CHAPTER – II

Review of the Related Studies
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REVIEW OF RELATED STUDIES

An attempt has been made in this chapter to present a brief review of research available in this particular field. However, it may be noted that very little information about Computer Assisted Instruction (CAI) and Computer Managed Instruction (CMI) is available in this country and also that there is an absence of conclusive findings over the various researches made regarding the effect of CAI and CMI on Self Concept, Study Involvement and Academic Achievement. Although CAI and CMI have been a focus of intensive research enquiry among the educationists and psychologists yet sufficient attention has not been paid in this field in our country.

Psycho-educational research on the effect of CAI and CMI on psychological variables in Indian sub continent have been tardy, isolated and disparate. This is quite in contrast to the systematic research that has been conducted in USA, Canada, Australia and England on similar lines. A few researches in the field of education and psychology have, however, attempted to break the ice but due to the complex nature of the problem these have failed to make significant contribution to the development of a rational theory about them. It has been found from the survey of available
research that though a large number of studies have concentrated on Academic Achievement, certain important aspects of personality such as Self Concept and Study Involvement have not caught the attention of many researches especially in the field of education.

Synoptic overview of the research in the area of CAI and CMI indicates clearly that only a few researches have made indepth analysis in this area. No doubt, it is difficult to classify the diverse kind of researches in this field but still a number of researches pertaining to this field have been reviewed which is being presented in this chapter. As the present study is aimed at investigating relative effectiveness of CAI and CMI, the related studies have been conventionally classified into following subsections:

2.1 Studies involving the effect of Computer Assisted Instruction and Computer Managed Instruction on Computer Attitude and Self Concepts.

2.2 Studies involving the effect of Computer Assisted Instruction and Computer Managed Instruction on the development of cognitive skills.
2.3 Studies involving the effect of Computer Assisted Instruction on Academic Achievement.
2.4 Studies involving the effect of Computer Managed Instruction on Academic Achievement.
2.5 Studies involving Computer Assisted Instruction and Programmed Instruction.
2.6 Studies involving Computer Assisted Instruction And Learning Rate.
2.7 Studies involving Computer Assisted Instruction And Retention Of Learning.
2.1 STUDIES INVOLVING THE EFFECT OF COMPUTER ASSISTED INSTRUCTION AND COMPUTER MANAGED INSTRUCTION ON COMPUTER ATTITUDES AND SELF CONCEPT

Much of the research that examines the effects of CAI and other microcomputer applications on student learning outcomes also investigates effects upon student attitudes. This line of inquiry has brought most researchers to the conclusion that the use of CAI leads to more positive student attitudes than the use of conventional instruction. This general finding has emerged from studies of the effects of CAI on student attitudes toward:


- Course content/subject matter (Batey 1986; Braun 1990; Dalton and Hannafin 1988; Ehman and Glen 1987; Hounshell and Hill 1989; Rapaport and Savard 1980; Roblyer, et al. 1988; Rodriguez and Rodriguez 1986; Stennett 1985)

- Quality of instruction (Kulik, Bangert, and Williams 1983; Kulik and Kulik 1987; Rupe 1986; White 1983)
School in general (Batey 1986; Bialo and Sivin 1990; Ehman and Glen 1987; Roblyer, et al. 1988)


Pelgrum and Plomp (1996) stated, "Student’s attitudes toward computers are considered to be very important indicators of students’ inclination to adopt this new technology in their lifelong learning". Christensen (1998) says:

A review of the literature on attitudes computer by Lawton and Gerschner (1982) showed that children found computers to have infinite patience, never to get tired, never to forget to correct or praise, to be impartial to ethnicity and gender, and to great motivators. In the same review, it was shown that students liked computer because they were self-paced, gave immediate feedback, and did not embarrass when they made mistakes.

Further, Computer-Assisted Instruction plays a considerable role in the students' attitudes toward learning. Bender and Bender (1996) believe that "efficient CAI use can improve a student’s attitude toward learning". According to Kulik, "Research
demonstrates that computer-based instruction has a positive effect upon students attitudes toward computer use”. The majority of the research literature in the area of students' attitudes toward computers strongly suggested that computers positively affect the students' attitudes (Boser et al., 1996; Brosnan, 1998; King, 1994-95; Sacks, Bellisimo, & Mergendoller, 1993-93). Students' attitudes toward computers is such a critical issue that Zhang and Espinoza (1998) claimed that attitudes should continually be monitored if the computer is used as a teaching and learning tool.

Attitudes toward computers have been documented at almost every level of education (pre-university and university level), and these studies involved different populations from different countries. It is useful to look at the previous evidence about students' attitudes toward computers. Different instruments were used in these studies to collect data regarding students' attitudes toward computers at various levels of education. In addition, these studies examined gender differences in attitudes toward computers. Orabuchi (1992) did a 4-month experimental study designed to determine the effectiveness of CAI. The results showed that CAI group was higher in self-concept, attitude toward school, attitude toward computers, and tasks they could do with computers. The
results also revealed that CAI students' scores were significantly higher than non-CAI group in inferences, generalizations, and math problem solving.

Rhyser (1985) as cited by Kulik and Kulik (1991) examined the effects of integrating computer-based instruction (CBI) in an urban elementary school and he found students receiving CBI expressed stronger “feelings of success in school” than students in an equivalent school without CBI. Such feelings are an important component of a positive self-concept.

Sivin and Bialo (1997) found CAI to have positive effects on student attitudes toward learning and on student self-concept. Students felt more successful in school, were more motivated to learn and had increased self-confidence and self-esteem when using computer-based instruction.

Lawton and Gerschner (1982) as quoted in Kulik and Kulik (1991) showed that children found computers to have infinite patience, never to get tired, never to forget to correct or praise, to be impartial to ethnicity and gender, and to great motivators, and it was shown that students liked computer because they were self-paced, gave immediate feedback, and did not embarrass when they made mistakes.
King (1995) as cited by Szabo (1997) examined seventh-grade students' attitudes toward computers and school in Australia and found that the computers positively increased the students' attitudes. However, no identifiable effect of the presence of the computer on the quality of school life was found.

