised a quantitative two-by-two experimental factorial design. An analysis of co variance was utilised to adjust any initial differences.

The purpose of the study was to determine the relationship of a multimedia computer-based science learning environment and gender differences on achievement and attitudes and interests of students in an eighth grade science classroom.

The control group received instruction based upon traditional science teaching methodologies while the experimental group received instruction using a multimedia computer-based sciences learning environment. The following relationships were found:
i. Students in the experimental classroom had a significantly higher post-test Mean score in 'self concept' than the students in the traditional science classroom.

ii. Female students with experimental classroom had a higher post-test Mean score on 'self perception as a student' than both the males and females of the traditional science classroom and the male of the experimental classroom.

iii. Students in the experimental classroom had a significantly higher post-test Mean scores on the computerised instruction Test on science than the students in the traditional classroom.

While Anderson et.al (1980) and Dalton (1986) reported that Computer Assisted Instruction enhances achievement and retention significantly in biological science among the secondary level students, it is to be noted here that insignificant difference was also reported by Zielinski (1981) and Nishiho (1994).

Out of the 14 studies identified in science subjects the Computer Assisted Instruction made favourable impact in nine studies and in five studies it is not so (Zielinski, 1981; Choi, 1985; Wainwright, 1985; Nishiho 1994; Tarrell, 1996). It was also observed that simulated modes of Computer Assisted Instruction were much useful in laboratory experiments.
2.5.3 Studies conducted on CAL in Language

Fourteen studies were identified under language development. Out of them eight studies were carried out on the impact of Computer Assisted Instruction on reading and the remaining studies concentrated on different dimensions such as grammar, spelling words, written communications and other language tasks.

Among the eight studies identified on the effect of Computer Assisted Instruction on reading, one study was taken up by Tarrent (1983). In his study, he has tried to find the effects of a drill and practice mode Computer Assisted Instruction programme on secondary school students ability scores on reading. It was reported that drill and practice may be advantageous when there is high motivation and interest in computers. Eighty eight secondary school students were randomly assigned to three groups for the study with the exception of students identified for the special group. Similar finding was reported by Taylor (1983). It was found that Computer Assisted Instruction showed significant improvement over the conventional method of instruction, when a study attempted to investigate the effects of achievement of drill and practice mode of Computer Assisted Instruction on vocabulary, comprehension and reading.

The finding of the study of Porinchak (1984) also showed that there was a significant difference in reading. The students who used Computer scored more marks than others in reading interaction of cognitive and affective factor among secondary school students. A study was investigated by Shinn
(1987) to determine whether the skills of sixth, seventh and eighth grade learning disabled students significantly improved in the area of reading language, writing, problem solving and self concept through the use of word processing and problems solving software. It was reported that experimental group scored significantly (P<.05) greater gains in reading comprehension and writing skills. The effects of computer based instruction on reading ability was also studied by Phillips (1988). A total of 152 sixth grade students (85 girls and 65 boys) from a rural elementary school in the south eastern portion of the United States participated in the study. Results revealed a significant interaction between the kind of information taught (facts and inference) and the reading ability of the learner (high and low).

The study conducted by Winslow (1985), on the efficacy of a computer multimedia program. The purpose of this study was to explore the efficacy of a computer multimedia vocabulary program at high and low levels of student verbal aptitude. The sample comprised 146 general and college preparatory English students from two central North Carolina public schools. Subjects were randomly assigned by class to one of three treatment conditions - text, movie, or multimedia - each of which presented 13 previously unknown vocabulary words. Students were instructed via the assigned treatment and then administered a series of three post-tests. These tests were re-administered two weeks later to examine retention effect. The results showed that higher verbal ability students responded significantly better to the multimedia treatment than the text treatment, and lower verbal ability students scored significantly better with text instruction than with multimedia instruction.
Another study conducted by Johnson (1996) was to evaluate the effectiveness of computer assisted instruction (CAI) for teaching adults reading skills. Demographic, economic and education variables were also examined. A pre-test, post-test comparison group design was applied. The experimental group included adults enrolled in one of the three computer labs (n=26). The comparison group included adults enrolled in one of the seven traditional classrooms (n=26). The Tests of Adult Basic Education (TABE) were used for pre and post-testing. A t-test of independent Means found no significant difference in pre-test scores between the two groups.

