# CHAPTER 2
THEORETICAL ORIENTATION AND REVIEW OF THE PAST STUDIES

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Introduction</td>
<td>15</td>
</tr>
<tr>
<td>2.2</td>
<td>Theoretical orientation</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>2.2.1 Definition of effectiveness</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>2.2.2 Definition of Computer Assisted Instruction (CAI)</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>2.2.3 Definition of achievement and learning achievement</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>2.2.4 Definition of effectiveness of Computer Assisted Instruction (CAI) on learning achievement</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>2.2.5 Theoretical Foundations of Computer Assisted Instruction (CAI)</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>2.2.6 The origin of computer assisted instruction</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>2.2.7 Computer managed instruction in schools</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>2.2.8 Types of computer assisted instruction (CAI) programme</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>2.2.9 Characteristics of computer assisted instruction (CAI)</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>2.2.10 Advantage and disadvantage of computer assisted instruction (CAI)</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>2.2.11 Effectiveness of computer assisted instruction (CAI) on students’ achievement</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>2.2.12 Basic Education Core Curriculum A.D. 2008</td>
<td>55</td>
</tr>
<tr>
<td>2.3</td>
<td>Review of the past studies</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>2.3.1 Importance of review of the past studies</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>2.3.2 Past studies related to the effectiveness of computer assisted instruction on learning achievement</td>
<td>64</td>
</tr>
<tr>
<td>2.4</td>
<td>Summary</td>
<td>83</td>
</tr>
<tr>
<td>References</td>
<td></td>
<td>85</td>
</tr>
</tbody>
</table>
CHAPTER 2
THEORETICAL ORIENTATION AND REVIEW OF THE PAST STUDIES

2.1 INTRODUCTION

The theoretical orientation is a foundation for the research study. Once these themes are established, researchers can seek answers to the topical questions they have developed on broad subjects. With a theoretical orientation, the researcher can resist getting off track by digging into information that has nothing to do with their topic. The main benefit of a theoretical orientation is that it can help a researcher determine problem areas, content considerations, research questions that need to be addressed, and the methodology or way in which the researcher plans to go about finding an answer to the research question. It can be used to make notes on findings so that at a later time the researcher can quickly recall this information. All of these sections of the research paper can be shown in neat thematic groups that can systematically, concisely and succinctly lead the researcher through the subject.

Merton, Robert K. (1979)\(^1\) illustrate that the value of theory depends on the clarity and coherence of their formulation and their adequacy to their conceptual frameworks. Theory helps the researcher to understand and to select the better choices.

This chapter, therefore, attempts to make a contribution to knowledge and theory building in the field of the effectiveness of Computer Assisted Instruction (CAI) on learning achievement. It is needed to state the theoretical concepts or the basic ideas on the Computer Assisted Instruction (CAI) and the work already done in the research studies, to attain an overall relevance and purpose. Theory is used to craft the null hypothesis, which is either proved or disproved by the research itself and the review literature provide readers with a background for understanding current knowledge on a topic and illuminate the significance for the new study.

In this chapter, the researcher tries to understand the theory about the effectiveness of Computer Assisted Instruction (CAI) on learning achievement which suggested by Ritzer, George (2007)\(^2\) as the below details:

1. The view of theory as conjecture to be tested and either confirmed or refuted,
2. The view of theory as a summary of all that had been found to be true so far,
(3) Theory began to be understood as the source of concepts and the connections among them that made it possible to produce hypotheses, identify confirmations or refutations.

The researcher has summarized the relevant theory from books and review of the past research which have already done in the area of effectiveness of Computer Assisted Instruction (CAI) on learning achievement.

2.2 THEORETICAL ORIENTATION

The theoretical orientation of the present study is to state the basic ideas on the topic i.e. definition of effectiveness, definition of Computer Assisted Instruction (CAI), definition of learning achievement, theoretical foundation of CAI, type of CAI, steps of constructing of CAI, advantage and disadvantage of CAI, effectiveness of CAI in teaching-learning process, and Career and technology subject in Thai basic core curriculum.

2.2.1 Definition of effectiveness

The term “effectiveness” can be defined by educators as below:

Fraser (1994) defined effectiveness as a match between stated goals and achievement. In other words, effectiveness can be refers to the quality or the achievement or output of education which must be involved judgements about the goals.

Erlendsson (2002) defines effectiveness as: the extent to which objectives are met (doing the right things).

Wojtczak (2002) defines effectiveness in the context of medial education:
Effectiveness: A measure of the extent to which a specific intervention, procedure, regimen, or service, when deployed in the field in routine circumstances, does what it is intended to do for a specified population.

NSIN (2002) defines effectiveness as a long term outcomes of learning which include many of the following:

• More knowledge and greater complexity of understanding
• More positive feelings, emotions and affiliation to learning: success, satisfaction
• Enhanced more skills and action appropriate to goals and context
• Increased engagement and self-direction
• More reflective approach
• More developed vision of future self as a learner
• Greater facility in learning with others
• More sense of participation in a knowledge community

UNESCO (2004)\textsuperscript{7} defines effectiveness as an output of specific review/analyses that measure (the quality of) the achievement of a specific educational goal or the degree to which education institution can be expected to achieve specific requirements.

Audioenglish.net Dictionary (2009)\textsuperscript{8} states that effectiveness has two senses:

1. Power to be effective; the quality of being about an effect
2. Capacity to produce strong physiological or chemical effects

Effectiveness is about outcomes, consequences and results. It is almost a synonym for success, for being effective means achieving the outcomes and results. Effectiveness is achieved by determining what the “right” thing which must be done; and then doing it right. The right vision for organization, coupled with focused execution and continuous improvement (i.e. efficiency), results in effectiveness.

Accurate and Reliable Dictionary (2009)\textsuperscript{9} effectiveness refers to producing or capable of producing an intended result or having a striking effect. Effectiveness means the ability to accomplish a purpose; the power to be effective, the quality of being able to bring about an effect.

Business Dictionary (2009)\textsuperscript{10} mentions that effectiveness is the degree to which objectives are achieved and the extent to which targeted problems are resolved. In contrast to efficiency, effectiveness is determined without reference to costs whereas efficiency means doing the thing right, effectiveness means doing the right thing. Effectiveness is very similar to efficiency, but the measure is related to some enterprise objective rather than the technical quality of output. The indicator of effectiveness is related to customer satisfaction rather than output. Therefore the effectiveness measure of a business process can be
indicated by the resources inputs needed to produce a level of an enterprise objective.

Free Online Dictionary (2009)\textsuperscript{11} states that effectiveness is the power to be effective; the quality of being able to bring about an effect. In the other words, it is the capacity to produce strong physiological or chemical effects.

Dean, R. Spitzer (2009)\textsuperscript{12} illustrates that effectiveness as the producing of desired results. Effectiveness has to do with getting the right results; efficiency relates to cost or investment. The effectiveness has to do with the outcomes due to the content of learning.

From the above definition, it can be concluded that effectiveness means the ability to accomplish a purpose; the power to be effective, the quality of being able to bring about an effect. It refers to the degree to which objectives are achieved and the extent to which targeted problems are resolved.

In the present study, effectiveness refers to the ability of computer assisted instruction (CAI) to accomplish a learning purpose in the career and technology subject for eleven grade students. This includes the power or the degree to be effective and the quality of being able to bring about the highest level of students’ learning achievement in knowledge, skills and attitudes or desirable performance.

2.2.2 Definition of computer assisted instruction (CAI)

Idea and practice of computer assisted instruction (CAI) is grounded in the twentieth century. Use of computer in education is referred by many names such as: (Wiki Educator, 2008)\textsuperscript{13}

- Computer Assisted Instruction (CAI)
- Computer Aided Instruction (CAI)
- Computer Assisted Learning (CAL)
- Computer Based Education (CBE)
- Computer Based Instruction (CBI)
- Computer Based Learning (CBL)
- Computer Based Teaching (CBT)
- Computer Enriched Instruction (CEI)
- Computer Managed Instruction (CMI)
New Terminology

- Web Based Training
- Web Based Learning
- Web Based Instruction

Computer-based education (CBE) and computer based instruction (CBI) are the broadest terms and can refer to virtually any kind of computer use in educational settings.

In a most narrow sense, CBT is an interactive instructional approach in which the computer, taking the place of an instructor, provides a series of stimuli to the student ranging from questions to be answered to choices or decisions to be made. The CBT then provides feedback based on the student’s response. Using the computer for training and instruction, CBT programmes are called “courseware” and provide interactive training sessions for all disciplines. Using graphics extensively, CBT was originally introduced on Main Frames, then Laser Discs, then CD-ROMs and, later, online. CBT courseware is typically developed with authoring languages that are designed to create interactive question/answer sessions. (Answers.com, 2010) 

Courses using the computer are the primary delivery method of instruction. No textbook is required. It may be self-paced, a self-contained interactive instruction on a CD, or instruction through e-mail and small group computer conferences with other students. The term CBT is often used interchangeably with Computer-Assisted Instruction (CAI). (Oregon Network for Education, 2010)

In most definitions, CBT focuses on courseware. Webopedia (2008) defines CBT as “a type of education in which the student learns by executing special training programmes on a computer”. So, for some people CBT is equivalent to programmes that provide self-paced student instruction, tests and learning feedback with very little or no involvement by a teacher.

Computer managed instruction (CMI) Computer managed instruction is an instructional strategy whereby the computer is used to provide learning objectives, learning resources, record keeping, progress tracking, and assessment of learner performance. Computer based tools and applications are used to assist the teacher or school administrator in the management of the learner and instructional process.
For the purpose of the present research study, Computer Assisted Instruction (CAI) is used consistently.

Computer Aided Instruction (CAI) is a narrower term and most often refers to drill-and-practice, tutorial, or simulation activities. Computer assisted instruction (CAI) is used in relation to other teaching presentations. CAI can be used either in isolation, bearing the whole responsibility for conveying instruction to students, or in combination with conventional, i.e., face-to-face, teaching methods. Research has shown that the combination of conventional and CAI instruction has been most effective in raising student achievement scores.

Computer assisted instruction is used through the entire range of education from pre-school to professional school. It has been offered in a wide variety of fields, including all the main school subjects taught in elementary and secondary schools. Computer assisted instruction (CAI) has been defined by many educators as presented below:

Association for Education Communications and Technology (1977)\(^\text{17}\) has defined computer assisted instruction (CAI) as a method of instruction in which the computer is used to instruct the student and where the computer contains the instruction which is designed to teach, guide, and test the student until a desired level of proficiency is attained.

Computer assisted instruction is described and defined by Frenzel (1980)\(^\text{18}\) as the process by which written and visual information is presented in a logical sequence to a student by a computer. The computer serves as an audio-visual device. The students learn by reading the text material presented or by observing the graphic information displayed. The primary advantage of the computer over other audio-visual devices is the automatic interaction and feedback that the computer can provide. Multiple paths through the course material can be taken, depending upon the individual student’s progress.

Locatis and Atkinson (1984)\(^\text{19}\) describe computer-assisted instruction as a mode of instruction that involves student interaction with the computer directly. Typically, students access program presented in segments, with each segment including information and questions or problems for students' response. The correctness of each response is indicated immediately and remedial or new information is presented.
Sometimes students also have the option of requesting help or skipping ahead. Although this tutorial (information-practice-feedback) form of CAI is most typical, there are other forms such as drill and practice exercise, simulations and games.

Steinberg (1991) defines CAI as computer presented instruction that is individualized, interactive and guided. He is of the view that CAI is not a method of instruction. Many methods are implemented in it, including direct and exploratory lessons, drills, games and simulations.

According to Munden (1996) computer assisted instruction is an educational medium in which instructional content or activities are delivered by a computer. Students learn by interaction with the computer and appropriate feedback is provided. Poole (1997) defined computer-assisted instruction as a computer-based system designed to help students learn subject matter of all kind.

Roblyer and Edwards (2000) defined CAI as software designed to help teach information and, or skills related to a topic; also known as courseware.

Wiki Educator (2008) defines Computer-assisted instruction (CAI) as a self-learning technique, usually offline/online, involving interaction of the student with programmed instructional materials. It is an interactive instructional technique whereby a computer is used to present the instructional material and monitor the learning that takes place. CAI uses a combination of text, graphics, sound and video in enhancing the learning process. The computer has many purposes in the classroom, and it can be utilized to help a student in all areas of the curriculum. CAI refers to the use of the computer as a tool to facilitate and improve instruction. CAI programmes use tutorials, drill and practice, simulation, and problem solving approaches to present topics, and they test the student's understanding.

Sylvette A. La Touche (2010) explains that computer assisted instruction is a teaching process in which a computer is used to enhance the education of an individual. It is software teaches specific skills and knowledge, often narrowed to a specific content area and grade range. It can also be used to describe internet based
instruction through the use of webpages, web bulletin boards, and real audio.

Manzer Abbas (2012)\textsuperscript{26} described computer assisted instruction as an interactive tutorial technique that uses a computer to gift academic material, track learning, and direct the user to further material that meets the student’s desires. It may be used to explain net primarily based instruction through the employment of web-pages, internet bulletin boards, listservs, newsgroups, video, and graphics.

Juergen Haas (2012)\textsuperscript{27} defines computer-assisted instruction (CAI) as the teaching process in which a computer is used to enhance the education of a student. It is a self-learning technique, usually online, involving interaction of the student with programmed instructional materials.

The free dictionary (2012)\textsuperscript{28} defines computer-assisted instruction (CAI) as a teaching process that uses a computer in the presentation of instructional materials, often in a way that requires the student to interact with it and also called computer-assisted learning.

Miller-Keane Encyclopedia (2012)\textsuperscript{29} states that computer-assisted instruction (CAI) is the instructional activities that use a computer as the primary vehicle for teaching content or processes rather than one-to-one interaction with a student.

Britannica Encyclopedia (2012)\textsuperscript{30} illustrates that computer-assisted instruction (CAI) is the use of instructional material presented by a computer. Since the advent of microcomputers in the 1970s, computer use in schools has become widespread, from primary schools through the university level and in some pre-school programmes. Instructional computers either present information or fill a tutorial role, testing the student for comprehension. By providing one-on-one interaction and producing immediate responses to input answers, computers allow students to demonstrate mastery and learn new material at their own pace.

McGraw-hill Science & technology dictionary (2012)\textsuperscript{31} defines Computer Assisted Instruction (CAI) as the use of computers to present drills, practice exercises, and tutorial sequences to the student, and sometimes to engage the student in a dialog about the substance of the instruction. It also known as computer aided instruction and computer
assisted learning (CAL).