Sacks et. al. (1994) as cited by Szabo (1997) studied the attitudes toward computer and computer use by Grade 10-12 students in a small urban school district in Northern California. The results indicated that-

(a) girls' attitudes toward computers improved while boys' attitudes did not;

(b) boys' attitudes toward computers and actual computer use were relatively unrelated, while girls' attitudes toward computers and actual computer use converged; and

(c) boys' attitudes and behaviors toward computers were relatively stable, while girls' attitudes and behaviors were not stable.

Brosnan (1998) examined the role of psychological gender in children's computer-related attitudes and attainments by 48 primary (6-11 year-olds) school-aged children in South London, UK. The studies inferred that boys hold more favorable attitudes towards computers than girls and that boys hold more positive...
attitudes and achieve higher levels of computer-related attainment than girls.

Lever, Sherrod, and Bransford (1989) as quoted by Szabo (1997) reported that the computer helped students to improve attitudes toward school and computers. An interesting finding was that females held more positive attitudes toward computers than did males.

Miyashita (1991) found that children who used computers had more positive attitudes toward computers than children who did not use computers. In addition, no significant differences were found between the two groups in the area of motivation to study, empathy, and creativity, as measured by the Young Children Computer Inventory.

Knezek and Christensen (1995) used the Computer Attitude Questionnaire (CAQ) to compare two types of computing curricula at a junior high school in Leander, Texas. The first program was a traditional computer literacy. The second program, a pilot program, taught the mandated computer literacy elements through the integration of computers within the existing 7th grade curriculum and they found that students in an integrated program enjoyed the computer more than students in a traditional computer literacy. In addition, integrated-program students rated themselves
as higher in creative tendencies than their peers enrolled in computer literacy. The most interesting finding was that females in the integrated group were significantly higher than males in the areas of study habits and empathy. Knezek (1998) found strong positive attitude toward electronic mail, some differences between states on computer enjoyment, differences across states on frustration-anxiety. Girls tended to show more empathy than boys.

Ireson (1997) found students attitudes toward computer-aided instruction at a 2-year college. Students were surveyed using an instructor-developed instrument. Results indicated that students held positive attitudes toward using computers, felt that computer-aided instruction was helpful, and that computer skills were transferable to the workplace.

Liu (1996) found the attitudes toward computers of Chinese students at American University and he explored the possible effects of gender, age, and computer experience on these students' attitudes toward computers. The study found that Chinese students' attitudes were positive. Age and gender factors did not appear to make any difference among these students. However, significant differences in attitude were found among the groups of Chinese students who had more computer experience.
Luckett (1997) examined the relationship between gender and ethnicity and African American and Caucasian college student attitudes toward computers. The results indicated that all groups have positive attitudes toward computers. No significant difference was found between gender and ethnicity among the students.

Serie (1991) compared teacher attitudes towards computer as an essential variable for an implementation of computer-assisted instruction in Korean secondary schools and found that teachers with higher level of CAI implementation showed more positive attitudes towards computers and using computers.

Kalia, Levin and Vij (2001) studied the Effect of Gender, Residence and Computer Experience on Computer Attitude and computer Confidence. The Findings of the Studies were-

- Females were find more Superior on Total Attitude Score and Computer Related Sex Stero type.
- No significant differences were observed on self Concept in Computer and Computer Attitudes between Urban and Rural Students.
- Confidence in Computer and Computer related attitudes and not Affected by Computer experience.
Mitra (1998) found undergraduate students at Wake Forest University regarding the categories of computer use and their relationship to attitudes toward computers. Higher use of computers among the students indicated more positive attitudes toward computers. The results suggested that distinct categories of computer use exists and that significant relationships can be found between these categories and attitude.

Kalia, Levine, Vij (2000) studies computer self-confidence and computer experience in relation to computer related attitudes and commitment to learning. The results show that self-confidence was positively and significantly related to computer stereotypes and total attitude scores. It was found that students with greater confidence in their ability to learn new computer uses that more favorable attitude towards computer.

DeGraw (1986) found that fourth graders grew in self-esteem and self-confidence when computers were placed in their homes and their school, as part of the Buddy System Project.

Bangert (1985) found that on average, Computer Assisted Instruction students at the elementary school level outperform their counterparts without Computer Assisted Instruction by .47 standard deviations. The relative advantage of Computer-Assisted
Instruction in these reports appears stronger for disadvantaged and low-ability students.

Kinnaman (1997) found that students like instruction more when they have instructional help from a computer but computers do not seem to change attitudes significantly toward subject matter. Yarbrough (1988) revealed that the CAI tutorial did significantly increase students scores of economic understanding. Students did show a positive significant attitude towards the CAI tutorial as a method.

Edwards (1975) applied and documented an instructional design system model, incorporating techniques of simulation design and of CAI design. Students who completed both simulation felt that computer simulation method was superior to the case method. Majority of students agreed that computer gave them the feeling of having a private tutor. Further, attitude towards the content of the simulation was far more favourable after simulation experience then before.

Hess, Dand and Tenzakis (1971) compared attitudes of junior high school CAI participants with those of non-participants toward teachers, computers and other sources of information. Both groups had a more favourable view of computer than teachers, text books or television news.
Sood (1994) found that good study habits contributed towards achievement in CAI and traditional teaching. Students with good study habits gained more with traditional teaching. The researcher also found that contribution of CAI and traditional teaching on achievement of Students with poor study habits was equal.
2.2 STUDIES INVOLVING THE EFFECT OF COMPUTER ASSISTED INSTRUCTION AND COMPUTER MANAGED INSTRUCTION ON THE DEVELOPMENT OF COGNITIVE SKILLS.

Gore, Morrison, Mass and Anderson, (1989) found the effectiveness of reinforcing basic reading skills and teaching computer literacy skills to five year old children though use of a drill and practice software program and the results indicated that the CAI program was effective in developing both kinds of skills in subject.

Kann, (1987) compared the effects of CAI, regular classroom instruction and no instruction on the knowledge, attributes and behavior of secondary students in three areas related to responsible sexuality-decision making assertiveness, and interpersonal communication. He found that CAI students significantly outperformed other groups on most measures.