In this study Schardt (1997) made a comparison of English language and reading skills of limited English proficient students with and without use of multimedia CD-ROM literature-based software. Ninety-six LEP students were matched by classroom and gender, then randomly divided into control and experimental groups. Results of the study showed no statistically significant difference between the experimental and control groups. A significant difference did appear between classrooms, suggesting the importance of the teacher in the learning process.

Results indicated no significant difference in post-test scores of adults in CAI lab versus traditional classroom for reading instruction. No significant difference in post-test scores was found when examining the variables race, gender, age, income and education at the .01 level of significance selected for this study.
It is understood that Computer Assisted instruction led to enhance the reading ability of the students. The studies measured the effect on vocabulary, comprehension, writing skills and reading ability found the results in positive direction (Tarrent, 1983; Taylor, 1983; Porinchak, 1984; Phillips, 1986; Shin, 1987; Winslow, 1995) and no significant difference on achievement was observed in two studies (Johnson, 1996 and Schardt, 1997).

In the study of 

Chin (1986) the students interaction with computer generated advisement were closely examined. Students choose their instructional experiences from the Computer Assisted Instruction, such as, question and answers, tutorial and simulations. It was reported that they used questions and answers to assess understanding and tutorial for learning. Simulations were used least frequently.

Similar result was reported when a study was conducted by Karen et al. (1988) to determine whether a four week computer sessions increases the students knowledge of spelling words and fractions among the eight, fifth grade classrooms (215 students). It was found that the students learned to spell significantly more words presented on the spelling software than students who did not use spelling software.

One more study in this direction was by Liner (1988). He measured the effects of Computer Assisted Instruction and the traditional classroom on achievement and retention of rule-based and memory-based language tasks among the secondary level students. It was reported that there was no
relationship between memorizational ability and retention of these language
tasks from the traditional classroom.

The results of the following three studies seemed to be quite different. In his study William (1980) found that the analysis of co-variance showed no significant difference between the control and experimental group on the performance, when it was conducted for development and testing of five Computer Assisted Instruction lessons in French grammar.

It was also reported by Rosenbaum (1988) that students using Pen and Paper showed greater improvement and higher scores in the final drafts of post-tests than students using computers. It was conducted to determine the value of computers in the revision process of written communication. Fifty nine high school students were involved in this study, 29 in the control group and 30 in the experimental group.

The study of Quinette (1989) was exploratory and its aim was to measure the attitude. He attempted to determine if the perception of self-as-learner of seventh grade English grammar students changes after experiencing the computer as a component of the instruction process. The study followed a one group Pre-test, Post-test design with random assignments of 81 students to one of the three groupings, individual, dyad, or triad. The results indicated that there was a significant change in the students attitude toward self-as-learner within the individual, triad between group results.
From the discussion so far made under language development it is noticed that nine studies revealed that Computer Assisted Instruction could be more effective for the development of reading skills among the students (Tarrent, 1983; Taylor, 1983; Porinchak, 1984; Chin 1986; Shin, 1987; Phillips, 1988; Karen et al. 1988; Quinette 1989 and Winslow, 1995). At the same time, no significant difference on achievement was observed in five studies (William, 1980; Resenbaum, 1988; Liner, 1988; Johnson, 1996 and Schardt, 1997).

2.5.4 Studies conducted on CAL in General Subjects

The following twelve studies related to the utilisation of computer assisted instruction for teaching general subjects. Use of computer methods was studied by Cox (1974) on problem solving. A sample of 48 boys and 18 girls studying in high school was used. The experimental group was exposed to a specially developed microcomputer program on problem solving. Problems were posed to students of both groups in the area of life science, social studies, and environmental education. It was found that there was significant difference on improvement with time when using the micro computer.

A positive significant effect was reported when Ford (1985) designed his study to determine the effects of computer programming on VIth grade students problem solving abilities. Two way analysis of variance indicated a significant treatment difference, $F(1.47) - 44.31$, $P < .0001$, favouring the computer programming group. In another study, the development of analytical problem-solving abilities of eighth grade students instructed in LOGO computer was compared by Mann (1986) with the development of problem solving.
solving abilities of students who received no programming instruction. The ten week study used a pre-test post-test control group design. Thirty one students from one computer class were matched by sex and scores on the cognitive abilities test to 31 students drawn from other computer class. Analysis of variance showed that there was a significant difference at the .05 level in overall gain between pre-test and post-test in favour of the experimental group.