From the above mentioned it can be concluded that computer assisted instruction (CAI) is an educational medium or interactive tutorial technique in which instructional contents or activities are delivered by computer which is used to enhance education of students and served as an audio-visual device. Computer assisted instruction (CAI) contains the instruction which is designed to teach, guide, and test the student until a desired level of proficiency is attained. The students learn by reading the text material presented or by observing the graphic information displayed. They learn by interaction with the computer and appropriate feedback is provided.

In the present study, computer assisted instruction (CAI) refers to a form of learning that utilize computers, and is typically intended as a way to supplement traditional teacher-based learning. The researcher attempts to present this research on the effectiveness of computer assisted instruction (CAI) as a teaching tool, especially as it impacts on the learning achievement. Following the definition for computer assisted instruction (CAI) above, this study aims to find out whether or not CAI can be effectively utilized for teaching and the eleventh grade students’ learning achievement in career and technology subject.

2.2.3 Definition of achievement and learning achievement

American Heritage Dictionary (2009)\(^{32}\) defines “achievement” as the act of accomplishing or finishing, something accomplished successfully, especially by means of exertion, skill, practice, or perseverance, successful completion; accomplishment.

Thinkexist.com (2011)\(^{33}\), “achievement” can be defines as: (a) the act of achieving or performing; an obtaining by exertion; successful performance; accomplishment; as, the achievement of his object, (b) a great or heroic deed; something accomplished by valor, boldness, or praiseworthy exertion; a feat, and (c) an escutcheon or ensign armorial; now generally applied to the funeral shield commonly called hatchment.

Chiu, K.F. (1994)\(^{34}\), Jones (1996)\(^{35}\), and Piccoli, G., Ahmad, R. and Ives, B. (2001)\(^{36}\) define similar definition of learning achievement. Learning achievement according to
their views means the accomplishment of changes in knowledge, skills and attitude of the learners after the completion of teaching. Learning achievement will be affected by learning styles, course design, teaching and other factors.

Loo, R. (1999) also believed that learning achievement is affected by learning styles, course design, teaching and other factors. As far as the evaluation of learning achievement is concerned, whether the learning achievement is good or not good, it can be determined from students’ school grades, the ability to obtain professional certificates, and performance in various internal - external examinations i.e. achievement test, performance test and attitude or desirable performance test.

Lantai Tanah (2006) defines learning achievement as the success of learners which are able to master the materials of the learning objectives. The learning achievement will be different depend up on what the kinds of motivation of the learner has. Deferent motivation will also make different of the learning achievement of learners. In other way, learning achievement can be identified as the education theory. There are three education theories. Those are functionalism, human capital, and empires theory.

Functionalism theory and human capital theory are rather similar. Those theories said that learning is a process to developing the learner quality in increasing economy aspect of a nation. It means that the achievement of learning process is measured by the knowledge and skills that the learner has.

The empiric theory has more substantial point a view in seeing the learning achievement. This theory has perception that learning not only has correlation with developing of economy but also as a way toward cultural mobilization. It means that learning achievement is not only focusing in helping economical aspects but also touch substantial aspect. The substantial aspect is to make the learners have more quality in change and increase their live in all aspects.

Although learning achievement can be depended into the learner within his motivation, in education or learning system, learning achievement have to be measured. Curriculum or syllabus in learning shows the general achievement called competent ion standard. It shows minimum target of learner which is explained by affective, cognitive, and psychomotor standard. Those standards are appropriate with the educational theory used by
the nation. In conclusion, learning achievement is target measured by competences of the learner in learning which are shown by score as a sign and score is not a final expectation.

Learning achievement can be defined as excellence in learning process or all academic disciplines, in class as well as extracurricular activities. It includes excellence in behaviour, confidence, communication skills, punctuality, assertiveness, arts, culture, and the like.

Bill Hunt (2011) defines learning achievement into three aspects:

1. Essential Life Skills: Students demonstrate the aptitude, attitude, and skills to lead responsible, fulfilling, and respectful lives.
2. Academics: Students obtain, understand, analyze, communicate, and apply knowledge and skills to achieve success in school and life.
3. Responsibility to the Community: Students understand and model the important attributes that people must have to contribute to an effective and productive community and the common good of all.

Learning goals should be based on achievement, integrity, and maturity.

- Achievement concerns to the committing to education includes differentiating and tailoring instruction to meet diverse student needs and the applying academic skills outside the classroom translates to learning as a lifelong process.
- Integrity concerns to being ethical which is a core component of decision making that positively impacts the classroom, school, and community. The concepts of honesty, trustworthiness, and respect are essential elements of the learning community.
- Maturity concerns to the respecting oneself and others as diverse members of society lead to greater appreciation for the contributions of others.

Jessia, H. Veater and Jenny, L. Ward (2012) states that learning achievement refers to the effective learning which is being able to apply knowledge learned to more than one facet of the daily life; and the ability to internalize information and apply it in future situations.

Rachelle, N. Wayman, Kimber, M. Stewart, and Bonnie, A. Ware (2012) describes that learning achievement can be defined as the effective learning which is done in
an authentic way to connect to students’ prior knowledge and future usage. It takes place when students involved and actively engaged in the learning process. The material taught should be applicable to age and level. Multiple teaching styles and appropriate medias should be used to reach all students.

Thain, G. Segler (2012) illustrates that learning achievement incorporates Bloom’s Taxonomy. When a student is able to remember, understand, and apply information then they are exhibiting affective learning. Being able to then analyze, evaluate, and create new things based on what was learned would demonstrate an even higher level of learning achievement.

Danielle Stolworthy (2012) mentions that learning achievement refers to the learning that is self-motivated through the learner’s ability to connect what is learned to life personal experiences.

In the present study, “learning achievement” can be defined as the real accomplishments in the students’ learning process i.e. knowledge, skills, attitude and the ability to perform the desirable activities which derived from the computer assisted instruction (CAI) that can be measured by achievement tests, performance test and attitude or desirable performance test.

2.2.4 Definition of effectiveness of Computer Assisted Instruction (CAI) on learning achievement

Effectiveness of computer assisted instruction (CAI) on the learning achievement refers to the ability of computer assisted instruction (CAI) to accomplish a learning purpose in the career and technology subject for eleven grade students. The learning achievement scores were obtained from the learning achievement test of eleventh grade students, before and after instructed by computer assisted instruction (CAI) in career technology subject under the title “Website implementation by Namo WebEditor 5.5”. This includes the power or the degree to be effective and the quality of being able to bring about the highest level of students’ learning achievement in knowledge, skills and attitudes or desirable performance. The computer assisted instruction (CAI) in the present study is a form of learning that utilizes computers, and is typically intended as a way to supplement traditional teacher-
based learning. The researcher attempts to present this research on the effectiveness of computer assisted instruction (CAI) as a teaching tool, especially as it impacts on the learning achievement. This study aims to find out whether or not CAI can be effectively utilized for teaching and the eleventh grade students' learning achievement in career and technology subject.

2.2.5 Theoretical Foundations of Computer Assisted Instruction (CAI)

Idea and practice of computer assisted instruction (CAI) is grounded in all the predominant learning theories of the twentieth century i.e. behaviourist, cognitive and constructivist.

(1) Behavioural Theory

Behavioural theory is theory of psychology and learning which became prevalent in the twentieth century and reached its pinnacle in 1950s and 1960s. The behavioural theory focuses on objective, observable behaviours. Behavioral theorists concentrate on immediately observable consequences. Behavioral learning theories tend to emphasize changes in observable behavior as indicators of learning.

Behavioural theory has roots in the work of Pavlov who presented Classical Conditioning theory as a result of his experiments with the salivation of dogs. Pavlov showed how an animal could be conditioned to salivate (response) at the prompting of an arbitrary stimulus bell paired with presentation of food. Pavlov called this process the "conditioned reflex". (Hergenhahn & Olson, 1987)

Edward Thorndike was another important influence on the behaviourist view. He studied the association learning in animals and human beings. He examined how certain types of stimuli affected learning, with a focus on how students might be promoted to learn new material by repeated association with the material they already knew. He also examined methods of shaping learning behavior through rewards and punishments. (Klein, 1996)

Huffman, Vernoy & Vernoy (1995) mention that behaviorist psychologist and founder of operant conditioning B.F. Skinner focused on basic principles of learning. He gathered experimental data to develop his stimulus-response theory. The major principle underlying his learning theory is that behaviours chance according to their immediate
consequences. Pleasurable consequences strengthen behaviours, while unpleasant consequences weaken them. Skinner modified behaviour by altering external conditions, noting the response to those conditions and encouraging or discouraging that response. These three elements of the learning experience are technically called the discrimination stimulus, the response and the reinforcing stimulus.

The behaviourist frame of reference tends towards the discrete, concrete, individualized and self-paced instructional materials. Skinner-and others viewed the teachers' job as modifying the behavior of students by setting up situations to reinforce students when they exhibit desired response, teaching them to exhibit the same response in all such situations (Roblyer, 2000; Hsu, Chen & Hung, 2000; Joyce & Weil, 1996; Tiene & Ingram, 2001). Behavioural principles underlie a teaching strategy known as programmed instruction. Computer assisted instruction originated with the presentation of programmed instruction through computers.

(2) Cognitive Theories

Cognitive psychology focuses on the mental processing of information. It is concerned with acquisition, storage, retrieval and use of knowledge. Cognitive psychologists study how humans gather, encode and store information from their environment using such mental processes as perception, memory imagery, concept formation problem solving, reasoning, decision making and language (Huffman, Vernoy & Vernoy, 1995).

Cognitive theorists view people as active processors of information, who seek out information in an attempt to make sense of the world around them. Therefore, the concept of cognitive theorists concerns to how the brain operates, so closely parallels the operation of computers that another label for cognitive theory i.e. information processing theory has emerged. According to this approach, humans gather information from the environment and then process it in a series of stages. A certain type of processing is performed at one level before the information is passed on to another level for a different kind of processing. Thus, cognitive theorists like computer programmers began to think of learning in terms of sensory input, encoding, and retrieval systems (Huffman, Vernoy & Vernoy, 1995).

The information processing theories developed from a branch of cognitive
psychology and focus on the memory and storage processes that make learning possible. Human brains are perceived to operate similar to the way the computer processes the information. Work of cognitive psychologists like Richard Atkinson, Piaget, David Ausubel and Robert Gagne laid foundations of information processing theory (Roblyer & Edwards, 2000). Under the paradigm of information processing, a learner's brain has three kinds of memory or stores.

- Sensory register: The part of memory that receives all the information a person senses.

- Short-term memory: Also known as working memory, here information is held temporarily until it is either lost or placed into long-term memory.

- Long term memory: The part of memory, which has an unlimited capacity and can hold information indefinitely.

According to this model learning occurs during a process by which information is sensed through receptors, this information goes to sensory registers to be last or to go to short-term memory if attention is paid. If information is processed in working memory it goes to long-term memory otherwise gets lost. This information processing paradigm has a number of implications. Information is treated something like an object, which is to be transferred into the students' head (Hergenhahn & Olson, 1997; Kemp & Smellie, 1989).

The knowledge is comprised mostly of concrete, abstract concepts, rules and procedures. Students are assumed to learn by individually digesting information, organizing information and structuring the information received from the outside world. The primary task of the teacher is to plan learning strategies, which facilitate and ensure this transfer of knowledge (Roblyer & Edward, 2000).

The information processing model implies certain things about how people of all ages should be taught. The goal is to get information and skills entered and consolidated into long-term memory in such a way that the learners can retrieve it when they need it. To learn something one must pay attention to it, but one can pay attention to only a few things at a time. Teacher must get student's attention to make them learn. If teacher does not get a student's attention or if he overloads a student, then he reduces the chance that the student will learn anything (Tiene & Ingram 2001).
(3) Constructivism

Constructivists believe that what gets into the mind is not transmitted or poured by some external manipulator but has to be constructed by the individual through knowledge discovery or social interaction. Learning takes place when individuals participate in meaningful activities. They construct both mechanisms for learning and their own unique version of knowledge, colored by background experiences and aptitudes. Constructivist perspective emphasizes the active role of the learner in building understanding and making sense of information (Roblyer & Edwards, 2000; Hsu Chen & Hung, 2000).

Constructive perspectives are based on the ideas of educational philosophers such as John Dewey, Lev Vygotsky, Jerome Bruner, Jean Piaget and Howard Gardner. There are two major strands of constructivist perspective. One strand might be called cognitive constructivism based on the epistemology of Piaget and the other social constructivism based on thoughts of Vygotsky (Roblyer & Edwards, 2000; Maddux, Johnson & Willis, 1997).

Cognitive constructivism

Roblyer & Edwards (2000) observed that cognitive constructivism is based on the epistemology of Piaget who studies how knowledge begins and develops in individuals. Two widely recognized features of Piaget's theories are: Stages of cognition development and Processes of cognitive functioning.

For the stages of cognitive development, Piaget believed that all children go through four stages of cognitive development while the ages at which they attain these stages vary somewhat. Every individual attains these stages in a sequence i.e. from simple to complex. Processes of cognitive functioning, according to Piaget's theory concerns to two tendencies: Organization and Adaptation. According to organization, it is believed that all human beings are designed to organize their observations and experiences into a coherent set of meanings. Every human is born with a tendency to organize his thinking processes into psychological structures. These psychological structures are our systems of understanding and interacting with the world. (Woolfolk, 1978) Adaptation is one's inborn tendency to get adjusted with the environment. One's cognitive development takes place through a gradual process of interacting with one's environment.
Ormrod (2000) summarizes Piaget's basic assumptions about children's cognitive development in the following way:

(a) Children are active and motivated learners.
(b) Children's knowledge of the world becomes more integrated and organized over time.
(c) Children learn through the processes of assimilation and accommodation.
(d) Cognitive development depends on interaction with one's physical and social environment.
(e) The processes of equilibration (resolving disequilibrium) help to develop increasingly complex levels of thought.
(f) Cognitive development can occur only after certain genetically controlled neurological changes occur.
(g) Cognitive development occurs in four qualitatively different stages.

**Social constructivism**

Social constructivism emphasizes the importance of interaction of a child with its environment for his cognitive development. Social constructivist perspective is grounded in the ideas of theorists such as John Dewey and Lev Vygotsky (Roblyer & Edwards, 2000; Maddux, Johnson & Willis, 1997).

Dewey's Social Constructivism: John Dewey's idea emphasizes on student centered education, learning by doing and need to center student instruction on relevant, meaningful activities support constructivist models of teaching (Roblyer & Edwards, 2000). Dewey viewed education as a process of social activity. He viewed school as a miniature society where children encounter personal and social problems and their experience lead them to construct and reconstruct their knowledge (Ornstein & Levine, 1995).

Vygotsky emphasized the critical importance of a child's social interaction in his cognitive development, He was of the view that children develop in social and group setting. His twin concepts of scaffolding and the zone of proximal development are important for social constructivist perspective (Muddex, Johnson & Willis, 1987; Roblyer & Edwards, 2000; Woolfolk, 1998).

