THE EFFECT OF COMPUTER BASED INSTRUCTION ON STUDENTS ACHIEVEMENT IN BASIC ELECTRICITY IN TECHNICAL COLLEGES

BY

TIALOBI QUEEN CECILIA

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CERTIFICATION

I TIALOBI QUEEN CECILIA, Matric No: 2007/1/28320BT an undergraduate. Student of Industrial and Technology Education Department certify that the work embodied in this project is original and has not been submitted in part or full for any other diploma or degree of this or any other University.

Name **Sign - Date**

APPROVAL PAGE

This project has been read and approved as meeting the requirements for the award of B.Tech degree in Industrial and Technology Education of the Department of Industrial and Technology Education, School of Science and Science Education, Federal University of Technology, Minna.

____________________________ ____________________________

Supervisor **Sign- Date**

Head of Department **Sign- Date**

External Examiner **Sign- Date**

DEDICATION

I hereby dedicate this project to God Almighty for his divine providence, love, guidance and blessings upon my life. Also to My Family Members for their love, care and supports, and to my Friends.

ACKNOLEDGEMENT

I hereby appreciate God Almighty for his divine assistance and guidance given to me, for the successful completion of my studies in school. I profoundly acknowledge my supervisor Mal A. M Idris, my H.O.D , DR. E. J Ohize, and my internal reader, Dr Samuel and all my lecturers in the department of Industrial Technology Education who has contributed greatly to my life, may God bless them all and replenish their strength and wisdom. I also acknowledge my ad and beloved late Mum, may her gentle soul rest in Peace. To my brothers, and friends for being there for me at all times, for prayers, moral support, encouragement and financial support, may God bless and reward you in heaven.

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ABSTRACT

The study was designed to see the effect to see the effect of computer-based instruction on students' achievement in basic electricity in technical colleges. The major objectives of the study were; (1) To find the relative effects of Computer-based instruction as supplementary strategy on the academic achievement in Basic Electricity; (2) To determine the mean performance of both the control group and experimental group before using the computer-based instruction to teach basic electricity to the students; (3) To investigate the difference in the performance of male and female students taught basic electricity with Computer Based Instruction. The experiment was a quasi experiment with a population of 40 students. The sample of the study comprised 40 first year Basic Electricity student, sampled from Technical high school college, Warri. Sample students were divided into two groups of 20 students each. Group A, experimental group and Group B, control group. Both groups were equated on the basis of their achievement scores in the pre-test and post-test in basic electricity. Each students comprised 20 students. Three research questions and three hypotheses were answered and tested respectively. Mean and standard deviation was used to analyze the data for answering the research questions while analysis of variance (ANOVA) was used to test the hypotheses at 0.05 level of significance. On the basis of the data collected and analyzed for this study, the following findings were made with respect of the research questions; (i) It was revealed that the students of the experimental group and control performed equally in the Pre-test. (ii) Students taught with Computer Based Instruction (experimental group) scored higher in the Post-test than those taught with conventional lecture method (control group). (iii) There was no significant difference in the mean scores of male and female students taught with Computer Based Instruction. Based on the research findings, recommendations were made on the need to develop relevant CBI packages for teaching basic electricity in Nigerian Technical Colleges.

CHAPTER I

INTRODUCTION

Background of the study

Computer based Instruction (CBI) is defined as the use of the computer in the delivery of instruction to student. CBI was considered the technological phenomenon to revolutionize education and training. The use of the computer as a tool, such as programming, problem-solving, running application programs, developing computer architecture and administrative applications outside the domain of instructional and student management. In the past, students learned by traditional teaching methods infused with the current technology and the new teaching methods of the time. Three distinct methods of CBI are currently used in classrooms and labs in academia today: (a) drill-and-practice, or tutorials; (b) learning and problem-solving tools; and (c) programming tools. Some educators perceive the use of these learning methods as the solution to the challenges of classroom teaching (Bell & Elmquist, 1992; Bruder, 1990; Cuban, 1993). Other educators perceive CBI as the implementation of an archaic teaching method of acquiring factual knowledge, accompanied by a drill-and-practice style, with little or no use of information processing skills (Underwood & Underwood, 1990). The rapid advances in technology, the need for lifelong learning, and the growth of non-traditional students have encouraged the use of the computer as a means of instructional delivery.

