Chapter II

REVIEW OF RELATED LITERATURE

This chapter describes the source of review of related literature. The researcher finds out some of the review of literature which could be very supportive and strengthen this study. After going through the available literature, the investigator presented some of the observations and findings of the experts in this area.

For any research project to occupy a place in the development of a discipline, the researcher must be thoroughly familiar with both previous theory and research. The literature related to any problem helps the scholar discover already known, which would enable the investigator to have a deep insight, clear prospective and a better understanding of a chosen problem and various factors connected to the study. So a number of books, journals and websites were referred. In the following pages, an attempt has been made to present briefly a few of the important researches and studies conducted abroad and in India, as they have significant bearing on the present study.

The literature in any field forms the foundation upon which all future work will be built. If there is a failure to build upon the foundation of knowledge provided by the review of literature,
the researcher might miss some works already done on the same topic. The reviews are discussed under the following topics to have a better perspective about CAI in the literature:

* Technology and Teacher Education
* CAI in Student’s Subject matter Achievement
* Studies on Computer Assisted Instruction/learning
* Studies on Computers and Physical Education
* Research in Athletic Training Courses
* Research in PETE Courses and Different Subject Matter Courses
* Students’ Attitudes and Perception toward CAI
* Multimedia

**Technology and Teacher Education**

The rapid improvement in information technology and other technological advancements in society have had major effects on teacher preparation programmes. *Imig and Switzer (1996)* stated that the advancements in information technology will fundamentally change the nature of teacher preparation programmes, because the majority of instructional environments contain interaction among students and teachers, and information is given to students. Furthermore, technological implications may change the nature of these interactions in many ways, including the ways the information can be obtained, manipulated, and
demonstrated in a content-specific teaching and learning environment.

Recently, information technology has played many roles in helping teacher education programmes. There are several publications and research studies that describe courses and programmes about pre-service teachers and technology with a growing body of literature in both qualitative and quantitative research (Willis & Mehlinger, 1996).

Different subject matters in the teacher education curriculum have also taken advantage of using information technology in their curriculum. Videodisc technology was developed at the Ohio State University PETE programme to teach physical education majors and to analyze sport specific skills (O'Sullivan, et al., 1989; Stroot, et al., 1991).

Consequently, information technology, including CD-ROMs, interactive videotapes, teleconferencing, electronic mail, and microcomputers with hypermedia/multimedia programmes has been part of teacher education programmes in several ways. Computer assisted instruction is just one of these technological applications. Overall, the effectiveness of CAI in education can be studied in terms of students at risk and with disabilities, as well as students' subject-matter achievement, problem solving abilities,
attitudes and perception, and learning retention and speed (Lockard, Abrams, & Many, 1997). It is very interesting that there have been plenty of research studies in the literature comparing subject matter achievement of students using CAI versus traditional teacher instruction or regular instruction (Din, 1996; Kulik & Kulik, 1991; Liao, 1992; Salerno, 1995; Shute & Miksad, 1997; Swan, et al., 1990; Weller, et al., 1998; Wilson, et al., 1996).

CAI in Students’ Subject Matter Achievement

Researchers have conducted several meta-analytic studies to understand the effectiveness of CAI. Kulik, et al., (1980) reviewed fifty-nine research studies using meta-analytic techniques about college teaching. They found that CAI made a small but significant contribution to the achievement of college students with positive attitudes toward the subject matter. In addition, Liao (1992) conducted a meta-analysis to synthesize the effects of CAI on cognitive outcomes from thirty-one studies in different subject matters and ages. They found that 23 (74%) of the research studies favored the CAI group over the control group. In another study, Khalili and Shashaani (1994) used meta-analytic techniques to examine thirty-six studies and found that although CAI increased student achievement in subject matters, time spent with computers was a significant variable for student achievement.
Therefore, they concluded that the most effective duration time was four to seven weeks and the effects of CAI disappeared when the duration is less than three weeks. Moreover, researchers concluded that older students got more benefit from CAI compared to younger ones.

Most recently, *Christmann, et al., (1997)* conducted a meta-analytic technique to compare the effects of CAI on the academic achievement of secondary students in different subject matters versus traditional teaching methods and traditional teaching methods supplemented with CAI. This study compared twenty-six studies and found that students who received traditional instruction supported with CAI gained higher achievement than those who were taught with traditional teaching methods.

*Erdner, et al., (1998)* conducted a study to examine the effects of CAI on the reading skills of first graders. Using a quasi-experimental design the investigators compared a group of students supplemented with CAI to a traditional classroom reading programme. They used a treatment by gender ANOVA design to assess changes in reading skills. Results were statistically significant with only males having an average increase when using CAI.
Saucier, et al., (2000) compared the effect of CAI and Written Nursing Process (NP) case study strategies on critical thinking skills in undergraduate family nursing clinical course students. The study used a pre-test and post-test design and 153 students were randomly divided into two groups. The findings showed that CAI as an intervention, produced equal outcomes to the traditional NP programme in terms of critical thinking skills. However, CAI provided some advantages over the traditional method in time efficiency and student satisfaction.