Acosta (1987) carried out a study to determine to what extent a computerized tutorial program could produce high ACT scores. The high school students were randomly assigned to an experimental group and a control group. The control group used a text book approach to prepare for the ACT and the experimental group used a computerised tutorial. It was found that the experimental group scored significantly higher on ACT composite scores than the control group.

The finding of the following two studies reported unfavourable result towards the use of Computer Assisted Instruction on problem solving abilities. The effect of the use of problem solving microcomputer software was studied upon pattern recognition and creativity by Lynn (1988). The sample was composed of 33 ninth and tenth grade students. Students were randomly assigned to control (n=17) and experimental (n=16) groups. Analysis between control and experimental groups indicated no significant difference regarding pattern recognition. On the figural creative measure, significant difference (at the .10 level) was observed in the originality and creativity index scores.
When an investigation was made on the relationship of microcomputer problem solving software and critical thinking abilities by Galinski (1989) among Junior-high students, it was reported that the use of traditional instruction was significantly better than traditional instruction plus other varied computer activity to solve problem analysis or synthesis. It could be understood from the results of the reviews studied that Computer Assisted Instruction in general had contributed significantly in a majority of the studies among secondary level students.

The purpose of the study by Royston (1989) was to ascertain the extent of microcomputer use in Missouri's secondary schools. Another purpose was to examine relationships between the extent of usage and selected principal and teacher characteristics. Emphasis was placed on the extent of incorporation into the everyday curriculum. Findings of the study are, about half of the principals had not received training related to microcomputers. The teachers indicated a slightly higher rate of training, but still about 40% had not received such training.

The purpose of the study conducted by Hiatt (1990) was to investigate computers and computer-related technology in the workplace as presented in second grade students' English Language Arts, Science, Social Studies and Maths textbooks. Three different publishers of textbooks at the second grade level for English Language Arts, Science, Social Studies and Maths were examined to determine the extent to which they presented or represented the use of technology. Twenty-three classroom teachers were surveyed to determine their use of computers for themselves and as teaching tools for their students.
The data indicated that students who have computers available in their classrooms spend very little time on them, making the inclusion of computers and computer-related technology, at this time, not very significant parts of their instruction.

Regser (1991) conducted a study on 'effects of computer education on students achievement, attitude and self esteem'. This study was designed to examine the effects of computer education of students achievement attitude and self esteem and b) investigate the relationship between success with computer instruction and personality characteristics, IQ, age and attitude towards school.

The major findings of the study are:

1. There were interesting students gain in effective areas such as attitude and self esteem. Students receiving computer instruction agreed more strongly with positive attitude statements.

2. There were no sex related differences in achievement attitude and personality characteristics.

Robert, Michael R (1994) made a "comparison in the effectiveness of the delivery of the interactive computer assisted instruction module to a traditional lecture / lab delivered module. This study examined the use of a computer-based multimedia interactive learning system to determine if the learning of a conceptual predictive technological concept was more effective with interactive Computer Assisted Instruction (CAI) or with Traditional
Instruction (TI). The main finding was that learners in the experimental group (CAL) scored significantly higher adjusted Mean post-test score than learners in the control group.

Elmore (1992) made an analysis of fifty one computer modules designed to enhance the knowledge skills and attitudes needed by teacher education students. This study analyses and reports the findings of students’, reactions to a set of 51 computer modules called Performance Element Modules (PEMS). These modules focussed on selected knowledge skills and attitudes needed by teacher education students. The main objective was to assess whether students will accept the 51 computer assisted modules as viable instructional tools.

The major findings revealed a Mean scores of 7.73 for user friendliness of the computer. For involvement and interaction of the computer programme (Modules) a Mean scores of 7.3 was reported. Did the modules help students correct a lack of information or improve a skill? A Mean of 7.12 was reported which was interpreted as an indication that the modules were visible instructional aids.