As early as the 1980's, computer-based instruction (CBI) was considered the technological phenomenon to revolutionize education and training. In the early 1960's, approximately a dozen years after the first commercial computer became available, a team at the University of Illinois began work on (1) a flat plasma panel for computer terminals and (2) software for a CAI system which was to become known as PLATO an acronym for Programmed Logic for Automatic Teaching Operations. Funded by numerous federal agencies, including the National Science Foundation and United States Office of Education, this effort eventually produced a training system which represents some of the most advanced thinking in the interactive process of communicating learning. Many of the PLATO software tools developed to support learning still serve as models for present day efforts and are described in a subsequent section. The primary function of PLATO was to provide a rich environment in which educators and trainers could create and deliver high quality interactive courseware to students in classrooms, homes, and offices with or without the presence of an instructor. Kemske reported in “The Computer-Based Training Report” (Filipczak, 1997) that computer-based training jumped to 15 percent of all training conducted by respondents in his study, up from ten percent the previous two years (1995 & 1996). Thirty-nine (39) percent of the respondents reported that the corporation’s intranet was going to be a means of delivering training in 1997. Training magazine’s “Industry Report 1999" reported that an estimate of 19 percent of all formal training was delivered via computer in 1998 and declined to 14 percent in 1999. Industry estimates predict that by 2003, no less than 30 percent of all training will be delivered over corporate intranets (Ryan, 2001).

With the advances of the technology and software surrounding the Internet, the conversion of courses from traditional face-to-face instruction into Web-based courses has become easier and is occurring more systematically in education. However, Phipps & Merisotis (1999) concluded that there is a lack of evidence that technology influences the learning process and that course design and pedagogy are important factors. There are those who believe that the theories and principles that guide practice in traditional face-to-face instruction can not be directly converted to computer-based instruction (Williams, 2000). There are also those who concluded that a single learning

theory is not enough, but that a quality learning environment should be based on instructional principles that are derived from multiple learning theories (Johnson and Aragon, 2002). However, there must be attempts at theoretical explanations for learning professionals to make teaching and learning decisions with confidence using this technology. In the pas
t, students learned by traditional teaching methods infused with the current technology and the new teaching methods of the time. As innovations in teaching have been developed, teachers have integrated these innovations into their classrooms. Where classroom was used in teaching and training students in electrical/electronics subjects in technical colleges, and higher institutions. It has been noted that “[e]vidence is to support technology advocates’ claim that 21st century information and communication tools, as well as more traditional computer based instruction applications, can positively influence student learning processes and outcome” (Cradler, McNabb, Freeman, &Burchett, 2002, p. 47). Computers began appearing in schools as early as the 1960s. In 1966, Patrick Suppes predicted that computers would change the face of education at a rapid pace. During the early stages of the introduction of computers in education, users were mainly restricted to small groups of dedicated teachers and selected students. Software-based educational programs of that era were developed by educators who had little or no commercial interests in mind. Originally the cost and processing power of computers posed the biggest obstacle to implementation in the educational arena. At that time, microcomputers were slow and limited in their capabilities.