Dwyer (1997) found that beyond the self-evident fascination children display toward technology, significant and mounting evidence showed that technology improved students' mastery of basic skills, test scores, writing, and engagement in school. With
these gains came decrease in the dropout rate and decrease in attendance and discipline problems.

Thomas (1983) found that the computer simulation experience in study seems to have provided a cognitive routine that the students could apply to the learning of problem solving.

Lee-Wei-Tsun (1989) found that there were significant differences among the subject's four test scores (taken after 10 days delay between each test) with respect to immediate feedback to CAI group, delayed feedback to text group and no instruction or feedback to the no treatment control group in learning to solve the analogy items.

Shaw (1982) concluded that whole class mode was better than individualized mode in imparting instructions through Computer Assisted instruction.

Fox (1986) concluded that a computer based individualized instructional delivery system for educating students in a general education science course was not as effective as lecture based instructional delivery system.
2.3 STUDIES INVOLVING THE EFFECT OF COMPUTER ASSISTED INSTRUCTION ON ACADEMIC ACHIEVEMENT.

The single best-supported finding in the research literature is that the use of CAI as a supplement to traditional, teacher-directed instruction produces achievement effects superior to those obtained with traditional instruction alone. Generally speaking, this finding holds true for students of different ages and abilities and for learning in different curricular areas. As summarized in Stennett's 1985 review of reviews, "well-designed and implemented D and P [drill and practice] or tutorial CAI, used as a supplement to traditional instruction, produces an educationally significant improvement in students' final examination achievement".

Much of the researches have focused on the effectiveness of CAI which is demonstrated through improved test scores (Balajthy, 1987; Williams and Brown, 1990). Effectiveness has also been measured through "heightened affective responses, or better attitudes, reduced learning time, higher course completion rates, an increased retention duration, and finally cost" (Williams and Brown, 1990). Generally the effectiveness of CAI has been
determined by comparing CAI with traditional classroom instruction (Clark, 1985).

To date, the most comprehensive compilation of studies on the effectiveness of CAI has emanated from the University of Michigan. The Kuliks and their colleagues have conducted several meta-analyses. These studies have revealed that students learned more and liked the instruction more when it was delivered via computer. Their meta-analyses also revealed that instructional time was reduced (Kulik, Bangert and Williams, 1983; Kulik, Kulik and Bangert-Drowns, 1984; Kulik, Kulik and Cohen, 1980). This was the case for elementary, junior high, senior high school, and college students. Upon further analysis, instigated by Clark's (1985) critique, Kulik, Kulik and Bangert-Drowns (1985), revealed that the effects of CAI were larger in published studies, in studies where a different teacher was used in the experimental group than in the control group, and in studies of shorter duration.

The meta-analysis of 31 studies conducted by Liao (1992) concluded that "CAI is a mildly effective approach for teaching students cognitive skills in the classroom setting". But it was also noted that there was no evidence to indicate that CAI is more effective or even as effective as other instructional strategies.
Research on Computer Based Instruction (CBI) has typically compared achievement, learning efficiency and student opinion in CBI and conventional instruction environments across an astounding range of subjects and age groupings. Several meta-analytic studies (Bangert-Drowns, Kulik and Kulik, 1985; Kulik, Kulik and Cohen, 1980; Kulik, Kulik and Shwalb, 1986; Niemiec, Samson, Weinstein and Walberg, 1987) have concluded that when CBI is used, achievement is moderately higher than or equal to that obtained from conventional instruction. When efficiency is the criterion, CBI is significantly better than conventional instruction, in the range of 10-35% savings of instructional time. Finally, student opinions generally favor learning under CBI than conventional instruction.

The results are so powerful, relative to other instructional interventions, that some have called for a halt on the comparisons with conventional instruction; they instead urge investigations in which the components or attributes of CBI are investigated to determine optimum learning conditions. For example, in the context of CBI, the role of interaction (Worthington and Szabo, 1995), animation (Szabo and Poohkay, in press; Szabo and Schlender, 1996), audio (Rehaag and Szabo, 1995) and testing
(Szabo, Poon, and Ally, 1997) has been researched in recent years.

CBI research is not without its critics. Clark (1985) has criticized the methodology of all media research, including CBI. However valid his criticisms may be, one cannot help but be impressed with the results. (Worthington and Szabo, 1995), animation (Szabo and Poohkay, in press; Szabo and Schlender, 1996), and audio (Rehaag and Szabo, 1995) has been researched in recent years. Lorelei (1985), found that the mean gain scores of the computer assisted group were greater than those of the control group and the gain scores for students with low mathematical ability also improved with the introduction of computer assistance.

Marsh (1985) found that the computer using group scored significantly higher on total score of the post-list and on sections of the test which involved the use of factual, comprehension and application type thinking skills. The results also indicated that there was no statistically significant difference in scores on sections of the test, which featured synthesis, analysis or evaluation type thinking skills.

Melnik (1986) compared the problem solving performance of students participating in two methods of instructions:
(1) one hour / week of teacher directed problem solving work sheet practice and
(2) one hour / week of independent student use of microcomputer problem solving software.

The results showed that both the teacher directed and computer software groups gains significantly in problem solving ability. Durnin (1985) suggested that the use of computer based learning material should be restricted to individuals alone. Many benefits appear to accrue by having pairs of groups of three working together. Michael (1993) compared the effectiveness of the delivery of an interactive computer assisted instruction module and found that CAI was more effective on low-achievers than regular and high achievers and more effective on younger learners than on adults. Weinburgh (1993) in his study investigated the relationship of CAI and attitudes towards computer with science Achievement and found that students attitudes were less positively correlated with academic achievement. Drexel (1989) indicated that students can learn selected English grammar principles as effectively on the computer with an individualized packages as students can learn the same grammar principles in the traditional class room setting.
Wechow (1984) compared Team Games Tournament and traditional Classroom methods in high school biology and found that TGT had no significant effect on the Biology achievement scores or attitudes towards Biology.

Vanlengen (1988) did study to examine the possible relationship between computer programming instruction and increased general problem solving ability. No significant difference in general problem solving was obtained.