Studies on Computer Assisted Instruction/Learning

Mars, et al., (1996) developed an interactive multimedia-based computer aided instruction (CAI) programme, to determine its educational worth and efficacy in a multicultural academic environment and to evaluate its usage by students with differing levels of computer literacy. Thirty-four volunteers from the class of 125 second-year students who participated in the CAI study; 13 of these were not computer-literate. The CAI programme reduced the time spent by students in the histology microscopy laboratory and did not negatively affect their marks in post-course evaluation. The concept of multimedia-based CAI in medical education was positively received by the students who participated.
Halloran, et al., (1995) evaluated differences in achievement between a control group taught by traditional classroom lecture (TCL) and an experimental group taught using CMI and keypad questions. This study suggested that CMI and keypads are suitable teaching option for nursing education. It is equal to TCL in student achievement, and provided a new level of interaction in the classroom setting.

Herriot, et al., (2004) developed Student Training, Education and Practice for Dietetics (STEP-DIET) CD-ROM at the University of Surrey to prepare dietetic students for the practical dietetic training component of their Nutrition/Dietetics degree. Quantitative and qualitative methodologies were employed with 41 dietetic students, separated by year group, completing questionnaires and taking part in six focus groups. It was perceived by students to be effective in preparing them for the practical component of their dietetic training. Students rated the programme highly in terms of design and content. However, there was a reluctance to accept computer assisted instruction (CAI) as a sole teaching method.

Corton, et al., (2006) assessed the impact of interactive, computer-based versus conventional, paper-based format in student, resident, and fellow learning and retention of anatomy
knowledge. Tests results were analyzed by using Student ‘t’ tests and analysis of variance. Thirty-nine subjects completed all testing. Regardless of instructional method, pre test to post test scores improved (P < .01), and post test to follow-up test scores decreased among all levels of training (P < .01). Student satisfaction was the highest with CD-ROM format. Improvement and retention of anatomy knowledge was not significantly different when comparing a new CD-ROM interactive approach with a traditional paper-based method.

**McNulty, et al., (2006)** tested the hypothesis that personality preference, which can be related to learning style, influences individual utilization of CAI applications developed specifically for the undergraduate medical curriculum. Personality preferences of students were obtained using the Myers-Briggs Type Indicator (MBTI) test. CAI utilization for every individual students were collected from entry logs for two different web-based applications (a discussion forum and a tutorial) used in the basic science course on human anatomy. Individual login data were sorted by personality preference and the data statistically analyzed by 2-way mixed ANOVA and correlation. There was a wide discrepancy in the level and pattern of student use of both the groups. Differences in the level of use of these CAI applications (i.e., higher use of discussion forum vs. a tutorial) were also found
for the "Perceiving/Judging" dimension. It was concluded that personality/learning preferences of individual student influence their use of CAI in the medical curriculum.

Khalil, et al., (2005) designed and implemented effective anatomy educational programmes. This study was conducted to evaluate students' perceptions toward using two computer based self-directed instructional modules (e.g., digestive system and canine skull) that were designed utilizing interactive imagery strategy for teaching and learning veterinary anatomy. Sixty-eight freshmen veterinary students and one graduate student participated in this study. Students reported positive attitudes toward the interactive imagery strategy used in the development of computer-based anatomy modules. Based on the findings, this study outlines the characteristics of effective instructional images that will serve as guidelines for the preparation and selection of anatomical images, as well as, how to utilize these images to develop computer-based instructional anatomy programmes. Students perceived interactive imagery as an effective design strategy that helped them learn anatomical concepts.

Howerton, et al., (2004) compared computer assisted instruction (CAI) - multimedia instruction focused on intra-oral radiography with lecture format using recent hardware and software advances. Seventy-five first-year dental students of
University of North Carolina (UNC) were pre and post-tested to determine student performance and instructional preference. Analysis of covariance and the sign test were used to determine significance (p<.05). There was no significant difference between pre and post-test outcomes, indicating that similar learning took place using the interactive CD and/or lecture format. However, students preferred CAI to lecture format.

Kim, et al., (2003) compared self-learning outcomes using the software and the printed materials. Eighty third-year student nurses were randomly allocated to either the CD-ROM group or printed material group. A test was administered after one week of study time. Results showed no significant differences between the two groups in self-learning measures. Text-based learning seems to be a convenient educational method because it can be used at any time in any place. However, with more time and facilities available, CD-ROMs may be as effective as traditional learning methods and can be an alternative tool.