Many of the initial economic and technical problems that hindered computer implementation were solved with the development of progressively more powerful and less expensive machines. These technological innovations led some educators to perceive computers, and later the Internet, as revolutionary tools that could be used to present interactive teaching material in novel ways that were previously not available through other media. Educational researchers also believed that computers offered the flexibility to adapt to different learning and teaching styles (Underwood & Underwood, 1990). The use of computer hardware and software technology in schools is on the rise (Gasiorowski, 1998). In their book, *Technology-Based Learning*, Ross and Bailey (1996) suggested that the assumptions and practices of schooling in the United States have changed from those of the industrial era to that of an information era. The authors suggested that "this paradigm shift from an industrial to an information society" (p. 12) will require the use of emerging technologies which, in turn, will test the fundamental premises of education. This phenomenon is witnessed in today's colleges and universities; educators are encouraged to include the use of personal computers and technology-based instruction in their teacher training programs (Bitter, 1989).

Personal computers clearly have great potential as instructional tools in the classroom (Moore, 1997). There is little doubt that computer technology will play a role in the classrooms of tomorrow. The trick is how to optimize usage and minimize disadvantages. The rapid advances in technology, the need for lifelong learning, and the growth of non-traditional students have encouraged the use of the computer as a means of instructional delivery. Some of the advantages for using the computer as a method of instructional delivery are that it: provides consistency of content delivery; provides training to remote locations; eliminates cost associated with employees' travel; provides means of tracking learner's progress; provides standardized testing; offers learner flexibility in controlling and pacing learning; provides for diverse learning needs; provides opportunities for practice through simulation; provides greater retention; and reduces the instructional time by approximately 30 percent. Two conclusions drawn from meta-studies on CBI are: (1) learners generally learn more using CBI than they do with conventional ways of teaching as measured by higher post-treatment test scores (Fletcher, 1999; Kulik, 1994), and (2) learners using

CBI generally do so in less time than those using traditional approaches (Kulik & Kulik, 1991; Orlansky & String, l979).

In addition, evaluating the effectiveness of CBI as a whole technology is very difficult. The inability to measure effectiveness is attributable, in part, to the fact that CBI is not just one component, but a complex range of services and activities carried out for instructional and learning purposes (Gibbons & Fairweather, 2000). Despite the abundance of research studies exploring a limited number of constructs in CBI, there have been only modest attempts at building a theoretical base for CBI. Williams (2000) found in her research on a framework for online environments for learning that there are several different views of what learning theory best fits learning by means of the computer. Because of these differences, it reiterated the need for theoretical approaches to learning. Williams (2000) found that an integration of behaviorist principles and constructivist principles may be best suited for computer-based instruction. The information to be learned needs to address variability in learning styles, provide motivation, and promote interactivity. Johnson and Aragon (2002) suggest that the learning environment should be comprised of the elements in behavioral, cognitive, and social learning theory. Steinberg (1991) also concludes that behavioral and cognitive learning theories should be integrated. CBI draws on learning theories, instructional models, practical experience, and technology. She synthesized theories of Bransford (1979) and Gagné (1977) and developed a framework for CBI that includes four components from learning theories and instructional models: target population, goals, task, and instruction; and two components from research and experience: computer application and environmental implementation. Kember and Murphy (1990) report that instructional design based on behavioral learning theory has been limiting and that new theories should be consistent with constructivist theories of cognitive psychology and allow for flexible, pragmatic development approaches.

Kember and Murphy believe that “technologies should teach learner to learn rather than act as passive purveyors of information or techniques for reducing learner involvement in the learning process. If teaching is the facilitation of learning, then efforts need to be concentrated on the learner rather than the instruction”. Based on these studies, it is becoming apparent that others besides the researcher-theorist believe that there is a need for an integration of theories and the development of a framework which can be empirically tested to provide the appropriate learning environment for computer-based instruction. Computer-based instruction can provide an effective and efficient device for implementing training to improve workplace performance. Educators of the adult populations in business and industry and learning professionals need to develop expertise as facilitators of computer-based learning and critical evaluators of technology. Moreover, computer-learning experiences often engage the interest of students, motivating them to learn and increasing independence and personal responsibility for education. Although it is difficult to assess the effectiveness of any educational system, numerous studies have reported that CBI is successful in raising examination scores, improving student attitudes, and lowering the amount of time required to master certain material. While study results vary greatly, there is substantial evidence that CBI can enhance learning at all educational levels. In some applications, especially those involving abstract reasoning and problem-solving processes, CBI has not been very effective. A theory of effective computer-based instruction for adults would aid them in this endeavor. Technology will continue to create new and more powerful learning environments.