According to Woolfolk (1998) the zone of proximal development is the area/phase where the child novice cannot solve a problem alone, but can be successful under
adult/expertise guidance or in collaboration with a more capable peer. Scaffolding means the support for learning and problem solving. The support could be clues, reminders, encouragement, breaking the problem down into steps, providing an example, or anything, else that allow the student to grow in independence as a learner (Woolfolk, 1998\textsuperscript{73}, Muddex, Johnson & Willis, 1997\textsuperscript{74}; Roblyer & Edwards, 2000\textsuperscript{75}).

2.2.6 The origin of computer assisted instruction

The origin of computer assisted instruction can be traced back to early decades of twentieth century when behaviorist theories were being embedded and implicated in educational institutions. Behaviorist approaches emphasized individualization, self pacing and mastery learning concepts in education. A natural outgrowth of behaviorist approaches was a teaching strategy called programmed instruction.

In the year 1959, computer was used for the first time in schools. It was the use of International Business Machine 650 (IBM 650) computer to teach binary arithmetic to New York City elementary school children. Then it was found that programmed instruction can be presented through computers more successfully. In the 1960's and most of the 1970's large mainframe computers and medium size minicomputers were used for imparting instruction to the students. (Poole, 1995\textsuperscript{76}; Roblyer & Edwards, 2000\textsuperscript{77}; Bansal, 2002\textsuperscript{78}) Patrick Suppes developed computer assisted instruction (CAI) at Stanford University for one of the first minicomputers in 1966. Suppes predicted that technology would transform education, primarily because he believed that advances in technology would permit the delivery of individualized instruction to students of all ages in many subject areas. At the university level he indicated that there is a very little individualized instruction and computers would provide better support for college students. Suppes conducted experiments, and set initial standards for computer assisted instruction (CAI). (Campbell, 2000\textsuperscript{79}; Rohlyer and Edward, 2000\textsuperscript{80}).

The first microcomputer came into school in 1977 in United States of America and the focus rapidly shifted from mainframes to desktop microcomputer systems (Roblyer & Edwards, 2000\textsuperscript{81}). This shift in hardware technology transformed the computer's role in education. Before microcomputers, courseware came primarily from hardware manufacturers such as IBM and CDC, and software systems companies like CCC. As microcomputers gained popularity, a new software market for education driven primarily by teachers emerged.
Computer resources and their instructional applications were no longer controlled by large companies or school district offices. Classroom teachers could decide what they wanted to do with computers (Roblyer & Edward, 2000; Allessi & Trollip, 1991; Campbell, 2000).

Work of Suppes for computer assisted instruction (CAI) demonstrated that computer based instruction would work, although much work needed to be done to make it affordable and more effective. Although computer assisted instruction (CAI) worked, there was no real need for it in the classroom and Suppes's dream of individualized instruction for most children "within a decade" was not realized. The availability of relatively inexpensive computers revived the dream when Commodore Business Machine (CBM) one of the first personal computer manufacturers introduced commodore pet and commodore 64 in the late 1970's. These computers were widely used in schools. Later the Apple, Atare, Tandy and Radioshah computers invaded classrooms (Campbell, 2000).

Hardware technology is improving with unimaginable fast speed. Software development techniques are also advancing with a rapid pace. These speedy advancements in hardware technology and software languages are opening new horizons for the application of computers in all walks of life including education.

2.2.7 Computer managed instruction in schools

Computer managed instruction includes computer software systems designed to keep track of student performance data, either as part of CAI programme or by themselves. It helps teachers manage their professional responsibilities in and out of the classroom. (Roblyer & Edwards, 2000; Poole, 1997) Students can take examinations on the computer, and the computer scores the examinations, displays results, provides study hints for improvement, records passing grades, and prints out reports of individual student standing at any given point in the semester. The computer does not replace the instructor; instead, it is used to help as a tool to help the instructor manage the clerical and assessment work needed to make such a course run smoothly.

Computer assisted instruction (CAI) can be designed for the subject matter presented in many programmes. Mathematics for example, often utilizes interactive programmes that present math problems for students and provides them with tools to answer problem. These programme grant real-time feedback based on the information the student
enters, allowing for faster responses than what is generally allowed by traditional classrooms
and teachers. Science lessons can also be facilitated through such programmes, and
physical science such as chemistry and physics often utilize systems similar to those found in
math.

Computer assisted instruction (CAI) can be found in language studies and
history. Studies of English and other languages can often use computer programmes
that provide sample sentences that are missing words, into which the student can
input words and receive feedback based on the accuracy of the word. More
interactive games and lessons can also be provided that stress vocabulary
development and understanding of different sentences. History lessons that utilize
computer assisted instruction can include an interactive timeline that lets students
select an event or period and then provides audio and video about that time. These
are even interactive games that allow students to explore different times through the
game interface.

Computer assisted instruction can also be used to assist students who
may have special needs for learning. Various disabilities can be partially overcome
through different forms of technology, and concentrated, reinforced learning can often
be more easily facilitated through a computer programme than from an instructor.
When this type of instruction is paired with the lessons and efforts of a trained teacher,
then the benefits become even more pronounced.

2.2.8 Types of computer assisted instruction (CAI) programme

There are many types of computer assisted instruction (CAI) programme.
Each of the CAI programme is appropriate under different instructional circumstances and
therefore takes a different pedagogical approach. Although the beginning of CAI was
presentation of programmed instruction through computer and initial forms of CAI i.e. tutorials,
drill and practice and games were oriented to behaviorist theories of learning. But now no
type 4CAIs solely associated with- a specific learning theory, as sophistication of computer
languages has allowed modifying each type of CAI according to any theoretical framework.
and Bitter and Pierson (1999) 92 have mentioned and explained the following types of CAI
(1) Software for Drill and Practice: The purpose of drill and practice software is to have the learner memorize information. It does not act as teacher, but as a kind of automated flash card. The programme presents a question to the learner, the learner responds, and the software then gives feedback as to whether is correct or incorrect. Most drill and practice software will accept two incorrect answers, and then provide the correct answer so that the learner is not a particular item for a long period of time. (Sandra, R. Lugpit, et al, 2011)

It can be said that drill and practice programmes are used to provide the students with repetitive exercise for specific skills that have been taught in the classroom and supplies immediate feedback on the correctness of the response. Used in this manner, CAI functions as a supplement to regular classroom instruction, and may be especially useful when a teacher does not have the time to work individually with each student. Drill and practice on the computer may also motivate students more than traditional workbook exercises. It is not the function of drill and practice software to impart instructional activities; rather, drill programs are useful for sustaining, refining, or perfecting performance in some category of behaviour already leaned by another method. Usually drill and practice is employed to increase the speed or accuracy of student performance of certain task. Software for Drill Practice allows learners to work problems or answer questions and get feedback on correctness. It is an important learning technique for building basic knowledge and basic intellectual skills, such as number manipulation, vocabulary, spelling sentence construction etc. These skills are the foundation for higher level intellectual activity. Good drill and practice software provides the user with an enjoyable opportunity for repetitive interaction and immediate feedback on the accuracy of response. Drill and practice software is typically associated with behaviorism, because students are commonly given 'stimuli' (questions), are required to make responses to the stimuli, and then receive some sort of reinforcement. (Hsu, Chen & Hunk; 2000, Roblyer & Edwards, 2000, Poole, 1997, Geisert & Furtell, 1995; Nladdux, Johnson & Willis 1997)

Drill-and-Practice Software assists students in reviewing, rehearsing, reinforcing, and practicing concepts to which they have already been introduced. It does not introduce new concepts Provides immediate and relevant feedback to students. It prevents students
from learning something incorrectly. CAI can focus on concepts, problems, etc. that a student needs to work on. It does not force students to go over topics that they already know.

(2) Tutorials Software: The purpose of Tutorials Software is to instruct the learner and intends to introduce new concepts and focuses on the presentation of new material in a format that captures the attention of a student, and keeps him/her focused on the most important aspects of the new topics. This type of software may include some practice or reinforcement, but it is primarily used in a teaching capacity. Constant or periodic interaction with the student may be provided to prevent the student’s attention from wandering and to evaluate his/her grasp of the new material. (Sandra, R. Lugpit, et al, 2011)

Tutorials activity includes both the presentation of information and its extension into different forms of work, including drill and practice, games and simulation. (Wiki Educator, 2008) Tutorials CAI provides some information or clarifies certain concepts in addition to providing the student with practice exercises. In this sense, the computer begins to take over actual instructional functions, tailored to the student’s individual level of achievement. (Kyaw Soe, et al, 2010) Tutorials act like tutors by providing all the information and instructional activities a learner needs to master a topic. All the conceptual or skill based body of knowledge is presented on screen followed by quiz to assess the user’s comprehension of the concept or acquisition of the skill. The software monitors progress on the basis of the results of the quiz taking the user on the new material or back over old material. A good tutorial presentation is enjoyable, thorough, and sensitive to the user capabilities; and provides immediate and appropriate feedback. Interactivity is key to user involvement and perseverance. (Cox 1995; Poole 1997; Roblyer 2000) Tutorial software is more associated with the cognitive learning theory, because new knowledge is presented in a systematic way. It is expected that students learn principles and rules, comprehend them and become able to apply the newly acquired knowledge to new situations. A computer based tutorial programme works with an individual student in a very interactive manner and often provides an ideal learning situation for information transmission. (Hsu, Chen & Hung, 2000)

Tutorial software usually assesses the learner’s skill, then presents new instruction, gives practice, asks a question and, depending on the learner’s response, either
remediate by re-teaching, or moves on to the next level. Tutorial software has value to the learner in that it allows the learner to answer every question, proceed at her/his own pace, and provides privacy of feedback. If the tutorial is branching rather than linear, it is more useful educationally. Linear tutorials allow the learner to take only one path, following it from beginning to end. Branching tutorials, on the other hand, allow the learner to decide which part of the software to use at a particular time. This means that if a student already knows some of the material, s/he can proceed to new, unfamiliar material.

(3) Simulation software: The purpose of simulation software is to provide approximate computer representations of real-world phenomena or situations. It provides learners with an opportunity to work cooperatively, solve problems, and speculate "what if". This type of software is time effective, cost effective, and safer than experiencing the situation first hand. These are condensed learning exercises specifically designed to represent vital real-life activities by providing learners with the essence or essential elements of the real situation without its hazards, cost or time constraints. If a simulation programme is designed correctly, students who use it may have experiences roughly equivalent to what they might encounter in similar real-world situations. For example, they might be able to study causality by investigating alternate chains of events, or to make choices and explore consequences of their decisions. (Sandra, R. Lugpit, et al, 2011)

As the simulation software simulates an environment, thus, it allows learner to change the values of parameters in the system, and provides feedback in the form of graphical or diagrammatic display of how the systems' behavior changes. For example in a simulation based on a model of a pond with three main inhabitants, phytoplankton, herbivore, and fish, the learner may change the number of one or more population and see the effect on the others. Simulations provide a means for learning about an environment that may otherwise not be available to learner to explore, for reasons of safety, time, expanse, or general practicality. A simulation focuses on exploration and discovery learning. It is not an exercise that necessarily has a fixed or correct solution, and the route to the solution may be varied. A computer simulation offers the opportunity for relationships to be explored and exposed by the student's direct manipulation of the variables in the model-. Although simulation programs are usually constructivist, i.e. they allow students to construct their own knowledge; they can
have cognitive orientations also (Cox, 1995). Alessi & Trollip (1991) identify two main types of simulations: Those that teach about some thing and those that teach how, to do something. These two main types are further classified into four categories i.e. physical, process, procedural and situational simulations.

Physical simulations: Users manipulate objects or phenomena represented on the screen. For example, students see selections of chemicals with instructions to combine them to see the result or they may see how various electrical circuits operate (Roblyer & Edwards, 2000).

Process simulations: These speed up or slow down processes that usually either take so long; or happen so quickly that students could not ordinarily see the events unfold. For example, courseware may show the effects of changes in demographic variables on population growth or the effects of environmental factors on ecosystems. Biological simulations like those on genetics are popular, since they help students experiment with natural laws like the laws of genetics by pairing animals with given characteristics and showing the resulting offspring (Roblyer & Edwards, 2000).

Procedural simulations: These activities teach the appropriate sequences of steps to perform certain procedures. They include diagnostic programmes, in which students try to identify the sources of medical or mechanical problems, and flight simulators, in which students simulate piloting an airplane or other vehicle (Roblyer & Edwards, 2000).

Situational simulations: These programmes give students hypothetical problem situations and ask them to react. Some simulations allow for various successful strategies such as letting students play the stock market or operate businesses. Others have most desirable and least desirable options such as choices when encountering a potentially volatile classroom situation (Roblyer & Edwards, 2000).

Reasons to use simulations are that the real-world phenomenon may operate in a time frame that is too long to investigate in the classroom. The real-world phenomenon may be too expensive to simulate in the classroom. Effective simulations can allow the students to gain important insights from the experiments without the expense of actually conducting them. The real world phenomenon may occur only at locations that are remote from the classroom. The students may need to be involved in a role-playing environment that would be
impossible for them to realize in the real world at their age. Many real-world situations are simply too dangerous to undertake in the classroom.

(4) Instructional games: Instructional games are courseware whose function is to increase motivation by adding game rules to learning activities. Instructional games often creates a contest to achieve the highest score and either beat others or beat the computer. Instructional games can be similar to drill and practice or simulation courseware but their instructional connotation to the student is different due to entertaining and competitive environment. When students know they are going to play a game, they expect a fun and entertaining activity because of the challenge of the competition and the potential for winning (Roblyer & Edwards, 2000).[113]

Cox (1995) mentions that some simulations are designed as games, often including role-playing. In such simulations the program focuses not only on the underlying model but also on the way in which the learner interacts with the model. Learning may be built up by discovery and conjecture; the simulation encourages learning by inquiry and decision making. According to Hsu, Chen & Hung (2000)[115], instructional games are usually associated with behaviorism because of the variety of reinforcement mechanism inherent in game environments in which students are motivated by competition and game rules to strive to reach to the goal.