**Studies on Computers and Physical Education**

Computers were used by physical education teachers in three ways; utilities, assessment and Computer-Assisted Instruction (CAI) (Silverman, 1997). The use of computers as utilities is the most common application in physical education
classes. At present, many physical education teachers use computers for managerial purposes such as data management, record keeping, attendance, planning, and communication with parents (Lambdin, 1997; Mohsen, 1997).

Assessment is the second important purpose for the use of computers in physical education activities. Physical education teachers use computers for skill and fitness assessment in a wide variety of ways. Bonnie’s Fitware (Mohsen, 1995) and Motion Software (1994) are good examples of this category. Bonnie’s Fitware helps students and teachers record fitness data, and provides information about their yearlong progress. By using Motion Software, students analyze their strokes using biomechanical principles.

Although computers have been used in physical education classes in many ways, there is limited research evidence about the effectiveness of CAI in K-12 physical education classes. Research completed in K-12 physical education indicates that CAI has produced positive outcomes in female junior high schools students’ volleyball skills (Wilkinson, et al., 1999) and secondary students’ badminton knowledge (Skinsley & Brodie, 1990). However, there is only one research study about CAI in elementary physical education classes and this study found no significant
effect of CAI on teaching tennis rules, scoring, and terminology to fifth grade students (Alvarez-Pons, 1992).

The research study about the use of CAI at the elementary school level was conducted by Alvarez-Pons in 1992. This study explored the effectiveness of a CAI programme in teaching tennis rules, scoring and terminology to fifth grade students. CAI was compared to the traditional teaching approach and data were collected using a pre and post-test ANOVA design in a five-week tennis unit. Although both groups improved their scores in the post test, the results showed that there was no significant difference between the groups. Briefly, very limited research have been completed in K-12 physical education classes, and these studies have produced different results in terms of the effectiveness of CAI.

Kao, et al., (2011) developed an evaluation system for the executive judgment of volleyball referees. They presented computer assisted techniques to digitalize volleyball games, make judgments, and generate evaluation results. Through the interface of the computer assisted evaluation system, times and correctness of judgments are recorded, and corresponding scores are prompted immediately after a test is over. The feasibility of this system was validated, as ten qualified volleyball referees of level A, B, and C
were chosen for test participators. According to the Pearson’s coefficient analysis, the results from three co related test sets showed that the computer assisted evaluation system for volleyball referee’s executive judgment was highly reliable in both test-retest form and alternate form. In addition to serve for the volleyball referees evaluation, the system can also be used as a training purpose to improve the performance of judgment technique.

**Vernadakis, et al., (2003)** determined the effect of computer assisted instruction on learning the skill of setting in volleyball. The participants were 32 high school students of first and second grade, aged between 12 and 14 years, who were randomly assigned to one of the two teaching method groups: a) traditional instruction (TI) and b) computer assisted instruction (CAI). Each group received nine 40-min periods of instruction, on successive and separate days. The subjects of TI group experienced the skill of setting through a series of progressive skills accompanied with drill and repetition of practice presented by an instructor. The CAI group experienced these skills of setting through a series of progressive skills accompanied with drill and repetition of practice presented by a multimedia programme. In the beginning and the end of this study, the groups received a 10-item multiple choice knowledge and a skill test. The result indicated that there were no significant differences between the TI and CAI
groups concerning the knowledge and skill test. The results suggested that the multimedia technology as a teaching aid is as effective and profitable as the traditional teaching method on learning skills.

**Brad Kilb, et al., (2001)** developed a CD-ROM on volleyball drills. Researchers and coaches at the University of Calgary, Sport Technology Research Centre developed a model for interactive coaching which included an education component on planning a practice, a database for drills using actual videos of the drills, and a practice planner linked to the drills. An interactive CD-ROM on volleyball was developed using this model. The programme included over 400 full video drills, 250 educational practice notes, the ability to modify the drills, a glossary with 130 volleyball related terms, and a customizable practice planning tool. In order to assess the effectiveness of the programme, 24 volleyball coaches at various competition levels were selected to attend a two-hour workshop to learn how to use the CD-ROM. Following the workshop, the coaches were asked to use the programme in planning their daily practices. Pre- and post-workshop testing consisted of questionnaires which evaluated coaches’ attitudes towards using computers in their planning, and the suitability of using technology based tools in their coaching. This study discussed the potential of technology tools in coaching, the general
coaching/technology model, and the Interactive Volleyball CD-ROM as a practical example of the theoretical model. Preliminary analysis indicated that all the coaches expressed enthusiasm toward the programme and expressed a desire to try and use the programme for their practices.