Tenyankam (1994) made a study on learner controlled lessons in co-operative learning groups during computer-based instruction. This study investigated the effects of studying alone or in co-operative learning groups on the performance of high and low achievers. The study also examined the effects of computer based instruction using either learner or programme control. This study concluded that both high and low achievers in the co-operative treatment increased achievement on programme controlled and learner controlled
computer lessons. The learner controlled co-operative learning group made more options while checking their concept learning and spent more time interacting with the learner controlled computer-based tutorial than the learner controlled individual learning group.

From the studies conducted in general subjects, the studies of Cox, 1974; Ford, 1985; Mann, 1986; Acossta, 1987; Galinski, 1989; Regser, 1991; Robert Michael. R, 1994; Elmore, 1992 and Tenyankam, 1994 found significant difference in favour of the treatment of CAL whereas insignificance difference was observed in three studies (Lynn, 1988; Rayston, 1989 and Hiatt, 1990).

2.5.5 Studies conducted on different modes of Computer Assisted Instruction

The present investigator identified 23 studies which were carried out to determine the effectiveness of different modes of Computer Assisted Instruction, such as Simulation and Animation, Tutorial and Drill and Practice. The above said studies were taken for further analysis from the studies discussed under the Caption 2.5.. Of the 23 studies, nine studies attempted on simulation, seven were on tutorial mode and the remaining two studies were on animation mode instruction.
2.5.5.1 Simulation Mode of CAL

Out of nine studies on the simulation mode of Computer Assisted Instruction, three studies were on learning science concepts, two studies were on using it for laboratory experiments and the remaining on decision making, athletic administration, verbal feedback and acquisition of skills.

Among the three simulation mode studies located on science concepts, one study was conducted by Swetman (1972) on simulation of particle seathering experiments in Physics instruction. It was found that Computer Simulation helped the students in an environment difficult to achieve in the conventional method. A similar study was conducted by Bunk (1979) on learning Physics with computer simulations. From the collected data, it was found that computer simulation enhanced the learning of the students. The finding of the study of Zieliviski (1988) is somewhat different from the studies of Swetman and Bork. When a study was conducted on the use of simulations mode of driven energy, it was reported that there was no significant difference on achievement between experimental and control groups. From the above discussions it is noticed that Computer simulation helped the students to achieve significantly in science subjects. At the same time, insignificant difference on achievement was also reported in the study of Zieliviski.

Of two studies identified under Computer simulation for laboratory experiments, one was conducted by Bobbert (1983) on the effects of using interactive computer simulated laboratory experiments. It was found that there
was no significant difference between the hands on laboratory experience and the experience through Computer simulation. Another identical problem was taken up by Choi (1985) on the effectiveness of the micro computers simulation on student understanding of the volume displacement concept. Findings of the study revealed that there was no significant difference between hands on laboratory experiments and the experience through computer simulation. It was observed from the results of the two studies that Computer simulation was not much conducive for using it for laboratory purpose.

Out of the four studies carried out on the effect of simulation, each one concentrated on different domains, such as, decision making, arithmetic administration, acquisition of skills and verbal feedback. A study on decision in Computer simulated experiments was taken up by Suits and Lagowski (1982). It revealed that students learnt to make empirical decisions more significantly than the control group students. In athletic administration by Branvold (1985). This simulation was designed for users with limited Computer experience. It was found that both students and instructors were enthusiastic regarding utilisation of the Simulation. Instructors were also very supportive and would consider the simulation if compatible hardware was available and cost was not prohibitive.

The effects of Computer delivered Science simulation on the acquisition of process skills was studied by Vensel (1989). All the school students were post-tested with the Test of Basic Process skills. It was found that treatment group membership, gifted group membership, and hours of simulation made statistically significant contribution to the prediction of post-test score (p<0.5).
A study was carried out by Hunt (1989) to determine if pre-service elementary school teachers would incorporate effective academic verbal feedback behaviours into their teaching when these strategies were presented to them by means of Microcomputer simulation. It was revealed that no significant differences were found in appropriate responses to students correct answers between or within groups across the three observations, and no group by time interaction was found.