(5) Problem Solving Software: Problem solving software requires students to apply higher order strategies and synthesize knowledge from multiple curricular areas in order to solve problems. Students can test hypotheses, learn from mistakes and refine skills as they gain mastery of problem solving techniques. Software of this type can provide practice in solving problem by modeling general critical thinking steps, by focusing on specific subject-area issues, or by creating an open environment in which students can discover their own strategies. The problem solving software affords the user more freedom than does drill and practice or tutorial software, but does not necessarily present the real world context that characterizes simulation software (Bitter & Pierson, 1999).[116] Problem solving software teaches directly, through explanation and/or practice, the steps involved in solving problems or help learners acquire problem solving skills by giving them opportunities to solve problems.
Problem solving software is sometimes associated with the cognitivist learning theory because students are explicitly taught specific cognitive strategies. A problem solving software is more sophisticated type of learning than that of drill and practice. The computer presents fairly complex problems in which students can learn and improve their problem solving skills. These types of problems cannot be solved by simple memorization; problem solving programs are designed to promote students’ higher order learning skills such as logic, reasoning pattern recognition and strategies. As they interact with the program, they gradually move from simple trial and error to more logical and systematic thinking processes (Hsu, Chen & Hung, 2000; Roblyer & Edwards, 2000).

It can be said that problem solving software is used to aid students in developing high-level problem-solving skills and strategies. In many ways it is like simulation software. Students make decisions by specifying values for variables and then observe the consequences of their decisions. Problem solving software usually requires a great deal of student input and presents the student with a lot of feedback. Some of the skills and strategies that can be fostered by problem solving software include the following: Classifying things, Establishing hierarchies, Identifying trends, Identifying sequences, Breaking a problem into parts Identifying relevant and irrelevant information, Working backwards to justify conclusions, Eliminating personal biases, Making and testing hypotheses, Graphing data and interpreting the graphs, Using arithmetic and mathematics to calculate or estimate values.

(6) Integrated Learning System (ILS): According to Underwood and Brown (1997), ILS are systems across computer networks that provide a comprehensive, multiyear collection of computer-assisted instruction (CAI) delivered primarily through a model of individual assessment and task assignment and which record and report student achievement. A good ILS includes courseware for broad range of learning experienced, including simulations and on-line vehicles for research. The development of ILS is grounded firmly in the behavioral school of learning theory. ILS have largely addressed mathematical and language material where the body of content is arranged hierarchically. Additionally there are deemed to be identifiably right or wrong answers. The behaviourist approach taken by ILS designer precludes any element of social interaction.
(7) **Software for Micro Computer-Based Laboratories:** Recognizing the value of micro computer based laboratory (MBL) to research, hardware and software systems have been developed. These systems have enabled the students to automate the process of gathering data from experiments, conducting relevant analysis and producing meaningful reports. Scientific experiments are linked to micro-computers in laboratories to automate the process of recording the results of experiments. Complete data sets can be stored in secondary memory for further analysis. Summary data are produced as text and in a graphed format (Poole 1997). Theoretical underlying purpose for MBL is precision in data collection and analysis and hence in conclusion.

(8) **Discovery Learning Software:** Discovery Learning Software provides a large database of information specific to a course or content area and challenges the learner to analyze, compare, infer and evaluate based on their explorations of the data. It provides a structured, simulated environment that directs a student’s attention toward a topic of interest. It also provides ways for students to manipulate facets of that environment to discover important concepts. This technique can be used to challenge the participants to create novel ways of addressing various issues based on the information that is provided to them. (Sylvette, A. La Touche, 2010)

(9) **Reference Software:** Reference software can take the form of any traditional reference works, such as dictionaries, encyclopedias, and thesauri on CD-ROM. Other reference software presents extensive collections of information on a focused topic. Electronic reference works can be utilized just as traditional reference material would be. Depending on the particular learning activity, students might refer to software as needed to answer specific questions. They also might openly explore a multimedia reference without specific goals to guide their learning. The multimedia components of reference software present information in graphic, audio, video or other alternate formats that allow uniquely unlimited access to students who might not be developmentally able to contend with the text version of the information (Bitter & Pierson. 1999)

(10) **Dialogue:** With this type of CAI use, the student takes an active role in interacting with the computer, giving instructions in the form of a computer language so as to
structure the student’s own curriculum. The computer provides information, exercises, and feedback. Dialogue CAI is believed to come closest to actually substituting for regular instruction (Gourgey, Azumi, Madhere, & Walker, 1984).

2.2.9 Characteristics of computer assisted instruction (CAI)

Computer assisted programmes can be characterized by many attributes suitable to enhance learning. Some of the special characteristics of CAI include: (Muhammad Khalid Mahmood, 2004)

Individualization: A computer program can provide multiple instructional paths, tailored to individualized needs (Steinberg, 1991). Students find multiple paths to proceed; every student finds an option to proceed according to his needs i.e. according to his previous knowledge of the subject, ability, interest and intellectual capacity. Game format can add motivation and fantasy and maintain learner's attention. Concepts can be presented in tutorials with the aid of illustrative animation, dynamically creating illustrations and interspersing verbal explanations. Simulations can provide new insights-into relationships, or experiences that would otherwise not he possibly.

1. **Flexibility**: Flexibility means access to teaching materials at a wide range of time or locations. Computers offer great flexibility in the type of resources available to a student as well as increasing flexibility of access to information. Greater flexibility in education is one strategy for dealing with increased number and diversity of students. Computer programmes can allow the user to choose from a variety of instructional treatments. A student who does not learn with a particular approach can be presented with material using an entirely different and unique approach. Instructional programs may use a variety of prompts and cues to produce correct student responses. (Sloane et al. 1989; Maier et al. 1995)

2. **Self-Pacing**: Self-pacing lets students precede at a pace appropriate for their individual learning levels. Students using self-pacing can control the time allowed to solve problem as well as the rate of presentation they can spend several weeks with remedial material or skip entire lesson. When they feel ready to be tested on the specific material, they can choose the testing cycle. Self-pacing can help to individualize instruction for those students who have used the program before or have prior knowledge of the subject. Self-pacing can be combined with self-placement testing, which directs the student to an
appropriate beginning point and to an optimal instruction rate.

(3) Remediation Options: The computer can vary instructional treatments and adapt to individual differences after analyzing student responses. Records of the student's past performance determine the sequence of instruction. In one type of remedial program, the instructor uses computer programs to diagnose the student's learning capabilities, achievement level, and cognitive style. On the basis of the diagnosis, the instructor chooses material that is geared to the student. Computer-assisted instruction programs may easily provide remedial treatments by employing branching strategies and/or through incorporating hyperlinks to present text, graphics or any type of material for remediation.

(4) Graphics and Sound: Graphic representation plays an important role in instruction. In addition to pictures, computer graphics also include the use of screen formatting features such as arrows, boxes, and illustrations to emphasize the concept. This nonverbal mode of instruction helps to build comprehension in areas that are difficult to teach by other instructional techniques. Sound in a program can prompt, focus, or reinforce students and thus enhance instruction. At a more sophisticated level, some CAT programs include speech synthesizers that produce words or sentences. Synthesizers are especially applicable with software for the very young or handicapped users. Computer graphics and sound infuse movement, excitement, and animation into a program.

(5) Distance learning: One of the most useful of computer-assisted instruction (CAI) is its adaptability for distance learning. Before the dominance of microcomputers, distance learning was mostly accomplished through the mail system supplemented by telephone contact. On the contrary, CAI provides regular and timely interaction with the instructor and current feedback. Students can repeat tutorials as often as needed and work at their own pace. CAI also can be used with greater numbers of students than a traditional classroom would hold. CAI and web-based instruction have opened avenues of access to individuals with disabilities that were not possible before. (Smrulisikha, 2012)

(6) Student's Individual Needs: CAI can adapt to the student's individual needs. It acquires information about the student's current knowledge of a subject and his/her goals in learning the subject and then creates a user profile based on this knowledge. It can then adjust itself to the individual student. It is unique in that students and/or instructors can
communicate with each other anywhere in the world within seconds via the Internet. Feedback from the instructor can be obtained immediately. (Smritisikha, 2012)

2.2.10 Advantage and disadvantage of computer assisted instruction (CAI)

Advantage of computer assisted instruction (CAI)

There is ample evidence that computer assisted instruction (CAI) is more effective than the traditional methods of instruction. The advantages of CAI as identified through the findings of research studies areas below:

(1) Increase the high achievement level: A large number of research studies provide evidence that CAI can be used to increase high achievement levels for students of different ages and abilities. (Bahr & Reith, 1989; Gore, et al. 1989; Braun 1990)

Computer Assisted Instruction (CAI) is among the range of strategies being used to improve student achievement in school subjects, including reading. Programmes for CAI have come a very long way since they were first developed over two decades ago. These programmes tutor and drill students, diagnose problems, keep records of student progress, and present material in print and other manifestations.

(2) Students are expected to benefit from CAI: Among the benefits that have been expected are better and more comfortable learning for students, since they learn at their own pace and convenience; opportunities to work with vastly superior materials and more sophisticated problems; personalized tutoring; automatic measurement of progress; and others. (Muhammad Khalid Mahmood, 2004)

(3) Teachers as well are expected to gain from CAI, as they experience less drudgery and repetition, greater ease in updating instructional materials, more accurate appraisal and documentation of student progress, and more time to work directly with students (Kulik, Bangert, & Williams, 1983). With increasing advances in computer technology, computer assisted instruction (CAI) is now seen by many as a method of providing relevant instruction for large numbers of students.

(4) A number of different approaches to the use of computers in education are reflected in educational practices. Learning from computers encompasses approaches to CAI in which the computer is used as a means for transmitting specific subject matter, such as reading. The flow of information is basically from the computer to the student, with the
computer presenting learning material or activities for student responses. The computer retains records of the student’s progress through the course of study. (Goldberg and Sherwood, 1983)

(5) Learning Rate: In addition to the rise in achievement levels, 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. (Capper & Copple 1985; Kulik 1985; Kulik & Kulik 1987)

(6) Computers have become a pervasive tool: There is no doubt that technology has become incorporated into our school systems. Computers are used not only as a means of helping schools analyze data, computers have become a pervasive tool toward optimizing student learning. For example, students are regularly using the Internet to gather and assimilate information for use in research assignments. They are preparing "electronic" presentations using computer presentation programs and LCD projectors. They are using word processing programs to create various other reports. Students are even using spreadsheets to increase their experiences with mathematical concepts. In addition, many schools have incorporated interactive computer-assisted-instruction into their program to provide students opportunities to master specific educational objectives or standards.

(7) CAI helps to increase student cognitive processes and motivation: Computer programmers have been able to create computer assisted instruction programmes that have served to increase student learning by affecting cognitive processes and increasing motivation. Current research shows the mechanisms by which computer programs facilitate this learning: (1) personalizing information, (2) animating objects on the screen, (3) providing practice activities that incorporate challenges and curiosity, (4) providing a fantasy context and (5) providing a learner with choice over his/her own learning.

Personalizing information allows computer-assisted-instruction to increase learner interest in the given tasks (Padma and Ross, 1987) and increase the internal logic and organization of the material (Anderson, 1984; Ausubel, 1968; Mayer, 1975; Rumelhart
and Ortoney, 1977). New information can be more easily integrated into existing schema if a student's name or other familiar contexts appear in a problem.

The animation of objects involved in the explanation of a particular concept, for example, Newton's First Law of Motion, increases learning by decreasing the cognitive load on the learner's memory thereby allowing the learner to perform search and recognition processes and to make more informational relationships (Reiber, 1991).

Computer assisted instruction increases motivation by providing a context for the learner that is challenging and stimulates curiosity (Malone, 1982). Activities that are intrinsically motivating also carry other significant advantages such as personal satisfaction, challenge, relevance, and promotion of a positive perspective on lifelong learning (Keller and Suzuki, 1988; Kinzie, 1990).

A fantasy context increases learning by facilitating engagement (Parker and Lepper, 1992; Malone, 1982). Fein (1981) and Signer (1987) have also found, apart from using computer programs, that involvement in fantasy is often highly intrinsically motivating.

CAI providing students with choice over their own learning: CAI provides learner controlled instruction, which contributes to motivation. Increased motivation in turn increases student learning (Kinzie, Sullivan and Berdel, 1988). Also, program-controlled instruction, as opposed to learner-controlled, may get in the way of the learner by requiring the learner to study all of the given subject matter rather than only the elements the learner needs (Mayer, 1964). Further, learner-controlled instruction makes it possible for individuals to make certain choices in an activity and to affect certain outcomes. As a result, the individual feels competent and self-determining, and the activity has greater personal meaning and intrinsic interest (DeCharms, 1968; Lepper, 1985). Tennyson (1980, 1981) found learner control to be instructionally effective when individuals were given advisement on their performance in relation to programme criteria. Further, learner control results in more positive attitudes toward the instruction (Hurlock, Lahey and McCann, 1974).

(8) Computer assisted instruction (CAI) programmes are interactive and can illustrate a concept through attractive animation, sound, and demonstration: CAI allows students to progress at their own pace and work individually or problem solve in a group. It provides immediate feedback, letting students know whether their answer is correct. If the
answer is not correct, the programme shows students how to correctly answer the question.

CAI offers different types of activity and a change of pace from teacher led or group instruction.

(9) Computer assisted instruction (CAI) improves instruction for students with disabilities: This is because students receive immediate feedback and do not continue to practice the wrong skills. CAI captures the students’ attention because the programs are interactive and engage the students’ spirit of competitiveness to increase their scores. Also, computer assisted instruction (CAI) moves at the students’ pace and usually does not move ahead until they have mastered the skill. Programmes provide differentiated lessons to challenge students who are at risk, average, or gifted.

(10) Computer assisted instruction (CAI) provides one-to-one interaction with a student, as well as an instantaneous response to the answers elicited, and allow students to proceed at their own pace. CAI is particularly useful in subjects that require drill, freeing teacher time from some classroom tasks so that a teacher can devote more time to individual students. A CAI program can be used diagnostically, and, once a student’s problem has been identified, it can then focus on the problem area. Because of the privacy and individual attention afforded by a computer, some students are relieved of the embarrassment of giving an incorrect answer publicly or of going more slowly through lessons than other classmates.

(11) Computer assisted instruction (CAI) helps teachers to success in teaching learning process: CAI instruction offers mastery learning materials, individualized programmed instruction that guarantees students’ success in mastering knowledge. When the teachers use computer assisted instruction properly it has many advantages. Such as; CAI offers lots of educational materials; also it provides drills to improve the student’s knowledge and game based drills to increase learning enjoyment. Furthermore it enables to assess students’ progress and capabilities with tests. CAI is more effective at practicing part. As it provides lots of question types so students can find the opportunity of seeing lots of question types. Also CAI, especially tutorial programmes give person to study individually and learn by him or herself. Students can solve a lot of problems or can do a lot of exercises with the help of CAI. Students received immediate feedback, so they can deal with misunderstandings easily. It also gains them a lot of time. Moreover, students enjoy their job, and learn more effectively.
Computer assisted instruction (CAI) provides a World-Wide learning environment with access to worldwide knowledge webs so this extends and enriches students' learning experience.