**Konukman (2003)** investigated the effects of multimedia CAI on undergraduate PETE majors' teaching of the serve in tennis. The data were obtained from 18 undergraduate students enrolled in a PETE evaluation and assessment course at Virginia Technology. Subjects were stratified by gender and randomly assigned to three groups as Computer Assisted Instruction (CAI) group (n=6), Teacher Instruction (TI) group (n=6), and Control (CG) group (n=6). The results of this study were gathered from three tests: Tennis Serve Content Knowledge Test, Tennis Serve Skill Analysis Test and Tennis Task Sequence Test. In addition, two six minutes micro teaching sessions were conducted and data was collected via Tennis Serve Pedagogical Content Knowledge (PCK) Assessment Sheet, and finally, an open ended survey was completed to understand students' attitudes toward CAI. Overall, teacher instruction (TI) intervention was very dominant in the results. Teacher instruction (TI) group performed significantly in the tennis serve content knowledge test, tennis serve task analysis test, PCK-Appropriate cues, and PCK-Appropriate demonstration.
However, CAI group was also successful in the tennis serve content knowledge test and PCK-Appropriate demonstration. Interestingly, none of the groups were successful in the tennis serve skill analysis test and PCK-Appropriate feedback. Finally, students’ perception toward CAI was positive in general and students indicated that they would like to use CAI in other PETE method courses. However, some of the students reported that CAI was very repetitive, and also technical problems were reported. The results of this study indicated that CAI can be an effective way of instruction in certain conditions: CAI had significant effect on content knowledge and PCK-Appropriate demonstration. In conclusion, the 21st century will be an information age and computers will be an essential part of the education system in all grades and ages. Physical education teacher education programmes and physical education lessons in K-12 education were no exceptions. Computers and instructional technology should be an integral part of PETE and K-12 physical education without sacrificing the physical activity.

McKethan (2001) examined the effects of CAI on learning and teaching various skills. The study examined the effects of a multimedia based instructional strategy and lecture based instruction on teaching cognitive components of manipulative skills to physical education majors in the Department of Health, Leisure
and Exercise Science at a medium sized Southeastern university. Subjects were randomly assigned to the control group (N=13), a multimedia group (N=13) and a lecture group (N=13). The multimedia group received instruction on components of the overhand throw, catch and kick using a multimedia computer programme while the lecture group received instruction via the traditional lecture method. The control group received no instruction on the selected skills. All subjects completed a pre test and post test. A Multivariate Analysis of Variance with repeated measures indicated that significant differences existed between groups on a test of components and cue descriptors of manipulative skills. A series of one-way Analysis of Variance (ANOVA) followed by Tukey's post hoc test indicated that differences in scores existed between groups. Continued investigations examining the merits of multimedia based instruction are needed. As the computer continues to make inroads in the instructional arena, it is prudent to study CAI as it relates to subject content areas and instructional applications, as well the design of software.

Marina Papastergiou (2009) analysed recently published scientific literature on the use of computer and video games in Health Education (HE) and Physical Education (PE) with a view: (a) to identify the potential contribution of the incorporation of
electronic games as educational tools into HE and PE programmes, (b) to present a synthesis of the available empirical evidence on the educational effectiveness of electronic games in HE and PE, and (c) to define future research perspectives concerning the educational use of electronic games in HE and PE. After systematically searching online bibliographic databases, 34 relevant articles were located and included in the study. Following the categorization scheme proposed by Dempsey (1996), those articles were grouped into four categories: (a) research, (b) development, (c) discussion and (d) theory. The overviewed articles suggested that electronic games present many potential benefits as educational tools for HE and PE, and that those games may improve young people’s knowledge, skills, attitudes and behaviours in relation to health and physical exercise. Furthermore, the newly emerged physically interactive electronic games can potentially enhance young people’s physical fitness, motor skills and motivation for physical exercise. The empirical evidence to support the educational effectiveness of electronic games in HE and PE is still rather limited, but the findings present a positive picture overall. The outcomes of the literature review were discussed in terms of their implications for future research, and can provide useful guidance to educators, practitioners and researchers in the areas of HE and PE, and to electronic game designers.
Roland Leser, et al., (2011) examined whether multimedia technology would impact learning in the field of sport motor skill acquisition. This question was investigated during a practical sports education course involving 35 students who participated in a university soccer class. The whole course was split into two groups: Group A was taught traditionally with no assistance of multimedia and Group B was prepared with multimedia assisted instructional units. To quantify selected skills of soccer technique and tactic, the subjects performed a specific passing test and a tactical assessment. Furthermore, a questionnaire was used to assess the subjective impressions of the test subjects. All testing instruments were applied before and after a six-week-long teaching period. A comparison of the gathered data between the two groups resulted in no significant differences, neither concerning the results of the technique test nor concerning the tactic test. However, the results of the questionnaire showed a positive agreement among the participants in the usability and assistance of multimedia for the sports practical course. Considering the reviewed conditions, it was concluded that the use of multimedia content does not affect the learning effects.