Computer based instruction (CBI) improves academic achievement besides influencing student’s attitude and motivation. More research is however needed to further verify the effectiveness of computer based instruction on student achievement in basic electricity in technical colleges desirable.

Statement of the problem

Unfortunately students' achievement in the certificate examination at the South Eastern States Technical Colleges has been consistently poor since the year 2000 in Basic Electricity and other Electrical/Electronics subjects (NABTEB, 2006). Aina (2006) confirmed that this failure rate had persisted for the past ten years. Although many factors could be responsible for students' poor academic performance in any subject, it is a known fact that the instructional system headed by the teacher is the chief factor which can encourage or hinder learning and the attendant academic achievement. It is however apparent that there is a decline in students' academic achievement in basic electricity. A number of reasons or factors have been found to have contributed to students' poor achievement. Some of these factors incude students' study habits and teaching methods used by the teacher in the teaching-learning process. (Yalam anf Fatokun,2007).

. Over the years, there has been shortcomings with the use of conventional instructional material for teaching basic electricity in technical colleges. More time are been spent by basic electricity teacher in trying to explain different concepts in basic electricity while students on the other hand engages in abstract learning, which could be boring to students. These problems seem to be common in our present day technical colleges.

Due to the present advancement in technology, the conventional methods (lecture and demonstration method) adopted by most teachers in teaching basic electricity in technical colleges do not seem to cater for the diverse learning styles of most students. For instance, Campbell and Campbell (1999) stated that traditional teaching methods do not adequately equip teachers with contemporary views of student intelligences and their vast learning capabilies. The weakness of the traditional teaching methods may have partly contributed to the poor performances of students in the trade subjects in the National exams over the years and also at the work place when eventually employed on graduation (Aina 2008). The need to prevent these problem then arises.

Moreover, the benefits of CBI include permitting learning at one's own pace, being objective, and individualizing learning (Hornbeck, 1991). Educational institutions must have a clear vision with a solid understanding of educational philosophy and be able to absorb the economical ramifications of implementing costly computer labs. Based on the review of other studies and the setbacks on studies, comparing CBI with conventional instruction, CBI can be considered as more effective than the traditional instruction. Two conclusions drawn from meta-studies on CBI are: (1)learners generally learn more using CBI than they do with conventional ways of teaching as measured by higher post-treatment test scores (Fletcher, 1999; Kulik, 1994), and (2) learners using CBI generally do so in less time than those using traditional approaches (Kulik & Kulik, 1991; Orlansky & String, l979). At least two other meta-analyses completed to date seem to suggest that commercial software programs used in math classrooms have limitations in comparison to teacher authored software programs (Hsu, 2003; Kuchler, 1998).

Hence, a study to determine the effect of Computer Based Instruction on student achievement in basic electricity in technical colleges is desirable..

Purpose of the Study

The purpose of this study was to determine the effects of CBI on students learning and achievement in basic electricity in technical colleges. Specifically, the study intend to:

1. Determine the differences in achievement of students tauugt Basic electricity using CBI and those taught using traditional method.
2. Determine the mean achievement of both the control and experimental group before using computer based instruction to teach Basic Electricity to the student.

3. To investigate the difference in the achievement of male and female students taught Basic Electricity with Computer Based Instruction .