Computer assisted instruction (CAI) is Learner-Centered and Interactive. The focus is the learner rather than the teacher as in Constructivistic Approach. CAI Instruction is Individualized Instruction. The students will have a virtual Personal Tutor helping he/she masters the information. Taking the course on computer increases the learner's computer skills. By doing so, the students will be able to critically analyze information, solve problems and communicate with others.

Computers become widespread with progressive technology: Students use computers commonly and they interest in technology. Using computers for a lesson is very effective to motivate them. Moreover, it can be find lot of sources from internet and apply them to students. Especially in practicing students see evaluation of their performance and give feedback to students. When the answer is false programme gives some clues to find the correct answers. In this way they analyze the clues and solve problems according to these clues. That improves information analyzing of students.

CAI help to increase students’ attention: There are lots of CAI materials and different activities. Students can reach these activities which may be funny for students. CAI can increase the students’ attention to the subject and so students study their own time and they can study outside the class.

CAI impacts and improves students overall level of mastery. In this process its’ receiving immediate feedback on students performance is very important. Students have too much chance to practice their learning, after practicing they can see their level of knowledge and they can see how much they know about the subject, in which areas they have trouble. So they should want help in the areas they are lack of. By the help of CAI teachers can assess students’ performance and lessons efficiency easily.

CAI has the capacity to initiate flexible interactions with the student which is not possible in the teaching machines. The computer is able to record and store all the responses of the students. It can use the information in deciding what information to give the student next. It can branch not just in terms of one answer but also in terms of a whole series of previous answers. It can also record the time taken to answer a question and the degree of
correctness of the student’s response. It uses information in planning to determine which branch to take

(18) CAI helps to determine subsequent activities in the learning situations. The large amount of information stored in the computer is made available to the learner more rapidly than any other medium. The dynamic interaction between the student and instructional programme is not possible to be secured by other medium. It can completely individualize materials. It can dramatically increase student’s access to information. It often engage the interest of students, motivating them to learn and increasing independence and personal responsibility for education. (Sandra, R. Lugpit, 2011)\(^\text{158}\)

From above mentioned, the advantage of CAI can be summarized as follow:

- One-to-one interaction
- Great motivator and sustaining motivation
- Freedom to experiment with different options
- Instantaneous response/immediate feedback to the answers elicited
- Self pacing- allow students to proceed at their own pace
- Helps teacher can devote more time to individual students
- Privacy helps the shy and slow learner to learns
- Individual attention and individualize instruction
- Learn more and more rapidly
- Multimedia helps to understand difficult concepts through multi sensory
- Student can solve the problems on their own
- Reaching learners even outside classrooms
- Using learning time efficiently
- Student can learn with enjoyment
- Increased peer interaction due to a collaborative rather than competitive learning environment
- Self directed learning, elimination of space, time and geographical constraints – students can decide when, where, and what to learn
- Increased interaction with more accessible teachers with decreased feedback turn-around time
• increased quality of learning with deeper critical reflection and systematic scaffolding of ideas taking place

• Increased access to databases and other resources not normally available to distance learners (Berge, 1995; Hiltz, 1994).

Disadvantage of computer assisted instruction (CAI)

There are also disadvantages of computer assisted instruction (CAI). (Sandra, R. Lugpit, 2011)

(1) One of the more difficult aspects of instructional computers is the availability and development of software or computer programs. Courseware can be bought as a fully developed package from a software company, but the program provided in this way may not suit the particular needs of the individual class or curriculum. A courseware template may be purchased, which provides a general format for tests and drill instruction, with the individual particulars to be inserted by the individual school system or teacher. The disadvantage to this system is that instruction tends to be boring and repetitive, with tests and questions following the same pattern for every course. Software can be developed in-house, that is, a school, course, or teacher could provide the courseware exactly tailored to its own needs, but this is expensive, time-consuming, and may require more programming expertise than is available.

(2) Another disadvantage is that computerized instruction cannot extend the lesson beyond the limits of the programming.

(3) Poorly designed CAI systems can dehumanize or regiment the educational experiences and thereby diminish students’ interest and motivation. All individualized instruction and CAI instruct the students in such a way, that all will achieve the same level of competency. Other disadvantages of CAI stem from the difficulty and expense of implementing and maintaining the necessary computer systems.

2.2.11 Effectiveness of computer assisted instruction (CAI) on students’ achievement

Computer use in classrooms as an aid to teaching and learning processes has increasingly popular during the last two decades. According to National Assessment of Educational Progress (NAEP, 1996) statistics, it was found that more than 80% of the K-12 students in the United States reported using computers for learning purposes in school or at home.
Different forms of CAI as supplement to traditional method of instruction have proved their effectiveness to augment student achievement. Poole (1997)\textsuperscript{163} asserts that computer is a tool in the hands of both the student and the teacher. The effectiveness of that tool depends entirely on the skills that the students and teacher bring to the learning process. Lei, L.W. et al, (2006)\textsuperscript{164} found that students who used at least two different CAI programmes scored significantly higher on the final examination than those who used only the CAI tool designed by their site’s instructor. Further investigation indicated that students might have benefited from the interactive features of a specific CAI tool. Such scaffolds could have successfully supported encoding processes while students were restructuring their mental models. In addition, students perceived the CAI programmes to be more effective when the tools were fully integrated into the curriculum. Perceived module effectiveness was significantly correlated with examination performance, suggesting a well-designed and appropriately used CAI tool may help students achieve not only learning efficiency, but also better learning outcome.

Many research findings regarding the effectiveness of CAI indicate the higher academic achievement of students than those who receive only traditional instruction. The following presents the effectiveness of CAI on students’ achievement.

\textbf{(1) Effectiveness of CAI on reading achievement}

Kyaw Soe, Stan Koki, and Juvenna, M. Chang. (2010)\textsuperscript{165} found that the CAI can increase students’ engagement in reading, promote reading comprehension, and improve reading skills. CAI can assist teachers in developing a more individualized approach to reading instruction to meet the diverse range of students’ needs in classrooms. Teachers can be empowered to vary the pace of instruction, review student learning, teach and reinforce specific skills and strategies, improve motivation, and provide students with relevant and timely feedback. Reading instruction aligned with computer assisted instruction can serve as a powerful teaching tool to assist teachers in helping students reach their potential in reading.

Hall, T.E., Hughes, C.A. , & Filbert, M. (2000)\textsuperscript{166} studied on Computer Assisted Instruction in reading for students with learning disabilities: A Research Synthesis and found that CAI can serve as a powerful tool for reading teachers, but it is only suitable as one part
of an effective reading curriculum. CAI should be used to supplement, not replace, traditional reading instruction. The studies examined in this analysis point to several elements of a successful CAI programme. Teachers who use CAI often implement it as an addition to their regular reading programme, meaning that students using CAI are receiving additional instruction and practice in reading. This extra reading time alone may account for some of the improvements shown by children who use CAI. CAI programmes designed using research-based teaching strategies were found to be highly effective. CAI programmes that provided students with both elaborate feedback on their responses and opportunities to correct mistakes and rehearse the correct response were found to be more effective than those not providing elaborate feedback and rehearsal. Most of CAI programmes in reading for this study employ drill and practice procedures, followed by strategy instruction, then simulation. The area of reading intervention focus was evenly split between word recognition and reading comprehension, followed by language/vocabulary, then pre-reading skills instruction.

(2) Effectiveness of CAI on Science subject

Helgeson (1988) reviewed studies determining the effectiveness of CAI in science classroom and science laboratories and found evidence in support of CAI, as laboratory activities and simulations and combination of two strategies yielded higher achievement than did conventional instruction. Morse (1991) found that CAI in science education can improve learning and positively influence student attitude and self-esteem. Bayrakter (2000) conducted a study employing meta-analytic research approach and found that CAI was most effective in physics education and had little effect on chemistry and biology achievement. Simulations and tutorial programmes had significant effect on student achievement in science education but drill and practice was not found effective. Another finding from the study was that experimenter developed software was more effective than commercial and that CAI was found more effective when duration of treatment was shorter than four weeks. Review of the literature reveals that simulations are the most effective type of CAI in the subject area of science. Microcomputer based laboratories (MBL) are also found to be effective for better learning of sciences concepts. Effectiveness of any computer assisted instruction programme depends upon: Quality of instructional
software and Quality and functioning of hardware.

Muhammad Khalid Mahmood (2004)\textsuperscript{170} compares the students’ achievement on general science subject using the traditional method and CAI found that students like the CAI programme and benefited from it. They found it better mode of instruction than the traditional method.

Mudasiru Olalere Yusuf (2010)\textsuperscript{171} investigate effects of computer assisted instruction (CAI) on secondary school students’ performance in biology and found that students’ performance exposed to CAI either individually or cooperatively were better than their counterparts exposed to the conventional classroom instruction. However, no significant difference existed in the performance of male and female students exposed to CAI in either individual or cooperative settings. Based on the research findings recommendations were made on the need to develop relevant CAI packages for teaching biology in secondary schools.

(3) Effectiveness of CAI on Science subject

Kuchler (1998)\textsuperscript{172} conducts a meta-analysis of the studies exploring the effectiveness of CAI on teach secondary school mathematics and found that computer assisted instruction (CAI) has an overall positive effect on mathematics achievement and skills of secondary school students. The most effective CAI mode appears to be "drill and practice" with the use of combinations of modes being equally effective. CAI mathematics instruction appears to be the most effective when it is used to supplement regular instruction.

Mintz (2000)\textsuperscript{173} and Campbell (2000)\textsuperscript{174} compared computerized and traditional instructions in the areas of elementary mathematics and elementary readings respectively. Both the studies examined the effect of computerized instruction on the achievement and critical thinking skills of fourth and Fifth graders. It was found that there were significant difference in critical thinking skills improvement between students who received CAI and students that didn't.

Mwel, K. Phillip, et al. (2011)\textsuperscript{175} studied the effect of Computer Assisted Instruction on student’s attitudes and achievement in Matrices and Transformations in Secondary
Schools and found that there was a significant difference in the Mathematics achievement and attitude of students. The results of the study indicated higher achievement and positive attitudes with CAI treatment groups. Making connections between the goals of Mathematics education and CAI offers a valuable means for improving mathematical knowledge and skills and hence performance in Mathematics. This indicates the need for teachers to provide opportunities for all students to engage in CAI groups in Mathematics.

Ghulam Murtaza (2006) studied on effect of Computer Assisted Instruction (CAI) on the secondary school students’ achievement in Science. CAI was use as a tool to facilitate and improve instruction. CAI programmes use tutorials, drill and practice, simulation, and problem solving. This study was designed, to see the effect of computer-assisted instruction as a supplementing strategy on the academic achievement of secondary school students in the subject of science. It was found that the students with high achievement level were taught through computer-assisted instruction. The computer-assisted instruction was found equally effective for both male and female students.

Mohammad, R. I. and Hadi, D. (2011) studied the effect of CAI on science achievement of higher primary students CAI software package and found that CAI has effect on academic achievement in science subject of students in experimental group and scores of students in experimental group were higher than the students who were teaching by traditional method in control group. The results of the study also revealed that there is no significant difference between boys and girls in academic achievement scores in science of experimental group after implement the CAI software package teaching method and both of two groups have been got higher scores in science subject.

(4) Effectiveness of CAI on students’ on social studies

Alpay Aksin (2006) study the effect of Computer Assisted Instruction on achievement in teaching of social studies lesson in primary education and found that experimental group is more successful with respect to the levels knowledge, comprehension, and application. At the end of the study, it is determined that computer assisted instruction in teaching social studies is more effective for acquiring knowledge, comprehension and application level behaviours than traditional instruction
Adeyemi B. A. (2012) investigated the effect of Computer Assisted Instruction (CAI) on junior secondary school students’ achievement in social studies and found that there is significant main effect of academic ability on students’ achievement in social studies. The high academic ability students were significantly better than the low ability students in their achievement in social studies.

(5) Effectiveness of CAI on students’ other benefits

The effects of CAI on students’ achievement are not only on various subject. Some researchers show influence of CAI on other benefits.

Capper and Copple (1985) found that CAI students have more of an internal locus of control/sense of self-efficacy than conventionally instructed students. They also state that students’ attendance improved in computer assisted instruction classes as compared with the classes which lecture method was employed. CAI students (experimental group) had higher rates of time-on-task than traditionally instructed students (control group).

Bandura (1993) found that self-esteem and its traits has an important role in successfulness and dropping out of each student. Some traits of self-esteem such as belonging and acceptance is essential to persons mental health and identified that self-efficacy which is one of traits of self-esteem has effect on enhancing the motivation and performance of each person. The results of his study which gained by applying the CAI in teaching science subject to the students shown that CAI teaching method has effect on self-esteem of students and the results confirmed that self-esteem of students has increased after treatment and when students (boys and girls) are in this kind of educational environment, they will enhance their self-esteem sense.

2.2.12 Basic Education Core Curriculum 2008

The Basic Education Core Curriculum 2008 (Ministry of Education, 2008) has formulated for providing local communities and schools with the framework and orientation of preparing school curriculums. Teaching-learning activities organized for all Thai children and youths at basic education level are aimed at enhancing learners’ quality regarding essential knowledge and skills required for their lives in an ever-changing society. They will be empowered to seek further knowledge for continuous lifelong self-development.
The learning standards and indicators prescribed in Basic Education Core Curriculum 2008 aims to enable agencies concerned at all levels to clearly visualize expected learning outcomes throughout the entire course of study. It provides relevant local schools with confidence in their collaborative efforts to prepare school curriculums of higher quality and harmony.

**Vision:** The Basic Education Core Curriculum is aimed at enhancing capacity of all learners, who constitute the major force of the country, so as to attain a balanced development in all respects - physical strength, knowledge and morality. They will fully realise their commitment and responsibilities as Thai citizens and members of the world community. Adhering to a democratic form of government under a constitutional monarchy, they will be endowed with basic knowledge and essential skills and favourable attitude towards further education, livelihood and lifelong learning. The learner-centred approach is therefore strongly advocated, based on the conviction that all are capable of learning and developing themselves to their highest potentiality.

**Principles:** The principles underlying the Basic Education Core Curriculum are as follow.

1. The ultimate aim is attainment of national unity; learning standards and goals are therefore set with a view to enabling the children and youths to acquire knowledge, skills, attitude and morality to serve as a foundation for Thai-ness and universal values.

2. The curriculum facilitates education for all, who have equal access to education of high quality.

3. The curriculum facilitates decentralisation of authority by allowing society to participate in educational provision, which suits prevailing situations and serves local needs.