Wang (1989) compared the effectiveness of the two types of CAI and discussion method for teaching logic to 72, 5th graders. The major findings of this study were:

a) Any one of the three types of logic classes taught in this project was effective in improving children's logical ability.

b) The low and average logical ability students improved their logical thinking during the logical classes, while the high logical ability students did not.

c) There was no difference of the effectiveness among the three logic classes.

Panda and Chaudhary (2000) studied the effect of Computer Assisted learning (CAL) in achieving higher cognitive skills. The results clearly indicated the superiority of CAL over traditional approaches. Also, the use of integrationist approach in CAL was
supposed to contribute to the over and above effectiveness of CAL.
Hawley (1985) indicated that adjunct Micro-computer assisted instructions significantly improved the mathematics concepts, math problem solving, total math and computer literacy of grade 3 and 5 students.
Bangert and Kulik (1985) studied the effectiveness of computer based Education in secondary schools on the basis of meta-analysis of 42 studies. The results indicated that computer assisted and computer managed instruction was very beneficial.
Prabhakar (1989) developed software for CAI and its comparison with Traditional Method for teaching semi-conductors at +2 level. The CAI was found to be effective in terms of achievement of students belonging to class XI and XII and also in terms of their reactions.
Bracey, (1987) found 85-89 percent of studies show positive effects of CAI and the effectiveness of CAI decreases from the elementary to secondary to post secondary level.
Campbell, Perk, Horn and Leigh (1987) compared the mathematics performance of third graders using a commercial computerized drill and practice program with that of similar students using a
conventional print drill program. No statistically significant differences between groups were observed.

Suresh (2000) found that CAI strategy had a significant influence on the achievement in Biotechnology, under the influencing conditions of student's receptivity, computer familiarity, Biology proficiency and attitude towards science among the eleventh standard students as a total group as well as grouped as boys, girls and mixed students from the State Board Higher Secondary schools. All these variables positively influence achievement in Biotechnology among the total experimental group as well as in boys, girls and mixed students. The experimental group students were found to have a significant favourable change in their attitude towards science after learning Biotechnology through CAI.

Himani (1990) conducted a study-development of CAI on microbes for class VIII. The developed CAI material proved quite effective which was quite evident through the significant gain of students and their reactions.

Dalton and Hannafin (1988) studied the effects of five different instructional approaches involving the use of computer-assisted and traditional mastery methods on computation accuracy and attitudes. They compared the effects of five different instructional approaches involving the use of mastery and non-mastery
methods and computerized or teacher-directed instruction. The subjects, eight grade math students, performed best with mastery treatments and initial instruction. There were no differences between CAI students and those receiving teacher-directed instruction.

Heilman (1983) found that computer simulation practice helped students reinforce rule-using behaviors as well as increased verbal learning.

Mahapatra (1991) conducted a study on Development and Effectiveness of CAI in terms of Achievement and Abstract Reasoning of Class IX students. The developed CAI was found to be significantly superior to traditional method when the students mean achievement scores were adjusted with respect to intelligence.

Sivin and Bialo (1997) found that students working in pairs demonstrated higher achievement that students working individually. They also found that elementary students using tutorial and drill software in cooperative groups had significantly better attitudes toward their computer lessons than students working independently.

Hall and McLaughlin (1989) compared the effects of Computer-Assisted Drill and Practice on spelling performance with Mildly
handicapped students of elementary school and found that the spelling achievement scores of CAI participants was significantly greater than the scores of conventionally instructed students, and half the CAI students had scores of conventionally instructed scores equal to those of their non-handicapped peers.


Adhikari, Raishree (1992) conducted a study Viz, Development of CAI Material on Cell and Cell Reproduction for class IX. The CAI was found effective in terms of achievement and reaction of students.

Kulik (1983) found the results of a meta-analysis of 48 comparative studies of the effects of computer based instruction, CBI was found to be moderately better than traditional method.

Bangert, Kulik and Walberg (1987) have concluded that when Computer based instruction is used, achievement is moderately higher than or equal
to that obtained from conventional instruction. When efficiency is the criterion, CBI is significantly better than conventional instruction, in the range of 10-35% savings of instructional time. Finally, student opinions generally favor learning under CBI than conventional instruction.

Das (1999) conducted a study on exploring of CALM (Computer Aided Learning Material) on rhymes in different modes. The study revealed that:

- intelligibility of message is a function of interaction of message, medium and mode and receiver.
- composite modes may not ensure higher language learning.

Kulik and Bangert (1985) compared the effectiveness of computer-based education in elementary schools. They found that in a meta-analysis of 32 studies of the comparative effects of computer-based instruction and non-computer-based instruction, computer-assisted instruction had a significant, positive effect on achievement. Computer-managed instruction had only a small, non-significant effect.

Merrell (1984) concluded that students receiving traditional instructions supplemented with 15 minutes of Computer-Assisted Instruction significantly improved academic gain in the subject of math but not in reading. CAI is recommended for use in math at all three grade levels, i.e. 3rd, 4th and 5th grade.
Ayoubi (1985) found that students spending half their class room instruction time studying chemistry from micro computers programs reached the same level of achievement as students receiving instruction only from class room teacher. There were some variations for students of different abilities. Medium ability students achieved significantly higher when they spent more time on computer. The significant differences between high and low ability students were erased if the low ability students spent more time on computer than the high ability students. Students preferred to work in pairs on the computer programs were helpful as instructional tools.

Khirwadkar (1999) conducted a doctoral study entitled "Development of Computer Software for Learning Chemistry at Standard XI". Pre-test - post-test and control-experimental group design was used for the study. The main findings of the study were reported that:

- the software package was found to be effective in terms of academic achievement of the students,
- the students liked this method of learning,
- the school teachers showed a favourable opinion towards the developed software.
Cosmos and John (1988) found that improvement in the arithmetic achievement in the traditional group instruction was statistically significant but was not significant in the computer based individualized instruction group. It was also found that there was a significant treatment effect due to gender with males scoring higher than females in both groups.