Out of nine studies identified on the effect of simulations mode of CAI on different subjects five studies brought out significant difference on the achievement of the students in favour of simulation mode (Swetman, 1972; Bunk, 1979; Logowski 1982; Branvold 1985 and Vensal, 1989) and the remaining four studies found no significant difference (Bobber, 1983; Choi 1983; Zieliviski, 1988 and Hunt 1989).

2.5.5.2 Tutorial Mode of CAL

Among the seven studies identified on the tutorial mode of Computer Assisted Instruction, three studies compared the tutorial mode with other modes, other three studies compared tutorial with traditional method of instruction and the remaining one study compared the effects of system control and learner control of tutorial system. Of the three studies comparing the tutorial mode with other modes, one study was conducted by Chin (1986) on students instruction activities such as tutorial, questions and answers and simulations. From the results of the study, it was found that tutorial and question and answers were used frequently for learning, whereas simulation
was used least frequently. A contrary finding was reported, by Faughn and Kuhn (1979) on the effect of computer tutorial program in Physics. Tutorial instruction was compared with the drill and practice. It was found that there was no significant difference between tutorial and drill and practice on achievement in Physics. When the achievement of weaker and stronger students was compared, it revealed that weaker students of tutorial group fared well. It was observed from the finding of a study that tutorial program was preferred by the students to simulation. It was also found that there was significant difference between tutorial and drill and practice modes.

The study of Poppen (1989) examined the effects of graphics, within a computer assisted instruction (CAI) tutorial program on retention and recall of information, and time spent using the program. Graphics were integrated within the tutorial program as antecedents which presented information, and as reinforcing consequence for correct answers to questions. One hundred college students were randomly assigned to four groups. Each group worked with one version of the CAI tutorial program.

The findings of this study are contrary to the generally accepted idea that graphics (Pictures) enhance comprehension and movies learners. Explanations for the results obtained are explored and future research topics are presented. In summary, the findings of this study indicate that graphics utilized as antecedents and/or consequences, in the CAI tutorial utilized in this research did not enhance significantly retention and recall, attitude and efficiency with students.
The mode of tutorial program was compared with traditional method of instruction on the attempt Acosta (1987) conducted a study to determine to what extent a computerized tutorial program could produce higher ACT scores by high school juniors and seniors. The results of the study showed that the experimental group scored significantly higher on ACT composite scores than did the control group. A study was conducted by Hurst (1987) on the effects of a Computer Assisted Instruction tutorial program on the academic performance. The experimental group was assigned a series of Computer Assisted Instruction tutorial lessons to be done in three months while the control group was tutored by the traditional method during the same period of time. It was found that computer-assisted tutorial instruction had a significant effect, on the academic performance of college athletes.

Ferguson (1989) made an attempt on the effect of locus control on achievement and performance in computer assisted tutorial systems which vary in terms of system control, learned with no coaching. The study results found that the gain scores were the lowest in the tutorial mode of instruction. Internals independently reviewed more study material than externals. Externals made more errors and browsed more than internals.

Ahern (1991) made a study on the effect of a tutorial mode with graphic interface on participation, interaction, and student achievement in a computer mediated small group discussion. The goal of this research was to investigate the effects of interface design on the participation, interaction, and achievement of students in a computer-mediated small-group discussion. There was, however, no difference in the amount of participation or achievement
possible to design an interface that encourages the use of constraints formative to group interaction. This has important implications for small-group instruction.

Out of seven studies located under CAI tutorial mode, experimental student scored significantly higher in four studies (Chin, 1986; Hurst, 1987; Faughn and Kuhn, 1989; Acosta, 1987) and at the same time four studies revealed no significant difference on achievement.

2.5.5.3 Drill and Practice Mode

Among five studies located on drill and practice mode of Computer Assisted Instruction, two studies tried to find out the effect of drill and practice mode among various ability students, two studies compared drill and practice with traditional method of instruction and a remaining study was compared with tutorial mode. Of the two studies investigated on the various ability students through drill and practice mode, one study was made by Tarrant (1983). He tried to determine if interaction with computer assisted individualised drill and practice programs for skills building would have differing effects for high ability students than for low ability students. It was found that Drill and Practice may be advantageous where there is high motivation and interest in computers. The findings of Steele et.al., (1982) were somewhat different. The study found no significant gains in Mathematics achievement between control group and experimental groups. The results of the two studies cited above revealed that drill and practice led to significant
impact for high ability students on learning, provided they have high motivation and interest.