4. Structure of the curriculum enjoys flexibility regarding learning contents, time allotment and learning management.

5. The learner-centred approach is strongly advocated.

6. The curriculum is intended for education of all types - formal, non-formal and informal, covering all target groups and facilitating transfer of learning outcomes and experiences.
Aims: The Basic Education Core Curriculum is aimed at the full development of learners in all respects - morality, wisdom, happiness, and potentiality for further education and livelihood. The following goals have consequently been set for achievement upon completing basic education:

1. Morality, ethics, desired values, self-esteem, self-discipline, observance of Buddhist teachings or those of one’s faith, and applying principles of Sufficiency Economy Philosophy;

2. Knowledge and skills for communication, thinking, problem-solving, technological know-how, and life skills;

3. Good physical and mental health, hygiene, and preference for physical exercise;

4. Patriotism, awareness of responsibilities and commitment as Thai citizens and members of the world community, and adherence to a democratic way of life and form of government under a constitutional monarchy; and

5. Awareness of the need to preserve all aspects of Thai culture and Thai wisdom, protection and conservation of the environment, and public-mindedness with dedication to public service for peaceful and harmonious coexistence.

Key competencies: The Basic Education Core Curriculum is aimed at inculcating learners with the following five key competencies:

1. Communication Capacity: This refers to the capacity to receive and transmit information; linguistic ability and skills in expressing one’s thoughts, knowledge and understanding, feelings and opinions for exchanging information and experience, which will be beneficial to oneself and society; negotiation for solving or reducing problems and conflicts; ability to distinguish and choose whether to receive or avoid information through proper reasoning and sound judgement; and ability to choose efficient methods of communication, bearing in mind possible negative effects on oneself and society.

2. Thinking Capacity: This refers to the capacity for analytical, synthetic, constructive, critical and systematic thinking, leading to bodies of knowledge creation or information for judicious decision-making regarding oneself and society.
3. Problem-Solving Capacity: This refers to the capacity to properly eliminate problems and obstacles, based on sound reasoning, moral principles and accurate information; appreciation of relationships and changes in various social situations; ability to seek and apply knowledge to prevent and solve problems; and ability for judicious decision-making, bearing in mind possible negative effects on oneself, society and the environment.

4. Capacity for Applying Life Skills: This refers to the capacity for applying various processes in daily life; self-learning; continuous learning; working; and social harmony through strengthening of happy interpersonal relationships; elimination of problems and conflicts through proper means; ability for self-adjustment to keep pace with social and environmental changes; and capacity for avoiding undesirable behaviour with adverse effects on oneself and others.

5. Capacity for Technological Application: This refers to the ability to choose and apply different technologies; skills in application of technological processes for development of oneself and society in regard to learning, communication, working, and problem-solving through constructive, proper, appropriate and ethical means.

Desired characteristics: The Basic Education Core Curriculum focuses on learners’ development for attainment of the following desired characteristics, which enable learners to enjoy their lives as Thai citizens and global citizens:

1. Love of nation, religion and the monarchy
2. Honesty and integrity
3. Self-discipline
4. Avidity for learning
5. Applying principles of Sufficiency Economy Philosophy in one's way of life
6. Dedication and commitment to work
7. Cherishing Thai nationalism
8. Public-mindedness

Learning Areas: Observance of the principles of development of the brain and multiple intelligence is required to achieve learners’ balanced development. The Basic Education Core Curriculum has therefore prescribed the following eight learning areas:
1. Thai Language: (knowledge, skills and culture in language application for communication; delight in and appreciation of Thai wisdom; and pride in the national language)

2. Mathematics: (application of knowledge, skills and scientific process for problem-solving, way of life and further education; reasonableness; favourable attitudes toward mathematics development of systematic and constructive thinking)

3. Science: (application of knowledge and scientific process for study and search for knowledge and systematic problem-solving; logical, analytical and constructive thinking; and scientific-mindedness.

4. Social Studies, Religion and Culture: (peaceful coexistence in Thai society and the world community; good citizenship; faith in religious teachings; appreciation of resources and the environment; and patriotism and pride in Thai nationalism)

5. Health and Physical Education: (knowledge, skills and favourable attitude towards strengthening one’s own health and that of others; prevention and proper treatment of various things affecting one’s health; and life skills)

6. Art: (knowledge and skills for initiation; inspiration and imagination in creating works of art; aesthetics and art appreciation)

7. Career and Technology: (knowledge, skills and attitude towards work; management; way of life, livelihood and application of technology)

8. Foreign Languages: (knowledge, skills, attitude and culture in foreign language application for communication, seeking further knowledge and livelihood)

For each learning area, the learning standards serve as the goals in developing learners’ quality. These standards prescribe what the learners should know and should be able to perform. They also indicate moral and ethical values as well as desired characteristics upon completing education at basic level. Besides, the learning standards serve as essential mechanisms in advancing the whole education system, as they inform us of the contents and teaching and evaluation methods. They also serve as instruments for quality assurance and are adopted for both internal quality assurance and external evaluation, practiced at both educational service area and national levels. Monitoring for internal quality assurance is essential, as it indicates the extent of success in achieving the quality as prescribed in the pertinent standards.
The learning area of career and technology contributes to the development of learners in acquiring knowledge and understanding the basic skills essential to their lives. Learners will be alert to the changes and able to apply the knowledge about living, career and technology into their work with creativity and competitiveness in Thai society and the world community. Learners will be able to see the prospects for their future careers, love working and have a favourable attitude towards work, as well as lead a happy life in the society, based on the principles of sufficiency.

The learning area of career and technology is aimed at learners’ holistic development with a view to enabling them to acquire the knowledge, the capacity and the essential skills required for work. Learners will thus efficiently see the prospects of their future careers and further education.

**Learning standards of career and technology subject**

There are 4 learning standards in career and technology subject:

**Standard 1: Living and Family:** Understanding of the concept of the work; possessing creativity and skills in various respect-work processes, management, problem-solving, teamwork and investigation for seeking knowledge, morality, diligence, and awareness of the need to economize on the consumption of energy, resources and the environment for living and for family.

**Standard 2: Design and Technology:** Understanding of the technology and technological processes; designing and making objects, utensils or the methodologies through the creative technological processes; selective utilization of the technologies beneficial to one’s life, society and the environment; participation in sustainable technological management.

**Standard 3: Information and Communication Technology (ICT) Understanding,** appreciation and efficient, effective and ethical application of information technology in searching for data, communicating, problem-solving, working and livelihood. Use the computers to facilitate creation of work or projects with the awareness and the responsibility.

**Standard 4: Career understanding and acquiring the necessary skills and experiences; proper perception of future career; the technological application for career development; possessing morality and favourable attitude towards careers.**
In the present study, Standard 2: Design and Technology and Standard 3: Information and Communication Technology (ICT) are selected to use for the instruction.

Main contents include in career and technology subject:

1. Life and Family: This includes the work in daily life; ability to help themselves, their families and society under the guidance of the principles of sufficiency economy; intent not to destroy the environment; emphasis on the actual practice until the attainment of the confidence and the pride in their accomplishments in order to discover their own capacities, aptitudes and interests.

2. Design and Technology: This includes the creative development of human capacities by applying the knowledge with technological processes to create objects, utensils and methodologies, or to increase efficiency in life.

3. Information and Communication Technology (ICT): This includes the process of information technologies; communication; the search for data; application of data and information; solution of problems or creation of work; values and effects of ICT.

4. Career: This includes the skills essential to learners’ career recognition of the importance of morality, ethics and favourable attitude towards careers; ability to use technologies appropriately; appreciation of values of honest careers; and ability to see the prospects for future careers.

Indicators: Indicators specify what learners should know and be able to perform as well as their characteristics for each grade level. Indicators reflect the learning standards. Being specific and concrete, they can be utilized for prescribing contents, determining learning units and organizing teaching-learning activities. They serve as essential criteria for evaluation in order to verify the learners’ quality.

Learners’ quality of career and technology subject

The learners’ quality refers to the following abilities:

1. Ability to understand the methods of working for their livelihoods; establish achievements through creative thinking; be skilful in team working, management, problem-solving and seeking knowledge; work morally and have an awareness of cost-effective and sustainable use of energy and resources.
2. Ability to understand the relationship between technology and other disciplines; analyze technological systems; have creativity in problem-solving or responding to the needs; make and develop objects and utensils through safe technological processes by using software to design or present the accomplishments; analyze and choose to apply the technologies appropriate to daily life, society and the environment, and manage the technologies through the clean technologies methods.

3. Ability to understand the components of the information systems, the components and the principles of functioning of computers, systems of data communication for computer networks, the characteristics of computers and connecting accessories, and be skilful in using computers to solve problems; write programming languages; develop computer programs; use hardware and software; communicate and search for data on the Internet; use computers to process data to serve as information for decision-making; use ICT to present achievements and use computers to create work or projects.

4. Ability to understand the guidelines for entering the employment, the choices and the application of technologies appropriate to the careers; have experiences in the careers they have aptitudes and interests, and have the desired characteristics for the careers.

2.3 REVIEW OF THE PAST STUDIES

The review of literature is a link between the research proposed and the past studies. It tells the reader about aspects that have been already established or concluded by other authors, and also gives a chance to the reader to appreciate the evidence that has already been collected by previous research, and thus projects the current research work in the proper perspective.

2.3.1 Importance of review of the past studies

Review of the past studies is a very important aspect of any research both for planning the work as well as to show its relevance and significance. It provides the background and justification for the research undertaken. According to Bourner, T. (1996) there is good reasons for spending time and effort on a review of the literature before embarking on a research project. These reasons include:
(1) To identify gaps in the literature, information and ideas that may be relevant to research project, methods that could be relevant to research project, and seminal works in researcher’s area.

(2) To avoid reinventing the wheel (at the very least this will save time and it can stop from making the same mistakes as others)

(3) To carry on from where others have already reached (reviewing the field allows the researcher to build on the platform of existing knowledge and ideas)

(4) To increase the breadth of knowledge of researcher’s subject area

(5) To provide the intellectual context for researcher’s work, enabling researcher to position the project relative to other work

(6) To put the work into perspective

(7) To demonstrate that the researcher can access previous work in an area

As far as the literature review process goes, ultimately the goal for the researcher is to complete their review in the allocated time and to ensure they can maintain currency in their field of study for the duration of their research.

Leedy & Ormrod (2005) mentioned two critical considerations stem about the review of past studies:

(1) Research must enhance the current understanding of a phenomenon, or contribute to enhance the body of knowledge.

(2) Research must communicate what was discovered in the new study.

Knowing the current status of the body of knowledge in the given research field is an essential first step for any research project.

Leedy & Ormrod suggest that an effective literature review helps the researcher to understand the existing body of knowledge including where excess research exists (i.e. what is already known?) and where new research is needed (i.e. what is needed to be known?). It provides a solid theoretical foundation for the proposed study, substantiating the presence of the research problem, justifying the proposed study as one that contributes something new to the body of knowledge, and framing the valid research methodologies, approach, goals, and research questions for the proposed study.
Kumar, V. (2009) states that review of the past studies help the research to make sure that the researches are not repeating the work that someone has already done earlier. It provides an option of modifying the work by adding a new perspective or altering some of the methods of research to obtain a perspective that will be different from earlier works and thus more valuable.

It can be summarized that review of literature is a very important part of research studies. It provides ideas, theories, explanations or hypotheses valuable in formulating the problem. It also suggests methods of research appropriate to the problem, to locate comparative data useful in the interpretation of results and to contribute to the general scholarship of the researcher. Review of literature is also important to highlight difference in opinions, contradictory findings or evidence, and the different explanations given for their conclusions and differences by different authors.

2.3.2 Past studies related to the effectiveness of computer assisted instruction on learning achievement

This chapter presents 11 past researches related to the effectiveness of computer assisted instruction on learning achievement which was already done in Thailand and in different countries as follow:


Objective of the study: The major objectives of the study were:

1. To find out the relative effects of computer-assisted instruction as supplementing strategy on the academic achievement in science;

2. To explore the difference between treatment effects on the students of high and low intelligence;

3. To investigate the difference between treatment effects on male and female students.

Research design: This study was designed, to see the effect of computer assisted instruction as a supplementing strategy on the academic achievement of secondary school students in the subject of science. The experimental research was adopted for this study. To
achieve the objectives of the study, following null hypotheses were tested:

1. There is no significant difference between the mean scores of the students taught science with CAI as supplementing strategy and without CAI;
2. There is no significant difference between the mean scores of the high achievers and low achievers of experimental and control groups;
3. There is no significant difference between the mean scores of male and female students of experimental and control groups.

**Tool used in the study**: The study was based on 'Operant Conditioning' theory of B. F. Skinner. There were two different treatment patterns applied during the experiment. Both the groups were taught through routine method by the same teacher. The computer-assisted instruction was used as additional strategy for the experimental group. During the experiment period, the experimental group received the treatment of independent variable, i.e. computer-assisted instruction whereby the experimental group was exposed to certain web-cites consisting of drill and practice, tutorials, simulations and animation. In the meanwhile he control group was kept busy in other activities such as guided practice and independent practice. This was adopted to control the variable of time and to realize the primary objective of the study. The experiment continued for six weeks. In order to find out treatment effects, a teacher-made post-test was administered to the experimental as well as control group immediately after the treatment (teaching) was over. The purpose of this test was to measure the achievement of the students constituting the sample of the study. Final data were collected from 40 students, 20 from each group.

**Sample of the study**: Secondary school students studying science subjects constituted the population of the study. The students of 9th class of The City School, H-8, Islamabad were selected as sample of the study. Only students studying biology as elective subject were included in the sample. Sample students were assigned to two group i.e. experimental group and control group. Both the groups were equated on the basis of their achievement scores in previous semester in the subject of biology. Each group comprised 20 students.

**Technique of analysis of data**: The achievement scores of the sample were obtained as a result of the post-test. After obtaining the scores, the lists were prepared for
each group and the means, standard deviations, differences between means were computed. Significance of difference between the mean scores of both the groups on the variable of previous achievement was tested at .05 levels by applying t-test. To see the treatment effects for male and female students as well as high and low levels of achievement of both the groups, the factorial design (2 X 2 analysis of variance) was applied. For this purpose the students of both groups were divided into two halves, namely, high achievers (above the mean score) and low achievers (below the mean score) on the basis of scores on previous achievement test.

**Major findings**: The results of the analysis of data revealed that the students taught through computer assisted instruction (CAI) as supplementary strategy performed significantly better. The students with high achievement level showed better results than those with low achievement level when taught through computer-assisted instruction. The computer assisted instruction was found equally effective for both male and female students.

**STUDY 2**: A Comparison of Traditional Method and Computer Assisted Instruction on Students Achievement in General Science. (Muhammad Khalid Mahmood)

**Objective of the study**: The purpose of this study was to examine the effect of computer assisted instruction on student achievement in general science as compared to traditional method of instruction.