Nwaizuu (1990) studied the effect of CAI in terms of achievement gains, CAI intervention was slightly more effective than TAI intervention over their baseline means. Both interventions were equally effective in terms of relative number of problems completed by each student.

Goel, Tomar, Khirwadkar, Das, and Joshi (2000) conducted a project on implementation of CAI in a school of Baroda. The CAI packages implemented were Satellite (Standard VI-I), Solar System (VIII), Magnet (VIII), Pollution (IX), Electricity (IX), Thermal Conductivity (IX), Biogas (IX), Organic Chemistry & Periodic Table (XI) & Chemical Bonding and Optics (XI). It was found that under the pretest-posttest experimental design the CAI were found to be effective irrespective, of the subject. For control group-experimental group designs the CAI was found as effective as the traditional method of instruction.
Dursky (1983) found that CAI is at least as effective as programmed text for teaching Latin and Greek derivatives. Jackson (1976) compared the effectiveness of CAI and programmed instructions material and found that CAI is more effective than programmed instruction. Stefen (1985) found that CAI is more effective over traditional instruction in improving bowling skills at the college level. Austin (1983) found that a computer assisted instruction lesson was effective for teaching a geometry concept attainment exercise. Hakes (1986) compared two methods of instructions i.e. individualized instruction by the teacher and individualized instructions by computer utilizing the system known as Programmed Logic for Automatic Teaching Operations (PLATO) and found no evidence to suggest superiority of one instructional program to the other. Ann (1981) studied a relationship between teaching techniques and students achievement of high cognitive level question asking skill's and reported that feedback and corrective responses enhance learning. Levy (1982) found that the traditional reading method was more effective then perspective method and computer assisted method.
Jamison et al (1974) found that even when there were no differences in achievements, CAI did produce some saving of time. They also found that CAI yielded the most improvement when used in small amounts with slower students.

Edgar (1980) concluded that the studies generally scored higher on a mathematics and reading posttest when instructions were supported by computer instructional management system. Montiel (1980) found that the students achieve better in terms of subject-matter content mastery when taught with psychological strategies using a personalized system of instruction based on mastery model.

Aeillo (1981) found that individualized instruction in science is somewhat more effective then traditional instruction. Reeve's (1989) compared the effect of teacher assisted computer instruction versus traditional teaching techniques for pre school children and found that CAI significantly improved scores on the four(4) subset measures at the .001 level.

Vezquiz (1983) showed that Computer Assisted Instructions was effective in Chemistry and science achievement at secondary school level.
Bennet (1985) found that students who received CAI would achieve significantly higher physics test scores and would develop significantly more positive attitude towards physics. Thomos (1985) concluded that computers have positive effect in learning accounting skills. Girdhari Lal (1986) found that learning packages was most effective mode of instructions out of three modes i.e. Learning packages as a mode of instruction, Lecture method and instructions through branching programme. Cosmos and John (1988) found that improvement in the arithmetic achievement in the traditional group instruction group was statistically significant but was not significant in the computer based individualized instruction group. It was also found that there was a significant treatment effect due to gender with males scoring higher than females in both groups. Lowery and Barbara (1988) did a study to compare achievement of students when using two teaching strategies, CAI and traditional method. The study revealed that there was no interaction between cognitive styles and teaching strategies. No significant difference in performance on the mastery examination was identified between CAI and traditional method students. This study identified that CAI promoted mastery of course content regardless of student's...
cognitive styles, saved time for students and was a cost-effective method of teaching.

Canady (1990) compared three instructional approaches – CAI, Co-operative learning and Teacher directed instructions. It was found that no significant differences existed between the three groups on improving student performance on math concepts, math problems, math computation and math total.

Bahr and Rieth (1989) compared the effects of conventional instruction, computerized drill and practice, and computer games on the mathematics achievement of learning disabled junior and senior high school students. Students in the drill and practice condition outperformed other students to a modest degree.

Bangert and Kulik (1985) presented the results of a meta-analysis of 42 studies. Computer-assisted and computer-managed instruction had very beneficial effects on achievement, while computer-enriched instruction had only modest positive effects. All forms of Computer Based Instruction had positive effects on student attitudes toward computers and toward courses which included computer activities.

Batey (1986) reviewed research on computer-assisted instruction, the use of computers in language arts, computer games, and the use of computerized tools such as databases, spreadsheets, and
science lab interfaces and reported positive effects of all kinds of computer use with elementary students.

Becker (1987) examined the surveys and research studies to determine the effects of CAI and other computer applications on student achievement and concluded that most studies are too flawed to permit reliable conclusions and suggests new directions for future research.

Becker (1990) summarized his researches and that of others to determine the nature, extent, and effectiveness of computer use in public schools. He cited disappointing results and attributed these to individual and institutional resistance to the kinds of changes that would lead to more productive use of computer technology.

Bialo and Sivin (1980) reviewed research on the impact of educational microcomputer use on student achievement, motivation, and attitudes, as well as their effects on classroom social interaction and the learning environment. There results were generally favorable, with effects differing by subject area, student characteristics, software design, and other variables.

Bracey (1987) found that 85-95 percent of studies showed positive effects of CAI, and the effectiveness of CAI decreased from the elementary to secondary to post secondary level.
Burns and Bozeman (1981) presented the results of a meta-analysis of 40 studies to compare the effectiveness of traditional instruction alone with a combination of traditional instruction and computer-assisted instruction on students' mathematics achievement. The combined traditional-CAI approach was significantly more effective.

Collins and Sommers (1984) summarized research on the use of computers in teaching composition and presented methods for integrating computer use into the writing curriculum. They supported the use of computerized word processing programs as part of a holistic writing program. They did not support the use of drill and practice programs for teaching isolated sub skills.

Dickinson (1986) presented the use of microcomputers in writing programs, followed by the report of a study conducted with primary-age children. The use of the microcomputer for teaching writing fostered cooperation and collaboration among students.