Two studies were identified by the investigator under the Comparison of drill and practice with traditional method of instruction. In a study Taylor (1983) found a significant achievement of drill and practice of Vocabulary, Comprehension and Reading over traditional method of instruction, when the study was taken up to find the effectiveness of drill and practice mode of Computer Assisted Instruction among the secondary level students. In another study, Wainwright (1985) evaluated the use of commercial drill and traditional instruction in General Chemistry. The finding of the study revealed that control group did better in achievement tests than the experimental group. It was observed from the presentation that drill and practice mode was considered more effective, when it was compared with traditional method of instruction. At the same time, a negative result was also reported in the study of Wainwright.

Only one study was identified under the comparison of drill and practice with tutorial mode of Computer Assisted Instruction. Blazejewski (1984) conducted a study to determine how drill and practice and tutorial computer programme affect intermediate elementary students’ Mathematical achievement in concepts, problem-solving and computation. It was revealed that there was no significant different drill and practice and tutorial modes of instruction.
Out of the results of studies identified on the effectiveness of drill and practice, four studies showed favourable result (Tarrant, 1983; Steele, et.al., 1982; Taylor, 1983; and Wainwright 1985) and remaining one study (Blazejewski, 1984) did not find any significant difference.

2.5.5.4 Animation Mode of CAL

Two studies were located on the effect of animation mode of CAI. Holmes, G.A. (1991) made a study on computer graphics variations (animated vs still) and their impact on the knowledge and performance of cognitive behavioural skills; fire-safety training. Fifty-six months fourth grade children served as participants in this study. Three training procedures (behavioural, animated-graphics and still-graphics) were assured for relative effectiveness in the acquisition of five emergency skills and attainment of knowledge. Results demonstrated a significantly higher level of fire emergency skill acquisition and knowledge attainment for both the behavioural and animated graphics groups relative to the still graphics and no-training groups. The value of using animated versus static images in computerized instruction for fire-safety skills training was demonstrated.

An another study was by Wilcox (1997) on the use of animation with instruction and feedback in fractions software for children. An experiment was conducted with second grade students to examine whether animated graphics were more effective than static graphics when used as instructional support during the tutorial or as corrective feedback during practice activities in fractions software. The objectives of the study were threefold. (1) to determine
whether animated graphics were more effective than static graphics compared to static graphics differentially affected retention of fraction concepts. An analysis of co-variance revealed significant difference on the total post-test between the no instruction groups receiving a software treatment.

Among the two studies located on Animation, the results of both studies [Homes (1991) and Wilcox (1997)] demonstrated significantly higher level of achievement.

2.6 SYNTHESIS OF REVIEW OF RELATED LITERATURE CONDUCTED ABROAD

The investigator collected 55 studies which were conducted at the secondary level (from VI standards to XII standards). When analysed according to subjects, it was found that 15 studies were made on Mathematics, 14 studies were on language, 14 studies were on Science and the remaining 12 studies on General Discipline.

Out of the 15 studies made in Mathematics, 11 studies showed that Computer Assisted Instruction helped the students to achieve significantly in Mathematics (Robin, 1982; Austin, 1983; Wright, 1983; Sasser, 1985; Rhoads, 1986; Kismani 1988; Alifrangis, 1989; Barnsley, 1989; Hayden, 1989 and Schmidt 1991). It was also reported from a study that Computer Assisted Instruction helped not only normal children but also handicapped students in their assignment activities. Moreover it was also found that the feedback of Computer Assisted Instruction made significant impact among high ability students on achievement. However, insignificant difference on achievement
was also reported in a few studies (Lee, 1985; Cosmos, 1989; Fredrick, 1989; Wood, 1991).

Out of the fourteen studies located by the investigator on the effect of Computer Assisted Instruction in Science subjects at secondary level, five studies were made in Physical Science, five studies were in Chemistry and four studies in Biological Science. From the results of the studies discussed, it could be observed that Computer Assisted Instruction was quite effective in providing theoretical as well as laboratory experience in physical science secondary students (Swchmart, 1972; Bork, 1979; Kunn, 1979; and Bannet, 1986). At the same time it was also reported that Computer Assisted Instruction programme did not make significant impact on laboratory achievement by Choi (1985).