CD-ROM programme was developed, especially for the needs of the study titled, The tree of Health. The intervention trial involved 12 fifth- and sixth-grade classes (N = 248 students), randomized into 3 groups: Multimedia Computer Assisted Instruction, Traditional Approach to teaching (TA), and Control. Students were tested using pre and post-tests that measured the knowledge of the subjects regarding Health related fitness. The experiment lasted 12 class hours, two classes per week over six weeks. The results of an analysis of covariance indicated that there was a significant increase in achievement post-test for the (MCAI) group when compared to either the (TA) or control groups, $F(1, 238) = 13.486$, $p < .0167$; $F(1, 238) = 53.872$, $p < .0167$). These results indicated that this new educational tool is an effective way to introduce health related physical education programmes for young students in typical classroom settings.

Aspasia, et al., (2011) analysed the use of technology in sports. The aim of this study was to present the researches focusing on the application of technology on movement education with emphasis on physical and dance education. The predominant research finding is that although contemporary technological media were substantially advanced and innovative, they had not been incorporated in the classroom everyday learning practice yet. A prerequisite for the achievement of this goal was the researchers’
interest to be focused: a) on the cognitive aspects of a technologically supported instruction and b) on the design of multimedia products according to the principles of the modern theories of multimedia learning.

**Collins (2009)** investigated the impact of Mobile Multimedia Learning, using Multimedia Content (Animation-Audio-Text) designed on the principles of Mayers Multimedia Learning Approach (1991), in a sports education domain. The present study aimed to provide selected basketball Coaches and Players with a number of multimedia animations to aid learning of team plays. The plays were designed using Mayer’s (1991) Multimedia Learning Theory and were delivered using the Apple iPod media device. The thesis also investigated other relevant learning theories, the development and design implications of the use of digital media in a contemporary classroom and the function of the tool in reality to facilitate learning in accordance with traditional domain oriented learning approaches. The study concluded with a positive approach towards the use of multimedia in sports education.

**Cernaianu (2007)** presented a practical model for learning Excel programme, with applications in physical education and sports. The system units, which form the model, allow the students to develop their abilities for solving the problems, to put
into practice the theoretical knowledge, which was assimilated at the courses and, after the graduation, to use the programmes for administrating the sports results. Independent practice in the classroom or at home represents also an advantage of these types of exercises. The optimization of the CAI for students of physical education and sports faculties stimulated their participation and active engagement in learning process. The elaboration of the practical model for learning Excel programme increased the level of competence and the efficiency of the teaching process.

**Toth-Cohen (1995)** examined the learning outcomes of a computer assisted instruction (CAI) tutorial in applied anatomy and kinesiology and to determine its applicability for use in two university settings. The learning outcomes of an experimental group of occupational therapy students using a CAI programme and a control group using books to study the same material were compared. Establishment of clear learning objectives, use of a theoretical base to design instruction, and development and testing in different educational settings can help improve the quality of CAI programmes and ensure their relevance to other curricula.

**Peter (2002)** compared the accuracy of human and computer based methods of predicting the 2003 Rugby Union World Cup. The computer based methods used data from the
previous four Rugby Union World Cups to develop predictive models of international rugby union results based on team strength, distance traveled to the tournament and recovery days between matches. The computer based methods correctly predicted between 39 and 44.5 of the 48 matches which were more accurate than the 40.66 averaged by 42 individual humans. An expert focus group successfully predicted 43 of the 48 matches which was better than the average computer-based method. The most successful of the computer based methods was a simulation model. The study provided evidence that computer based methods are more successful at predicting the outcomes of international rugby union matches than the average human, but is not as successful as human experts.

Dario (2002) assessed attitude of experienced coaches towards technologies and sport sciences. A questionnaire was used to evaluate three areas: (1) Attitudes towards technology and sport science in coaching, (2) Technology and scientific knowledge in practice, and (3) Perceived importance of technology and science in enhancing sport results. Results showed that top-level coaches rated having a good relationship with the athletes’ as a major goal. Overall, members of this group of experienced coaches seem to recognize the general importance of sport sciences, and appear to be positive about the use of sport technologies, but do not
necessarily translate these positive attitudes into actual practice within their competitive sport environments, even when they all use information technology for other activities.

**Wiksten, et al., (2002)** analysed the effectiveness of using a CD-ROM on Sports Injuries 3-D, by Cramer Products (Gardner, KS) in an introductory athletic training laboratory class of Undergraduate Kinesiology major as a supplement to traditional lecture instruction. Student attitudes toward the CD-ROM programme were favorable, and the qualitative data suggested that students would use this type of educational resource provided it was targeted toward the specific course and offered a time-efficient method for access.