Edwards, Norton, Weiss and Dusseldorp (1975) reviewed on the effects of CAI on achievement, retention, and learning rate and its effects on students of different ability levels. CAI as a supplement to traditional, teacher-directed instruction was found to be very beneficial.
Hall, McLaughlin and Bialozor (1989) reported the results of a study in which computer assisted instruction was used with mildly handicapped elementary students. The spelling achievement scores of CAI participants was significantly greater than the scores of conventionally instructed students, and half the CAI students had scores equal to those of their non handicapped peers.

Hasselbring (1984) summarized results of research studies and meta analyses on the effects of computer-based instruction on student achievement and attitudes. Results favoured on the use of CBI over traditional instruction.

Hounshell and Hill (1989) compared the achievement and attitudes of students participating in a "computer-loaded" biology course with those participating in traditional biology instruction and found that students using the computer simulations had significantly better achievement and attitudes than those in the conventional setting.

Kinzie, Sullivan and Berdel (1987) compared the test performance of eighth grade science students who engaged in a learner-controlled CAI lesson with those who participated in a program-controlled lesson. They found that those in the learner-controlled condition significantly outperformed program-controlled subjects.
Kulik (1985) reported the results of three meta-analyses of research on computer-based education at the elementary, secondary, and postsecondary levels. He found Computer Based Education superior to traditional instruction in its effects on achievement, retention, learning rate, and attitudes toward computers and courses.

Kulik, Bangert, and Williams (1983) presented the results of a meta-analysis of 51 studies on the effects of computer-based teaching on students in grades 6-12. In general, computer-based instruction was favored over conventional instruction to a moderate degree.

Kulik (1985) compared a meta-analysis of 32 studies of the comparative effects of computer-based instruction (CBI) and non-computer-based instruction. Computer assisted instruction (CAI) had a significant, positive effect on achievement. Computer-managed instruction (CMI) had only a small, non-significant effect.

Lopez and Harper (1989) examined the connection between degree of control of CAI lessons, locus of control (LOC), and achievement of Hispanic junior high students. Although it was expected that internal LOC students would outperform external LOC students in the maximum-control situation, this was not the case.
Louie (1985) reported the results of a study undertaken to determine the effects of microcomputer learning activities on the locus of control of students of 9-15 years old. Children twelve years and younger exhibited a shift toward internal locus of control, presumably because of the empowering effects of the computer activities.

Martin (1973) investigated the effects of a computerized drill-and practice programme on the achievement and attitudes of third and fourth grade students of different ability levels and found that participants outperformed controls, and low ability students gained more than middle- or high ability students. No attitudal differences were observed.

Mevarech and Rich (1985) compared the effects of CAI and traditional instruction on the mathematics achievement and attitudes of disadvantaged Israeli students in grades 3, 4, and 5. The achievement of CAI participants was higher, and their attitudes toward school and toward themselves as math learners were more positive.

Mikkelsen, Gerlach and Robinson (1989) compared the effectiveness of a supervised and an unsupervised microcomputer tutorial program for teaching keyboarding skills to students in grades 3 to 6. The program was found to increase keyboarding
speed and accuracy and to be equally effective for both conditions, all grade levels, both sexes, and for students with and without previous keyboarding experience.

Mokros and Tinker (1987) presented the results of three studies designed to determine the effects of microcomputer laboratory activities on the graphing skills of middle school students. Participants' skill significantly increased.

Ragosta, Holland, and Jamison (1982) presented the results of a four-year study conducted on four Los Angeles elementary schools on the use of CAI for compensatory education. Participants engaged in drill-and-practice activities helped in raising skills on reading, mathematics, language and arts.

Kinnaman (1997) found that gains in achievement are fairly consistent when CAI (computer assisted instruction) is used to supplement regular classroom instruction. Achievement results are mixed in studies in which CAI is substituted for traditional instruction.

Cawelti (1997) found that students in small, self-instructing groups can support and increase each other's learning. He also found that using small groups of student's to work on activities, problems, and assignments can increase student mathematics achievement.
Rapaport and Savard (1980) reviewed and synthesized research on the effects of CAI on student achievement, attitudes, and learning rate. They found traditional instruction supplemented by CAI superior to either method alone, and found CAI to be beneficial to student attitudes and learning rates.

Bradley (1983) concluded that Computer Assisted Instruction has been effective in mathematics, science and social studies. This showed improvement in achievement for both, male and female, using Computer Assisted Instructions to study American history.

Edmonton (1997) found that the use of Computer Assisted Instruction as a supplement to traditional, teacher-directed instruction produces achievement effects superior to those obtained with traditional instruction alone.

Mahajan (1993) indicated that the CAI for teaching singulars and plurals was found to be effective in terms of achievement of students belonging to experimental group at the 0.05 level. In another experiment he (1993) indicated Computer Assisted Linear Programming on Geometry was found to be effective in terms of achievement of students belonging to experimental group than that of control group at 0.05 level.

Robertson, Ladewig, Strickland and Boschung (1987) reviewed research on the effects of CAI on self-esteem by comparing the
scores of eighth and ninth grade students receiving only traditional instruction with the scores of students whose instruction was supplemented with CAI activities. It was observed that CAI participants had significantly higher self-esteem ratings than control students.

Sood (1994) found that CAI is a superior method of teaching as compared to traditional teaching. The researcher also found that low achievers as well as high achievers gained more with CAI than traditional teaching. However, gain was more in case of low achievers.

Schwartz et al. (1999) describe the integration of an intelligent tutorial system (ITS) into an educational psychology course. An ITS functions much like an instructional expert system, with a user interface, an expert supplying domain expertise, a learner model that provides feedback and guidance to the student, and a pedagogical model that contains knowledge needed for making decisions about the tutoring tactics available to the system. A software shell, termed STAR.Legacy, was designed to assist students in learning from case-based, problem-based, and project-based learning. Schwartz et al. (1999) report that the software helped students to apply what they had learned in one setting to a new setting (i.e., creating vital linkages among cognitive
schemas). Similarly, Orey and Nelson (1993) describe how to theoretically integrate cognitive theory into an ITS. The authors advocate consideration of learner characteristics in the design of an ITS, including the level of the learner's prior knowledge. While neither study is empirical in nature, both Schwartz et al. (1999) and Orey and Nelson (1993) nonetheless provide valuable insight into the integration of intelligent tutorials into the classroom. An empirical research effort is found in Clariana et al. (1991), who perform an intra-medium study on the effects of different feedback strategies for a drill-and-practice exercise using computerized multiple-choice questions. Their study compares the effects on learning of three feedback strategies:

(1) knowledge of correct answer,
(2) answer until correct, and
(3) delayed feedback.