When the studies of Vazgues (1983), Moore, et al. (1980) and Ayoubi, (1986) advocated that Computer Assisted Instruction made significant impact on achievement in Chemistry, insignificant difference on achievement was also reported by Wainwright, (1985) and Tarrell, (1996) among the secondary level students.

While Anderson et al. (1980) and Dalton (1986) reported that Computer Assisted Instruction enhanced achievement and retention significantly in Biological science among the secondary level students, it is to be noted here that insignificant difference was reported by Zielinski (1981) and Nishiho (1996).
From the studies conducted under language development it is noticed that nine studies revealed that Computer Assisted Instruction could be more effective for the development of reading skills among the students (Tarrent, 1983; Taylor, 1983; Porinchak, 1984; Chin 1986; Shin, 1987; Phillips, 1988; Karen et al. 1988; Quinette, 1989 and Winslow, 1985). At the same time, no significant difference on achievement was observed in five studies (Liner, 1988; Resenbaum, 1988; William, 1980; Johnson, 1996 and Schardt, 1997).

Among the twelve studies conducted in general subjects, the studies of Cox, 1974; Ford, 1985; Mann, 1986; Acossta, 1987; Galinski, 1989; Regser, 1991; Robert Michael, 1994; Elmore, 1992 and Tenyankam 1994 found significant difference in favour of the treatment of CAL whereas insignificant difference was observed in three studies (Lynn, 1988; Rayston, 1989 and Hiatt, 1990).

Out of nine studies conducted on the effect of simulations mode of CAI on different subjects five studies found significant difference on the achievement of the students in favour of simulation mode (Swetman, 1972; Bunk, 1979; Logowski, 1982; Branvold, 1985 and Vensel, 1989) and the remaining four studies found the insignificant difference (Bobber, 1983; Choi, 1983; Zieliviski, 1988 and Hunt, 1989).

Out of seven studies located under CAI tutorial mode, experimental student scored significantly higher in four studies (Chin, 1986; Hurst, 1987; Faughn and Kuhn, 1989; Acossta, 1987) and at the same time four studies revealed no significant difference on achievement. Among the seven studies identified on the tutorial mode of Computer Assisted Instruction, three studies
compared the tutorial mode with other modes, other three studies compared tutorial with traditional method of instruction and the remaining one study compared the effects of system control and learner control of tutorial system.

Out of the results of the studies conducted on the effectiveness of drill and practice, four studies showed favourable result (Tarrant, 1983; Steela, et al. 1982; Taylor, 1983; and Wainwright 1985) and the remaining one study (Blazejewski, 1984) did not find any significant difference.

Among the two studies located on Animation, the results of both studies (Homes, 1991 and Wilcox, 1997) demonstrated significantly higher level of achievement.

From the review of 55 studies conducted abroad and 16 studies in India on the effects of Computer Assisted Learning Software on several variables, it was inferred that almost all the studies were in the nature of experimental study. Majority of the studies followed "Pre-test, Post-test Equalent Group Design". The size of the sample selected in the studies were from 30 to 250. Among the identified studies, considerable studies were from the subjects like Mathematics, Literature and Science. The treatment of experiment in studies were for the period from one week to nine weeks. The terms used in the study for 'Computer Assisted Learning' were different as Computer Assisted Instruction (CAI), Computer Based Instruction (CBI), Computer Managed Instruction (CMI), Computer Tutorial Instruction (CTI) etc. The statistics used in the studies were t-test ANNOVA, Percentage Chi-square and Correlation.
Very few studies used 'ANCOVA'. The salient findings of the studies are given below:

1. It was found in many studies that CAL has produced higher scores of grades than traditional method of instruction. There are a few studies in different subjects which revealed insignificant difference on achievement.

2. Some studies have shown that CAL was more effective for Low-ability students than High ability students.

3. Some findings of the study have reported positive students attitudes towards computers for the course taught with computers.

4. A few studies have found that CAL is more useful as a supplement to instruction than as a replacement for instruction.

5. It was found by some studies that CAL has reduced the time required for instruction.

The forthcoming chapter deals with the conceptual framework work of the study.