**Wilkinson, et al., (1999)** examined the effects of a volleyball CD on cognitive and psychomotor skills of 69 junior high school girls. Students were randomly selected to be in the experimental and teacher instruction groups. Repeated measures of ANOVA were used to determine the effects of the CD on the students’ learning. Students completed pre and post skill tests and written cognitive tests. In addition, game play was videotaped during a tournament and successful and unsuccessful trials were recorded. Results showed that although students in both groups improved their forearm pass, set, and underhand serve, the CAI
group obtained significantly higher scores in the forearm pass and had more successful passes/serve, sets/serve, and contacts/serve during game play. Moreover, both groups improved significantly in their knowledge test, but there was no significant difference between the groups.

**Skinsley and Brodie (1990)** studied the effectiveness of CAI on the cognitive knowledge of 12 years old male students’ badminton knowledge. A total of 42 students were divided into two groups as CAI and teacher instruction according to their knowledge and badminton ability. Both groups were taught the same badminton unit. Using a pre and post test design with ANOVA, results showed that both groups improved their test scores considerably, but there was no significant difference between the two groups. However, the CAI group retained information better with a mean score of 6.8% higher on the post-test than teacher instruction group.

**Research in Athletic Training Courses**

To date there have been very few research studies about the effectiveness of CAI on undergraduate athletic training courses. **Buxton, et al., (1995)** compared the effects of an Interactive Athletic Training Computer (IATEC) with a traditional reading method. Participants (N=34) were randomly assigned to four
different treatment groups as IATEC, reading, IATEC/Reading, and control group. All but the control group received an hour intervention ‘Q’ angle. Using pre and post-test measurements with ANOVA, results showed that IATEC/reading and IATEC group were significantly higher than other groups.

Chen, et al., (1995) used the same programme, IATEC, to investigate the effectiveness of CAI. They compared IATEC programme to a textbook about the assessment of the quadriceps angles on a human model. Thirty-two subjects were randomly assigned to four treatment groups as IATEC, textbook, IATEC and textbook, and control. All participants completed pre and post oral practice tests about assessment of quadriceps angles and received an hour intervention, with the exception of control group. A one-way ANOVA with post hoc test showed that the IATEC and textbook combination group produced better results.

Research in PETE Courses and Different Subject Matter Courses

Lease (1981) conducted one of the first studies to determine the effects of CAI on the Kinesiology knowledge of physical education majors. The purpose of the study was to develop and implement a series of CAI programmes in an undergraduate kinesiology course about the mechanical analysis of motion. The author developed a series of four CAI programmes
using the BASIC Plus 2 language. Sixteen subjects participated to evaluate effectiveness of CAI programmes. To measure the effectiveness of the programmes a pre test and post test was developed for each CAI programme and each pre test was correlated with the corresponding post test to determine the relationship of the content of tests. The study showed that results were significantly related in three out of four programmes. The investigator concluded that CAI can help students to improve their knowledge of Kinesiology.

Adams, et al., (1989) using a quasi-experimental design, compared the effects of voluntary CAI versus required CAI on physical education majors’ exercise physiology knowledge. Participants were enrolled in three exercise physiology courses over a three-semester period. The control group (n=28) did not receive any CAI in the first semester period. During the second semester the voluntary CAI group (n=44) participated in the condition of voluntary use of CAI. Finally, the mandatory CAI group (n=27) received CAI in the third semester. A multiple choice 50-item knowledge test was administered at the end of each semester. One way ANOVA was used to determine if significant differences existed between the groups. Results indicated that the mandatory CAI group had better achievements than the control and voluntary
groups. There was no significant difference between the control and voluntary CAI groups.

**Whitaker (1990)** made the comparison of three different instructional strategies on physical education majors’ knowledge of statistics. These were CAI, Tutor Retrieval Text (TRT), and Programmed Lecture (PL). During the study, 47 PETE majors were randomly divided into three groups. The author used a pretest/post test experimental design. After a two week period of three hours training, subjects completed a 57-question post knowledge test. An ANOVA with repeated measures, followed by a post hoc Tukey test, was used to determine differences between the groups. Results of this study indicated that there was no significant difference between the groups. The PL group was less efficient. Moreover, there was no difference between the CAI and TRT groups.

Research in biomechanics courses also produced different results and did not support CAI as an instructional strategy. **Armin (2011)** analysed the basic structure and a first step towards an evaluation of the given eLearning units when being used as an add-on to university seminar on Biomechanics in sports. The topic of the study was an eLearning module for the Biomechanical analysis of Motor performance in sports – A learning tool for
academic teaching. The result indicated that eLearning had a positive approach and it should be used in self-directed learning settings only with learners having a precise guideline on exactly what to do and how long to do it.

**Boysen & Francis (1982)** conducted a study to determine the instructional effectiveness of a computer lesson in biomechanics. Totally, thirty-six students were randomly assigned to control (work sheet) or experimental PLATO groups. The score of midterm examinations were used to determine the differences between the groups using an independent t-test. Results showed that there was no significant difference between the groups.