Immediately after completing the drill-and-practice exercise, students completed a post-test based on the material in the exercise. The post-test was re-administered (unannounced) two weeks later to assess student retention. Analysis of variance (ANOVA) revealed a statistically significant main effect for feedback, as well as significant two-way and three-way interaction effects for the within-subjects factors of question level, feedback,
and support (text passage provided vs. no text passage provided). Of particular interest is the statistical significance of the interactions. As Clariana et al. (1991) note, if only one level of question had been built into the experimental design, the results would have been directly related to the level of question. Thus, their study highlights the dynamic interplay among learner attributes, media attributes, and task difficulty.
2.4 STUDIES INVOLVING THE EFFECT OF COMPUTER MANAGED INSTRUCTION ON ACADEMIC ACHIEVEMENT.

Franklin and Marasco (1977) examined interactive computer based testing in post-secondary science courses. They identified (and exploded) five myths:

(a) forcing students to use a computer presents an unwarranted additional obstacle their attempt to attain their educational goals,

(b) computer based testing is crude and inflexible,

(c) the use of computers is part of the mechanization and dehumanization of the educational process,

(d) interactive computer based testing (ICBT) is too expensive, and

(e) ICBT has serious problems with security and cheating.

They also identified several advantages: ICBT

(a) provides a broad variety of sophisticated tactics,

(b) is amenable to virtually any educational strategy,

(c) permits a more thorough integration of testing and teaching,

(d) provides immediate and individualized feedback,

(e) requires and promotes explicit pedagogical decisions,

(f) allows excellent pedagogues to widen their audience and increase their impact,
(g) has evolutionary potential, 
(h) has extensive record-keeping and clerical capabilities, and 
(i) is an economical approach to serious educational problems. 
Several large-scale projects on individualizing instruction in the 
1960s and 1970s found the computer to be valuable in managing 
instruction: Program for Learning in Accordance with Needs 
(Flanagan, 1969); Individually Prescribed Instruction (Cooley & 
Glaser, 1969); Instructional Management System (Silberman, 
1968); and Computer Assisted Study Management System or 
CAISMS (Anderson et al., 1975). 
Anderson and colleagues (1975) developed a computer assisted 
study management system (CAISMS) for use in a University of 
Illinois economics course. A well-controlled experimental research 
study was conducted among students in a large undergraduate 
course to compare students who used CAISMS with those who 
didn't. Students in the treatment group read study assignments 
and immediately completed on-line tests to assess their learning. 
Successful learning allowed a student to proceed through the 
syllabus, while unsuccessful learning required continued study of 
material already covered with retest opportunities. The treatment 
was developed in accordance with deep cognitive processing 
theory.
Results from this study indicated that students using CAISMS scored significantly higher on all course exams. Attitudes toward the course and method, as measured in the Anderson et al. study were significantly higher for the CAISMS students. Attitude scores for students was improved through the use of CAISMS for large but not for small classes. CAISMS had no overall effect on course completion rate.

Tennyson (1981) addressed problems of learner control associated with CMI. He was concerned with research indicating that students may be incapable of making and carrying out "decisions of content element selection and personal selection". Specifically, students whose instruction is self-paced may terminate their study prematurely (before they have mastered the objectives) and may not assume proper responsibility for their own learning. The Minnesota Adaptive Instructional System (MAIS) was devised to indicate to students the discrepancy between actual and mastery scores, provide study assignments based on discrepancies, and continually update the student. The MAIS system was replicated in several different content areas using 12th grade students. The criteria consisted of several examination scores covering the content of the lessons.
The results of the Tennyson series of studies are notable for their direction and their explanation. Two groups received identical CMI instruction. One group received advice from the CMI system via MAIS, while the other did not. It was found that achievement scores were significantly higher for the groups which received advice to help them to decide when to terminate instruction and which content to study next when compared with those who made the decisions in the absence of any external advice. The comparison was made between students who could terminate their study at any time and those who received performance feedback to assist them to decide whether they were ready to discontinue instruction. It was concluded that the guidance function provided by the management system enabled high school students to make better judgments about their own learning and thus improved scores. The implication drawn was "students can successfully participate in the management of their learning when provided with their own individual diagnostic and prescriptive information".

Szabo and Estes (1978) reported on the comparative costs of developing computer based instruction materials. Data were taken from logs of a project in which six-university bachelor degree nursing courses were converted to a CMI format on the IBM 1500 System for distance delivery using a mobile van.
A comparison was made between developing computer managed instruction materials and developing computer assisted instruction materials. The CMI development was based upon the use of existing instructional resources; none were developed. On the other hand, the CAI materials were developed from scratch. It was found that an hour of CMI student contact time was developed in an average of 39.7 developmental hours. In the same project, an hour of CAI was developed in an average of 161.5 developmental hours. These data suggest a developmental ratio of 4 to 1, favoring CMI over CAI.

Kot, Skillen and Wales (1986) conducted an evaluation of a PLATO-based CMI course in nursing at the University of Alberta. Forty-six students at the post-RN baccalaureate level were randomly assigned to either a conventional lecture/discussion treatment or to a CMI treatment for the theory portion of the course. After the course had been delivered on campus for several terms, it was delivered in a distant town using microcomputers, modems, and public telephone networks.

Achievement scores, as measured by midterm, final, and practical exams, was a dependent variable in the Kot, Skillen and Wales (1986) study. Achievement scores and learning time for the two groups were equivalent, indicating equal amounts of learning. The
Kot, Skillen and Wales (1986) study examined instructor time and concluded faculty "spent twice as much time per student on instructional activities for the control group". This time savings worked out to about 35 hours per instructor per course for this particular study. When students kept student time logs, it was concluded that they spent equivalent amounts of study time in the CMI and the conventional instruction classes.