**Research design**: The experimental research was designed, to see the effect of computer assisted instruction students’ achievement of secondary school students in the subject of science. Study was conducted using posttest only control group design with matched groups on intellectual capacity. Students of the experimental group received computer assisted instruction, for a period of nine weeks in the computer laboratory of the school and the control group studied general science in their class as traditional method.

**Tool used in the study**: Computer assisted instruction program for the experiment was developed by the researcher using interactive tutorial mode of presentation, covering four chapters from the textbook of general science for secondary classes. Each tutorial comprises a text segment in Urdu followed by multiple choice questions and immediate feedback. Hyperlinks are added to the program for explanation of the text.
Post-test was an achievement test comprising one hundred multiple-choice items, measuring knowledge, comprehension and application components of achievement in three types of the selected content area i.e. biology, chemistry and physics. To evaluate the CAI program in terms of student’s opinion an opinionnaire was administered to the experimental group students.

Sample of the study: An experiment was conducted with 9th class students of session 2001-2003 studying general science at Government Central Model High School No.21, Lahore.

Technique of analysis of data: Eleven null hypotheses were tested by analyzing the data on achievement test. Paired t-test was applied to determine the significance of difference between the mean achievement scores of the experimental and the control groups. Analysis of variance (ANOVA) was applied to explore the difference among the mean achievement scores by the three intellectual capacity sub group of the experimental group. Contract analysis was also run to find out the sub group significantly different on achievement.

Major findings: The results of the study revealed that the experimental group outperformed the control group in all achievement areas i.e. overall, by levels of cognitive domain and by type of content. Achievement scores by the intellectual capacity grade. Students like the CAI program and benefited from it. They found it better mode of instruction than the traditional method. Efforts are being made on the part of the government to expand computer facilities in schools. Expansion in computer literacy, a computer education and computer facilities warrants the need of CAI.


Objective of the study: The purposes of this research were:

1. To study the fundamental information about constructing a Computer Assisted Instruction (CAI) on the Buddhism Principle of Four Gharavasa-Dhamma for tenth graders;

2. To construct the CAI to meet the 80/80 efficiency criterion;

3. To experiment the CAI with tenth graders;
(4) To know the students’ learning achievements and their opinions after having studied the CAI

**Research design:** The experimental research was designed, to see the effect of computer assisted instruction students’ achievement of secondary school students in the Buddhism principle of Four Gharavasa-Dhamma subject. Study was conducted using pretest - posttest design and testing the significant difference between the pretest-posttest scores on students’ learning achievements.

**Tool used in the study:** The Computer Assisted Instruction (CAI) on Buddhism Principle of Four Gharavasa – Dhamma for Tenth Graders which required 4 hours for study was used for gathering data. The structured interview forms and opinionnaire were used for gathering data about the students’ opinions after studying CAI. Achievement tests (pretest – posttest) was used to obtained the students’ learning achievement scores.

**Sample of the study:** An experiment was conducted with the 30 tenth graders randomly selected by the Simple Random Sampling Method from tenth graders studying in two classes at Bang Pa-in ‘Rachanukor 1’ School, Bang Pa-in district, Phranakhon Sri-Ayutthaya province during the second semester of academic year 2004.

**Technique of analysis of data:** The statistical methods used in data analysis were percentage (%), mean (\( \bar{X} \)), standard deviation (S.D.), t - test (dependent type) and content analysis.

**Major findings:** The results of this study are as follow:

1. The fundamental information in the CAI constructed on the Buddhism principle of Four Gharavasa -Dhamma for tenth graders consisted of four aspects i.e.
   (a) the CAI model was big font size, animation, colouring display, easy content, cartoons, musical sound effects which needed one student per a computer and the CAI could be taken to study both inside and outside classes;
   (b) The CAI content consisted of meaning, importance, use, the story of the Buddha’s previous life and example for daily practice;
   (c) The CAI utility was for student’s learning, revising and instructional preparation;
(4) Evaluation consisted of pretest-posttest and students’ opinions on the CAI.

2. The content of the CAI on Buddhism principle of Four Gharavasa-Dhamma were: Sacca; truth and honesty; Dama; taming and training oneself; adjustment; Khanti; tolerance; forbearance; Caga; liberalty; generosity. The constructed CAI met the efficient criterion of 83.13/83.67, which was higher than the required criterion.

3. Due to researcher’s observation, the students could study the CAI by themselves, especially when the CAI made quickly feedback ‘true’ or ‘false’ answer.

4. The students’ learning achievements of pretest and posttest were statistically significant difference at the 0.01 level and the students’ opinions towards the CAI were at the highest levels both in whole part and in details.

STUDY 4: Effect of Computer Assisted Instruction on Achievement in Teaching of Social Studies Lesson in Primary Education. (Alpay Aksin (2006))

Objective of the study: The purpose of this study was to investigate the effect of computer assisted instruction on 7th grade students’ achievement in social studies. The essential question investigated is that “Is there any significant difference between traditional classroom and computer assisted instruction classroom with respect to achievement?”

Research design: The quasi-experimental research was designed, to see the effect of computer assisted instruction students’ achievement of secondary school students in the social subject. The experimental and control groups, some variables such as students’ genders, numbers, their average degrees while passing the 6th classes, their average marks in social studies lesson at the end of the educational year of the 6th classes and the results of the pre-tests were taken into consideration. Computer assisted instruction is applied to the experimental group, traditional instruction which is teacher-centered and lecturing method is given to the control group.

Tool used in the study: Computer assisted instruction programme for the experiment which was developed by the researcher using interactive tutorial mode of presentation of social studies for 6th classes students was the tool of the study.
Sample of the study This study based on experimental method was carried out in Yavuz Selim Primary School and Dr. Sedat-Dr. Melahat Baran Primary School during the 2004-2005 academic year in Sungurlu, Çorum.

Technique of analysis of data: The data collected is obtained from 15 knowledge, 15 comprehension, 10 application, totally 40 questions from a multiple choice-test. Mean ($\bar{X}$), Standard deviation (S.D.), and t-test were used to analyze the data.

Major findings: The results of the study revealed that the experimental group is more successful with respect to the levels knowledge, comprehension, and application. At the end of the study, it is determined that computer assisted instruction in teaching social studies is more effective for acquiring knowledge, comprehension and application level behaviours than traditional instruction.


Objective of the study: The purpose of this study was to investigate the effect of using Computer Assisted Language Learning software programme of English language on the achievement of secondary students in Jordan.

Research design: The quasi-experimental research was designed, to see the effect of Computer Assisted Language Learning on achievement of secondary school students in the English subject. Computer assisted instruction was applied to the experimental group and lecturing method was given to the control group.

Tool used in the study: The instruments of the study were Computer Assisted Language Learning software programme for teaching the passive voice and an achievement test. It was developed by the researcher.

Sample of the study: The sample of the study consisted of 212 secondary school students distributed randomly on four experimental groups and four control groups.

Technique of analysis of data: An Analysis of Covariance (ANCOVA) was used to find out the effect of the effect of Computer Assisted Language Learning programme on the students’ achievement in the passive voice.
Major findings: The results of the study revealed that the students of experimental group obtained more successful than the students in control group.

1. There were statistically significant differences between the students’ achievement mean scores in grammar attributed to the Computer Assisted Language Learning programme. This difference is in favour of the students in the experimental group.

2. There were statistically significant differences between the students’ achievement mean scores in grammar attributed to gender. This difference is in favour of male students.

3. There were statistically significant differences between the students’ achievement mean scores in grammar attributed to stream of study. This difference is in favour of the scientific stream students.

In light of the findings of the study, it was recommended that Computer Assisted Language Learning was effected on secondary school students’ achievement.


Objective of the study: The study investigated the effect of computer assisted instruction on the performance of secondary school students in biology. Specifically, the study examined:

1. The difference in performance in biology, if any, of secondary school students exposed to individualized computer assisted instruction, cooperative computer assisted instruction, and those exposed to conventional instruction.

2. The influence of students’ gender on their performance in biology, when they are exposed to individualized computer assisted instruction, or cooperative computer assisted instruction.

Research design: This study was a quasi-experimental type, of the pre-test, post-test, non-equivalents, non-randomized, control group design. The design is a 3x2 factorial design. This paradigm represents three levels of treatment: the individualized Computer Assisted Instruction (experimental group 1), Cooperative Computer Assisted Instruction
(experimental group 2) and the Conventional Instruction (control group); and two levels of
gender (Male and female).

**Tool used in the study**: The instruments for this research were the treatment
instrument “Computer Assisted Instructional Package (CAIP)” and the test instrument,
“Biology Performance Test (BIOPET)”. The treatment instrument, Computer Assisted
Instructional Package (CAIP) on Biology, was a self-instructional, interactive package that
lasted for 21/2 hour for an average student. It contained five lessons structured into modules.
The topics covered in the package are food chain, food web, energy flow, nutrient,
movement, and pyramid of numbers, all from the ecology aspect of the Nigerian senior
secondary biology curriculum. It was developed by the researchers, with the assistance of a
professional programme developer using Dream weaver and flash that is, written in Hypertext
Markup Language (HTML) with illustrations converted to Graphic Interchange Format (GIF).
Intrinsic programming sequence in which single alternative frame exist to reinforce concepts
that appear difficult to some students was adopted. At a consistent portion of each frame,
navigation buttons were included.

In the development of the package four methodological phases were strictly
followed: analysis, design, implementation and validation. In analysis stage, students’
cognitive skills to be improved were considered as a baseline for the development of
components of the software, and evaluation instruments were also analyzed and
developed at this stage. At the design stage, storyboards, scripts, frameworks and other
aspects of the software were defined. At the implementation stage, the software development
was based on user-centered design, where the opinion, interests, needs, emotions, thoughts,
and so on of users became key factors in the software’s
development. Validation involved the evaluation by biology experts for the appearance,
operation and logic of hyperlink, spelling, grammar, readability, and clarity from the viewpoint
of persons unfamiliar with the content.

In addition, end users’ usability evaluation was done through a pilot study on a
sample, similar to the final sample used in the study. The results obtained in the usability
experience were used for improvement of the package.

The test instrument, Biology Performance Test (BIOPET), was a 30 item multiple-
choice objective test with five options each which were drawn from the past West African
Examination Council (WAEC) Senior Secondary Certificate Examination biology paper II questions. The test content was based on a table of specification covering the six levels of cognitive domain of learning.

Sample of the study The target population of this research was the first year senior secondary biology students in Oyo town and Ibadan city, Nigeria. The nature of the study, however, required that the research sample was purposively selected. This is because a research on CAI must necessarily be conducted in schools where computers are available for students’ use and where the students are computer literate. This was why the NESTO College, Oyo, and Ise Oluwa Montessori Secondary School, Ibadan were purposely sampled for the study. These two schools were selected as the experimental groups. A third school, St. Francis Catholic College, Oyo was also sampled as the control group, as the school is believed to be more or less equivalent in standard to the schools used for the experimental group.

The sample for Experimental Group 1 is made up of 40 students. This comprises of 20 males and 20 females.

The Experimental Group II also has 40 students made up of 19 males and 21 females, while the control group was made up of 19 males and 21 female students.

Technique of analysis of data : All the groups (experimental and control groups) were subjected to the Biology Performance Test (BIOPET) as pre-test. Then, the students in the first experimental (individualized) group were exposed to CAIP which had been installed on desktop computers using a web browser (Explorer or Firefox), while the second experimental group were exposed to the same content with four students working on a desktop computers. Other applications such as Internet access, CAI packages, games, and so on were disabled or removed. The students in the experimental groups were introduced to the CAI format under teacher’s supervision long enough for them to be familiar with the navigation buttons and use the package independently. In addition, they were encouraged to take enough notes that could be useful for them in the post test.

The control group students were exposed to the conventional teaching method on the same content used for experimental groups. They were taught using conventional classroom format. The classroom contained a chalkboard, overhead projector, and charts which were used for the instruction. The treatment for all the groups lasted for five weeks.
After the treatment the three groups were exposed to the BIOPET which had been rearranged as post test.

The scores of students in the three groups were analyzed using ANCOVA. The analysis was done using the three research hypotheses stated for the study.

**Major findings**: The results of the study are as follow:

1. There was no significant difference in the performance of students in biology when they are exposed to (i) Individualized Computer Assisted Instruction (ICAI), (ii) Cooperative Computer Assisted Instruction (CCAI), and (iii) Conventional Instruction (CI).

2. There is no significant difference between the performance of male and female students in biology when they are exposed to individualized computer assisted instruction (ICAI). Analysis of covariance (ANCOVA) was used to find out the effect of the main treatment (ICAI) on the performance of the male and female student.

3. There is no significant difference between the performances of male and female students in biology when they are taught using Cooperative Computer Assisted Instruction (CCAI). Analysis of Covariance (ANCOVA) was used to find out the effect of CCAI (the main treatment) on the performance of female and female students.

**STUDY 7 : Effect of CAI on Self-Esteem of Higher Primary Students.** (Mohammad Reza Iravani and Hadi Delfechresh: 2010)

**Objective of the study**: The purpose of this study was to determine the effect instructional media (computer – assisted instruction (CAI) vs. traditional textbook) on self-esteem of students during taught science by CAI software package in science subject. The effect of gender on self-esteem was also investigated.

**Research design**: The quasi-experimental research was designed, to see the effect of Computer Assisted Instruction (CAI) on achievement of 8th grade students in the science subject. Computer assisted instruction (CAI) was applied to the experimental group and traditional text book method was given to the control group.

**Tool used in the study**: The instruments of the study were the Computer Assisted Instruction (CAI) and the traditional text book method on 5th grade science subject. Students had registered for 3 days in week (9 weeks and 25 sessions) computer console that
accompanied the teaching science by CAI software package in science subject and had been randomly assigned to the control and experiment group. The experimental group (treatment) used a CAI method to teach science subject and the control group used the traditional teaching method. The cooper smith self-esteem inventory was the instrument administered during this study to measure students' self-esteem change.

**Sample of the study** The experimental research conducted on the sample of 200 students of 8th standard of higher primary school (middle) (100 males and 100 females) of Ahwaz city in Iran.

**Technique of analysis of data**: Mean (\( \bar{X} \)), Standard Deviation (S.D.), ANCOVA, t-test, were employed to determine: (1) Experimental group (treatment) versus control group self-esteem difference; and (2) Male versus female self-esteem difference.

**Major findings**: The results of the study reveled that the mean and standard deviation scores in pre-test and post-test in experimental group after treatment were greater than mean and standard deviation scores in pre-test and post-test in control group. The result from an ANCOVA analysis include data on the post-test science achievement scores for the experimental and control groups after using the pre-achievement sores in science in previous semester and non verbal intelligence (SPM) indicated that the gain scores of students in the experimental group were significantly higher than the control group. The analyzed of the t-test value of gain score between boys and girls has showed that there is no significant difference between boys and girls of 8th standard students in self-esteem as learners scores after use of CAI.