**McPherson and Guthrie (1991)** implemented a study to evaluate CAI programme in an undergraduate biomechanics course. 45 students were randomly assigned into two groups as CAI and lecture versus lecture only. Theoretical competency tests were given to students at the end of the units. A paired t-test was used to determine if significant individual differences existed between treatments and an ANOVA was used to find out differences between the groups. Results showed that there were no significant difference between treatments and groups.

**McKethan, et al., (2000)** analyzed the effects of multimedia computer instruction on learning and teaching cues of
manipulative skills: overhand throw, catch and kick. All of the subjects were elementary education majors enrolled in a course on teaching elementary physical education for children. The subjects were divided into two groups; the experimental group (n=45) received information about manipulative cues via CAI, while the lecture group (n=52) received the same information via teacher instruction. All participants completed fill-in-the blank answers to determine critical cues for manipulative skills as a pre and post test measurement. A multivariate analysis of variance (MANOVA) with repeated measures, followed by a Wilks’ Lambda was used to determine if there was a difference between the groups. Results showed that although the lecture group scored significantly higher than the CAI group on the post test, there was no difference between the groups on specific cue descriptions.

Students' Attitudes and Perception toward CAI

Computers and computer assisted instruction are gaining importance, and the integration of computers into teaching and learning environments is a very common trend in today's schools. In these circumstances, students’ attitudes and perceptions toward CAI are essential factors for the students’ achievements in CAI, and the application of computers as a successful educational tool. There are several studies to measure students’ attitudes and perceptions toward CAI in literature. Kulik, et al., (1983) analyzed
ten research studies to determine students’ attitudes toward CAI. Authors found that the majority of the students had a positive attitudes toward CAI compared to their regular classes.

One of the first studies to determine students’ attitudes toward CAI was conducted by Steffen (1985). The main purpose of the study was to compare cognitive and psychomotor bowling scores in a collegiate basic instruction programme. Subjects were 90 university students. As a part of this study all subjects completed the University of Iowa Student Perception of Teaching (SPOT) questionnaire and the CAI group also completed a six-item questionnaire about perceptions toward CAI. The results of this study showed that students had very positive attitudes toward CAI. In addition, students in the CAI group indicated that they had better instruction than the traditional instruction group.

Wilkinson, et al., (1999) studied the effects of volleyball software on female junior high school students’ volleyball performance. Participants were 69 junior high school girls in a 16-day volleyball unit. Students’ attitudes toward using CAI were measured via a Likert scale, with responses ranging from “strongly disagree” to “strongly agree”. Results of this study showed 75% of CAI group reported that using CD-ROM improved their performance in volleyball skills. In addition to this, 84% of the CAI
group indicated that they had a better understanding of cognitive concepts such as rules of volleyball via CAI.

The attitudes of pre-service and in-service teachers toward CAI have been emphasized in some of the research studies. Fratianni, et al., (1990) examined students’ attitudes and perceptions in teacher education programmes at University of Northern Iowa. Results showed only 19% of students felt that they were adequately prepared to implement computer technology in their teaching. In addition, 67% of students reported that an educational computing course should be required in teacher education programmes. Moreover, they reported that students in mathematics and science programmes felt more comfortable applying technology compared to social science, physical education and music majors.

Vermette, et al., (1986) examined elementary school students’ and teachers’ attitudes toward computers in education. Students (n=116) and teachers (n=50) completed a teacher and student survey and six open-ended short answer questions. Results of this study showed that both students and teachers emphasized the educational value of computers but they were negative about the personal effects of computers. In addition, both
students and teachers had negative attitudes toward computers in terms of dehumanization perspectives such as socialization issues.

**Ross, et al., (1991)** assessed the effects of CAI on students’ attitudes toward schools, grades, computer skills, standardized test scores, and teacher evaluations using the Apple Classroom of Tomorrow (ACOT) programme. Subjects were at-risk seventh grade students. Results showed that the CAI group was successful in Math and Reading compared to the control group. However, they reported that some academic achievements were lost and students remained at risk because of lack of on-going computer use and limited access to computer lab after the two year experiment.

**Multimedia**

**Glittenberg, et al., (2006)** created 3D animations and interactive computer programmes demonstrating the neuro ophthalmological nature of the oculomotor system, including the anatomy, physiology and pathophysiology of the extra-ocular eye muscles and the oculomotor cranial nerves, as well as pupillary symptoms of neurological diseases. At the University of Vienna, they compared their teaching effectiveness to conventional teaching methods in a comparative study involving 100 medical students in a multiple choice exam and a survey. The comparative study
showed that the experimental group students achieved significantly better test results than the control group. Three dimensional computer animation technology can significantly increase the quality and efficiency of the education and demonstration of complex topics in ophthalmology.