Day and Payne (1987) compared the use of lectures with CMI to deliver basic nursing content in the first year of a baccalaureate in nursing program. This study used the same CMI system and course materials as were used in the Kot, Skillen and Wales study. The major difference was that the Day and Payne study used first year "generic B.Sc." students as subjects while the Kot, Skillen and Wales study used post-RN students as subjects.

The Day and Payne (1987) study confirmed the Kot, Skillen and Wales (1986) results in that no significant difference in achievement was observed between the two groups. The study found that students learned equal amounts based on course examinations and clinical sessions.

In the Day and Payne study, there was an indication of less positive attitude among the CMI group, although no statistical analysis was presented. If indeed lower attitude scores were
present, several alternative plausible hypotheses would need to be confirmed, for instance (a) the application was well designed (some right answers were counted wrong, no feedback given for wrong answers); (b) it was not used with the appropriate target audience (the course was designed for experienced nurses returning for academic upgrading and the sample was first year baccalaureate nurses); and (c) the majority of students had recently completed a high quality computerized testing program in anatomy and may have made unobserved comparisons between it and the nursing application.

Boblin and Gibson (1986) developed a CMI component for an anatomy and physiology course for diploma nursing students at the University of Alberta Hospitals School of Nursing. This component was developed using the PLATO Learning Management (PLM) program. The CMI component consisted of a module component and an exam component. The module component consisted of 21 modules which corresponded to the subject areas taught. These modules were optional and were "designed to assist students in acquiring the course content and preparing for the exams". The exam unit consisted of six compulsory unit tests. Due to cost, a "picture book" was developed for student use rather than developing on-line graphics.
Boblin and Gibson (1986) found that students in the class using CMI achieved higher marks "for all of the unit tests, for the average of the unit tests and for the final course mark" when compared to the previous three (non-CMI) classes.
2.5 STUDIES INVOLVING COMPUTER ASSISTED INSTRUCTION AND PROGRAMMED INSTRUCTION

The term semi-programmed instruction refers to written instructional materials with programmed examples but traditional narrative text. In general, the use of programmed instruction produces small, positive effects on student achievement (Aiello Wolfle, 1980; Kulik, 1984; Kulik, Cohen, & Ebeling, 1980; Kulik, Schwalb, Kulik, 1982; Schimmel, 1983; Willett, Yamashita, Anderson, 1983). The literature indicates that programmed instruction is more effective for college students than for pre-college students (Kulik, 1984), and thus it has potential to serve as a replacement for traditional discussion section in college general chemistry. Another advantage of using programmed instruction is a reduction in instructional time (Kulik, et al., 1980; Spencer, 1989).

As with programmed instruction, computer-based instruction produces small, positive effects on achievement and attitude (Aiello & Wolfle, 1980; Kulik, Bangert, & Williams, 1983; Kulik & Kulik, 1986; 1991; Kulik, Kulik, & Bangert-Drowns, 1984; Roblyer, Castine, & King, 1988; Spain & Allen, 1990; Willett, et al., 1983; Wise, 1989). Computer-based instruction also results in a
substantial savings in instructional time (Kulik & Kulik, 1991; 1986; Kulik, Kulik, & Cohen, 1980) and increased cost effectiveness (Fletcher, Hawley, & Piele, 1990; Lowery 1988/1989). Roblyer, Castine, and King (1988) reported six general findings on the effectiveness of computer based instruction (CBI), including (a) a comparison of the effectiveness of CBI across grade levels resulted in a significant difference favoring CBI; (b) when effects in different content areas were compared, the literature indicates that computer-based instruction has a greater effect on achievement in science than in other disciplines; (c) when the effects of computer-based instruction on low-achieving students is compared with average students, there is no significant difference between the two groups; (d) there is no evidence of a difference between males and females using computer-based instruction, but the number of studies comparing gender differences is small; (e) computer-based instruction yields small, positive effects on attitudes; and (f) when males versus females are compared, attitudes toward CBI are not significantly different.

Studies comparing programmed instruction with computer-based instruction report contradictory results. Emerson (1988) compared computer-assisted instruction, which consisted of a computerized program that branched to frames depending upon a subject 's
answers to multiple-choice questions, with programmed instruction, which was identical to the computer-assisted instruction with the exception of being non computerized. The subject matter of this investigation was diffusion and osmosis, and the subjects were first year college students. The computer-assisted instruction group had significantly higher scores than the programmed instruction group on a posttest. Wainwright (1989) compared computer-assisted instruction with worksheets, which had identical exercises. The subjects were high school chemistry students, and the subject matter was writing and naming formulas and balancing chemical equations. The worksheet group scored higher than the computer-assisted instruction group on posttests of both formula writing and equation balancing.
2.6 STUDIES INVOLVING COMPUTER ASSISTED INSTRUCTION AND LEARNING RATE

Computer Assisted Instructions not only enables the students to achieve at higher levels but researchers have also found that CAI enhances learning rate. Student learning rate is faster with CAI than with conventional instruction. In some research studies, the students learned the same amount of material in less time than the traditionally instructed students; in others, they learned more material in the same time. While most researchers don't specify how much faster CAI students learn, the work of Capper and Copple (1985) led them to the conclusion that CAI users sometimes learn as much as 40 percent faster than those receiving traditional, teacher-directed instruction.

2.7 STUDIES INVOLVING COMPUTER ASSISTED INSTRUCTION AND RETENTION OF LEARNING

If students receiving CAI learn better and faster than students receiving conventional instruction alone, do they also retain their learning better? The answer, according to researchers who have conducted comparative studies of learning retention, is yes. In this research, student scores on delayed tests indicate that the retention of content learned using CAI is superior to retention following traditional instruction alone.

EPILOGUE

The available literature in this field suggests that very little work has been done on the effect of Computer Assisted Instruction and Computer Managed Instruction on psychological variables. The researches available are scanty and mostly related to Academic Achievement and attitude towards computer. The present investigator has, therefore, undertaken the problem of assessing the effectiveness of Computer Assisted Instruction and Computer Managed Instruction on Self Concept, Study Involvement and Academic Achievement.