**STUDY 8**: An Investigation of the Impact of Computer Assisted Instruction (CAI) on Reading Comprehensive of Middle School Sixth grade in a Rural South Carolina School District. (Gillard, Delphine: 2010)

**Objective of the study**: The purpose of this study was to examine the impact of Computer Assisted Instruction (CAI) on Reading Comprehension by analyzing test score reports of the participants before and after the implementation of Computer Assisted Instruction. The study then examined the impact of CAI on the English Language of sixth grade students in a rural district in South Carolina. This study further explored whether CAI
significantly impacted the reading comprehension of students based upon race, gender and socioeconomic status.

**Research design:** The experimental research was designed, to see the impact of Computer Assisted Instruction (CAI) on Reading Comprehension of sixth grade students in a rural district in South Carolina.

**Tool used in the study:** The instrument of the study was the Computer Assisted Instruction (CAI) on Reading Comprehension of sixth grade students.

**Sample of the study:** Participants for this study were 1,355 sixth grade students in the public school students from a rural school district in the low country of South Carolina. A total of six middle schools were divided, three Compass Learning schools and three non-Compass Learning schools.

**Technique of analysis of data:** Data used in this study were examined using the following statistical procedures: Descriptive Statistics, Analysis of Variance (ANOVA), and t-test. In order to examine the hypotheses, an Analysis of Variance test was performed to investigate the relationship between student achievement, programme status (Compass Learning versus non-Compass Learning), gender, race, and meals status (free/reduced versus full price). The t-test model was used to investigate the implementation of Computer Assisted Instruction (CAI) on Reading Comprehension, 6th grade PASS ELA achievement, program status (Compass Learning versus non-Compass Learning), gender, race, and meals status (free/reduced versus full price). The sixth grade PASS ELA scale score was the dependent variable.

**Major findings:** The results of this study revealed that there was no significant difference in the 6th grade PASS ELA scores of Compass Learning versus non-Compass Learning students. The adjusted mean for the Compass Learning students with free/reduced-price meals was lower than that for non-Compass Learning students. On the other hand, the adjusted mean for Compass Learning students with full-price meals was higher than that for non-Compass Learning students with full-price meals. It was also revealed that there was no significant difference in the 6th grade PASS ELA scores of Compass Learning versus non-Compass Learning students while taking meals status (free/reduced versus full price) into
consideration. Further, this investigation found that there was a significant difference in PASS ELA scale scores in regards to gender.

The programme status (Compass Learning versus non-Compass Learning) had no effect on student achievement in terms of the dependent variable (sixth grade PASS ELA scale score) on all the ANOVA models used to answer the four research hypotheses. Subsequent models determined that gender had an effect on student achievement with females outperforming males by an average scale score points on the sixth grade PASS ELA. Race had an effect on student achievement with white students outperforming black students and Hispanic students. Meals status and program status appear to have an interactive effect on student achievement. The non-Compass Learning students with free/reduced-price meals outperformed the Compass Learning students with free/reduced-price meals. On the other hand, the Compass Learning students with full-price meals outperformed the non-Compass Learning students with full-price meals.


Objective of the study : The purpose of this study was to design and develop a Computer assisted instructional module and to investigate its effects on students’ attitudes and achievement in matrices and transformations. The study was investigated under four questions: (1) What are the effects of the CAI module on students’ achievement in matrices and transformations? (2) Is there any significant difference in the achievement on matrices and transformations between subjects exposed to CAI module and those not? (3) What are the effects of the CAI module on students’ attitudes towards Mathematics course? (4) Is there any significant difference in attitudes towards lessons on matrices and transformations between subjects exposed to CAI module and those not?

Research design: The quasi-experimental research was designed, to see the effect of Computer Assisted Instruction (CAI) on students’ attitude and achievement in Matrices and transformation between form four students who received instruction using CAI module or conventional instruction method. Computer assisted instruction (CAI) was applied to the experimental group and conventional method was given to the control group.
**Tool used in the study**: The Mathematics achievement test (MAT) and the students’ Questionnaire (SQ) were the main instruments. The MAT instrument assessed the Students’ achievement on the concepts of matrices and transformations while SQ assessed their attitudes. Piloting of MAT and SQ gave Cronbach $\alpha$ coefficient of 0.72 and 0.8 respectively. The other was the students’ interview guide.

**Sample of the study**: The target population of this three – week research study was form four students from schools offering computer studies. The rationale for this criterion was to have students who are homogeneous in their knowledge and operation of the computer. The assumption was that prior computer use was necessary to enhance student learning with the CAI module. The students were drawn from Uasin Gishu district. Six classes from six schools were selected through cluster random sampling. In situations where there was more than one stream in the school, one stream was selected at random.

Seventeen schools that met the criterion were categorised into Boys’, Girls’ and mixed. For each category of school type, two schools were randomly selected. Eventually, the two treatments (CAI and Conventional instruction) were assigned at random to each of the two schools in each category.

As a result, 205 students, 105 in experimental groups and 100 in control groups participated in the study. 117 students were male and 88 were female. The Mathematics teacher in each of these classes was assigned to teach their class. Three teachers were trained on how to implement the CAI module.

**Technique of analysis of data**: Mean ($\bar{X}$), Standard Deviation (S.D.), ANCOVA, t-test, were employed for analysis of data. All statistical significance were tested at alpha = 0.05 level. Analyses of the pretest achievement and attitude scores were conducted to establish the homogeneity of subject groups.

**Major findings**: The results of the study reveled that the factorial ANOVA of achievement revealed not statistically significant difference for the main and interaction effects and school type. Also a 2 x 2 x 3 factorial ANOVA of attitude revealed not statistically significant difference for both main and interaction effects and School Type. These analyses indicated that the subjects were homogeneous in Mathematics achievement and attitude on pretest scores.
The results of this study also indicated that there was a significant difference in the Mathematics achievement and attitude of students. These indicate the need for teachers to provide opportunities for all students to engage in CAI groups in Mathematics. It is not suggested here that all Mathematics content be studied using CAI mode, however, Mathematics educators are encouraged to recognize the effectiveness and benefits of this alternative approach and to structure more CAI lessons in their classrooms. A possible explanation for the effectiveness of CAI learning in this study involves students’ active involvement in the learning process through frequent and student-machine interaction. However, differences were found according to gender within treatment groups.

STUDY 10: Effect of Computer Assisted Instruction (CAI) on Science Achievement of Higher Primary Students. (Mohammad Reza Iravani and Hadi Delfechresh: 2011)

Objective of the study: The purpose of this study was to bring a definition of CAI and types of it. Also due to importance of CAI in teaching and learning process and more clearly on academic achievement of students, it has done the teaching by CAI software package in science subject for 3 months and in higher primary schools. The study was to investigate the effect of CAI academic achievement in science subject of student in experimental group and control group.

Research design: The quasi-experimental research was designed, to see the effect of Computer Assisted Instruction (CAI) on academic achievement in science subject between students who received instruction using CAI and conventional instruction method. Computer assisted instruction (CAI) was applied to the experimental group and conventional method was given to the control group.

In this study 8 standard students (boys and girls) were selected for exposure to the CAI software package in Science subject, in the control group students had taught by traditional method which was teacher, class and chalk, blackboard, but the experimental group had taught by CAI software package. In order to study the effectiveness of the developed CAI two types of research design were utilized. Two groups, control group and experimental group randomly selected for boys’ school design and two groups Pre-test and Post-test in science achievement in control group and experimental group for girls’ school design. The pre-achievement scores in science of students in pervious semester and non-
verbal intelligence test scores (SPM) have been obtained as co-variants for this research study. The educational software in science subject was referred to a software program which was included an explanation of all contents of science subject textbook with animation, description of examples and answer all practical questions, self – evaluation for each part of textbook at the end, questions samples for final exam at the end of the textbook and some entertainment in forms of game, conversation, story and drill. This was noticed to be known that the educational software was used in this study had been created in association with ministry of education in Iran and all higher primary schools (middle) are using this software to teach science along with teaching teacher in the classroom. This software has been created by ministry of education and no one before has used it for its research and firmly has approved by educational technology experts.

**Tool used in the study**: The Computer Assisted Instruction (CAI) on science subject was the main instrument. The science achievement test was used as instrument to assess the Students’ achievement.

**Sample of the study** The sample of this three months research study was 200 higher primary students (boys and girls) of Ahwaz city in Iran. It has collected around 200 academic achievement scores in science subject in form of pre-test and post-test from two different groups (control and experimental group). Pre-achievement scores in science in pervious semester and non verbal intelligence scores have obtained as co-variants for the study.

**Technique of analysis of data**: Mean (\( \bar{X} \)), Standard Deviation (S.D.), ANCOVA, t-test, were employed for analysis of data.

**Major findings**: The results of the study revealed that the mean scores of post-test in experiment group is greater than post-test of control group. The result from an ANCOVA analysis include data on the post-test science achievement scores for the experimental and control groups after using the pre-achievement scores in science in previous semester and non verbal intelligence (SPM) as co-variants. Data indicated that the gain scores of students in the experimental group were significantly higher than the control group.

It can be concluded that CAI software package has effect on academic achievement in science subject of students in experimental group and scores of students in experimental group were higher than the students who were teaching by traditional method in
control group and also the results revealed that there is no significant difference between boys and girls in academic achievement scores in science of experimental group after implement the CAI software package teaching method and both of two groups have been got higher scores in science subject.


**Objective of the study :** The study investigated the effect of Computer Assisted Instruction (CAI) on Junior Secondary School Students’ achievement in Social Studies. The study equally examined the interaction effects of treatment of academic ability on students’ achievement in Social Studies.

**Research design:** The study makes use of 2 x 2 randomized pre-test, post-test factorial design in a quasi-experimental setting. Two research assistants were trained on how to use the instruments. SSAT and SAAT were administered on the experimental and control groups prior to the instruction. The scores obtained after administering SSAT served as pre-test while the scores obtained from SAAT was used to classify the students into high and low ability groups. The students who scored below the mean score in SAAT are classified as low ability students while those whose score range between mean score and above were classified as high ability students.

The students in the two groups were taught three topics: (i) Leadership and followership (ii) Science and Technology and (iii) Transport and communication, the experimental group with the use of Computer Assisted Instruction (CAI) and the control group with the use of conventional method. At the end of the six weeks the post-test in Social Studies achievement was administered on the two groups.

**Tool used in the study :** Four major instruments were used in the study. These include:

(a) Social Studies Achievement Test (SSAT). This is a 60-item multiple choice test. It covers three levels of cognitive domain i.e. knowledge comprehension and application. This instrument has a reliability estimate of 0.87.

The Computer Assisted Instruction Guide for Social Studies (CAIGSS) is a programmed instructional package for the purpose of instruction in the classroom. The instructor guide which contain three major topics in Social Studies: (i) Leadership and followership (ii) Science and Technology and (iii) Transport and communication. The programmed Computer Assisted Instruction consists of a lesson plan for each lesson, and each of the lesson plan contains specifics such as: subject, content (topic), objective to be achieved at the end of the instruction, instructional materials, and assessment. The CAIGSS has a reliability value of 0.79.

(c) Teacher Operational Guide for Social Studies Instructional (TOGSSI)
The teacher Operational Guide for Social Studies is an instructional guide employed in teaching the control group by utilizing the conventional method of teaching. It consists of lesson plan written for each lesson. Each of the lesson plans contains specifics like: subject, content (topic), objective to be achieved at the end of the instruction, instructional materials, specific activities, and assessment. The TOGSSI has reliability coefficient of 0.71.

(d) Students’ Academic Ability Test (SAAT) consisted of 30-item multiple choice achievement test with five options per item A to E which the students were to choose the correct option. The SAAT has reliability coefficient of 0.78.

Sample of the study Simple random sampling was employed in selecting four co-educational schools from Ife Central and Osogbo Local Government Areas. Simple random sampling was employed in selecting 40 students in each of the schools selected. In all, 160 students constituted the sample for the study. Subjects were therefore classified into the experimental and control groups.

Technique of analysis of data: A two-way Analysis of Covariance (ANCOVA) was used to analyze the data obtained. Normally, one would have used a t-test analysis to compare the experimental and control group; and at the same time use t-test to compare low and high students’ academic ability, but this study is also interested in interaction effect which could only be carried out with the use of ANCOVA.

Major findings: The results of the study revealed that:

(1) There is no significant main effect of treatment (Computer Assisted Instruction and Conventional Methods) on student achievement in Social Studies.
(2) There is significant main effect of academic ability on students’ achievement in Social Studies. The high academic ability students were significantly better than the low ability students in their achievement in Social Studies.

(3) The findings further revealed that there is no significant interaction effect of treatment and students’ academic ability in their achievement in Social Studies.

2.4 Summary

The second chapter discussed about the effectiveness of Computer Assisted Instruction (CAI) on the learning achievement.

The effectiveness of computer assisted instruction (CAI) on the learning achievement refers to the ability of computer assisted instruction (CAI) to accomplish a learning purpose in the career and technology subject for eleven grade students. The learning achievement scores were obtained from the learning achievement test of eleventh grade students, before and after instructed by computer assisted instruction (CAI) in career technology subject under the title “Website implementation by Namo WebEditor 5.5”. This includes the power or the degree to be effective and the quality of being able to bring about the highest level of students’ learning achievement in knowledge, skills and attitudes or desirable performance.

The computer assisted instruction (CAI) in the present study is a form of learning that utilizes computers, and is typically intended as a way to supplement traditional teacher-based learning. The researcher attempts to present this research on the effectiveness of computer assisted instruction (CAI) as a teaching tool, especially as it impacts on the learning achievement. This study aims to find out whether or not CAI can be effectively utilized for teaching and the eleventh grade students’ learning achievement in career and technology subject.

Eleven past studies are reviewed in order to make sure that the present research is not repeating the work that someone has already done earlier. The researcher can get more information and ideas that relevant to research work. After viewing the past researches, it can be seen eleven past research studies on the effectiveness of Computer Assisted
Instruction (CAI) on the learning achievement in Science, Mathematics, social studies, Language and others benefits such as self-esteem, attitudes.

The present research studies the effectiveness of Computer Assisted Instruction (CAI) on the learning achievement in Career and Technology subject which was not appearance in any research. Therefore, this research is a unique research or only one research which indicates the effectiveness of Computer Assisted Instruction (CAI) on the learning achievement in Career and Technology subject. The learning achievement of eleven grade students is the dependent variables of the present study whereas the Computer Assisted Instruction (CAI) on the learning achievement in Career and Technology subject is the independent variables.

In order to go for data collection, plan & procedure as well as the development of the Computer Assisted Instruction (CAI) on the learning achievement in Career and Technology subject will be described in chapter 3.
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