Maag (2004) at 2 universities in Northern California, determined the effectiveness of an online interactive multimedia learning tool versus text only, text and images, and multimedia learning explanations on Math achievement, Math self-efficacy, and student satisfaction. Compared to students in the control group, students in the interactive multimedia group demonstrated equal post test and retest knowledge of Math; their Math self-efficacy scores were also the same. Interactive multimedia group students were more satisfied with the method of learning, reported the technique to be enjoyable and more interesting, and provided sufficient feedback. An online interactive multimedia learning tool is a realistic and creative method of teaching medication dosage calculations.

Wender and Muehlboeck (2003) investigated whether computer animated graphics are more effective than static graphics in teaching statistics. Four statistical concepts were presented and explained to students in class. The presentations included graphics either in static or in animated form. The concepts explained were
the multiplication of two matrices, the covariance of two random variables, the method of least squares in linear regression, alpha error, beta error and strength of effect. A comprehension test was immediately administered following the presentation. Test results showed a significant advantage for the animated graphics on retention and understanding of the concepts presented.

Carmichael and Pawlina (2000) developed animated presentations for all lectures in Gross and Developmental Anatomy. As a starting point, they scanned pen-and-ink drawings to create a digital image. The image is edited and manipulated in an image processing programme. Next, the image is imported into a PowerPoint slide where it is labeled and otherwise enhanced (arteries overlaid with red color, veins in blue, and so forth.) and the enhancements are animated, as they described here step by step. For the lecture, the file is loaded on a server that is accessible through a network from a computer in the lecture hall. The output is directed to a video projector and the PowerPoint presentation is projected in the "Slide Show" mode. They used a wireless mouse that allowed them to control the presentation from anywhere in the room. Before the lecture, students were provided with the same unlabeled drawings as handouts, and during the lecture the students were actively engaged in labeling the drawings and making related notes. After the lecture, the file was saved in HTML
format and posted on the authors’ course web site where students can access the slides. Evaluation by the students at the end of the course demonstrated that this style of presentation was very favorably received.

**Summary of the Literature**

The reviews were presented in eight sections such as Technology and Teacher Education, Student’s Subject Matter Achievement, Computer Assisted Instruction, Physical Education, Athletic Training Courses, PETE Courses and Different Subject Matter Courses, Students’ Attitudes and Perception towards CAI, and Multimedia. This section gives an insight into the number and range of how computer assisted instruction has been used as teaching methods in different disciplines.

In summary, studies on Computer Assisted Instruction revealed much on learning styles of the learners, and redefined the role of a teacher from the level of disseminator of knowledge into a constructive guide facilitating optimum learning. The studies reviewed in this section mostly in the disciplines of Physical Education, Medical Science, Dental, Physics, Library, Mathematics, Plant Physiology, Medical Anatomy and Physiology, Radiology, and so forth. The evaluation of these CAI materials revealed the fact that the computer assisted instruction was more interesting, useful and enjoyable. However, some studies revealed that there were no
significant differences existed between Computer assisted instruction and Traditional instruction in terms of skill, knowledge test and so forth.

The research studies reviewed were from many journals available in the websites such as www.pubmed.gov, www.aace.org, www.icass.org, www.ijcss.org, ERIC websites and so forth. All such websites employ Computer Assisted Instruction, Development of Courseware/CD ROM and Multimedia Courseware in the disciplines of Medical, Dental, Physics, Mathematics, Education, Language, Economics, Statistics, Plant Physiology and so forth, that too at school and college level.

Studies on Physical Education revealed much on technology role in teaching, coaching and learning. It is observed from the review of literature that there are some reviews related to Computer assisted instruction in Long Jump performance, Tennis, Volleyball and so forth. But there were no reviews related to Computer Assisted Instruction regarding Hurdles skill, performance and so forth. Hence, this inference has motivated the researcher to develop this study in Hurdles event. Moreover, teaching the skills of Hurdle event is very difficult as it is highly technical and athletes may not be able to keep the pictures of teaching progression effectively in their mind. As the researcher felt
that teaching traditionally alone cannot help the students to achieve their performance, he thought to combine traditional instruction method with computer assisted instruction method.

On the basis of the reviews of related research studies and from the above discussion, bringing in newer teaching methods such as combination of computer assisted instruction with traditional instruction in hurdles events for physical education students become a significant need. Besides, the researcher himself is an athletic coach and has been teaching and coaching different events of Athletics. The significant need felt through the review of related literature, qualification, in-depth knowledge in relevant subject areas and functional knowledge in computer promoted the researcher to turn his attention towards computer assisted instruction. It is hoped that the present study may serve as a base for future research in Athletics through computer assisted instruction.