Significance of the Study

The purpose of this study is aimed at the significant of computer based instruction on students learning and achievement in basic electricity in technical colleges. The result of the study will be of immerse benefit to basic electricity teacher, they are expected to gain from Computer based Instruction. It shows that computer-based instruction (CBI) usually produces positive effects and advantages on students and teachers. The studies covered learners of all age levels — from kindergarten pupils to adult students.CBI enables students to learn at their own pace, and acquire a wide range of skills, educational background and procedures to classroom, as long as they have acquired the required competences. This study permit learning at one's own pace, being objective, individualizing learning, and prevent students from learning the wrong concept. Students with low background who are determined to learn can now learn skills in basic electricity using the appropriate tools provided by CBI. Student attitude toward learning and content is significantly and positively affected by CBI. Numerous studies have reported that CBI is successful in raising examination scores, improving student attitudes, and lowering the amount of time required to master certain material/procedures. In the traditional training, students do substantial amount of homework, and by so doing, the student performance in those homework assignment is not good enough because the teacher had to grade the homework before returning it to the student Learning With CBI, students can determine their own weaknesses and concentrate efforts on overcoming those weaknesses before moving on to more advanced concepts.

This encourages students to confidently move to more complex concepts. CBI can make learning interesting and exciting. What could be a more boring waste of time than practicing a procedure over and over that has already been mastered? On the other hand, some students are satisfied with only a cursory grasp for important fundamental concepts. While on the other hand, some students are satisfied with, as much as they can grasp and master the important fundamental concepts. In otherwas, CBI makes student spend more time on a concept until it is fully mastered. More often, students learn from a more advance concept while still holding misconceptions about the basic or fundamentals topic. This often leads to problems in that the student's understanding of a concept is not sufficient to enable her/him to progress smoothly to the next concept.

The findings of the study, teachers should therefore be encouraged and trained in the use of computer based instruction in the delivery of instruction to students in order to improve the students performance, effective thinking and cater for the diverse learning styles of students.

The government and curriculum planners stand to benefit from the findings of this study. The information provided in the findings of this study could be used by the government through the assistance of the planners to improve or develop new curriculum in which Computer Based Instruction serves as a supplement to conventional instruction and effective instruction in improving student achievement.

Educational researchers and the ministry of education should provide a base plan and conduct further research in improving students learning through the use of Computer Based instruction.

Scope of the Study

The scope of this study is covers the following;

To see the effect of computer based instruction on students learning and its achievement in Basic electricity students in Technical Colleges in Nigeria, in the subject of Basic electricity, the topics covered during the experiment included: (1) Capacitors (2) values of resistior(s), (3) Basic principles of air-conditioning.

Research Questions

The following research questions were developed to guide the study:

1. Will there be any difference in the achievement of students taught Basic electricity using Computer Based Instruction and those taught using traditional method?
2. What is the mean achievement scores of both the control and experimental group before using Computer Based Instruction to teach Basic electricity to the student?
3. What is the difference in the achievement of male and female students taught Basic electricity using Computer Based Instruction?

Hypotheses

The following research hypotheses were tested in the study:

$H_{01.}$ There will be no significant difference between the mean achievement scores of students taught Basic electricity using Computer Based Instruction and those taught using traditional method.

$H_{02.}$ There will be no significant difference in the mean achievement scores of both the control and experimental group before using Computer Based instruction to teach Basic electricity to the students.

$Ho_{3.}$ There will be no significant difference in the mean achievement scores of male and female students

taught Basic electricity with Computer Based Instruction.

CHAPTER II

REVIEW OF LITERATURE

In this chapter, the following main topics are discoursed under review of the literatures:

- Nature of Computer Based instruction.
- Mechanism of computer Based Instruction.
- Role of teacher in Computer Based instruction
- Methods of Teaching Technical Education.
- Computer Based Instruction and Programmed Instruction.
- Gender and Academic achievement in Learning
- Computer Based Instruction and Learning Theories.

Nature of Computer Based Instruction

Computer based instruction refers to any kind of computer use in educational settings, including drill and practice, tutorials, simulations, instructional management, supplementary exercises, programming, database development, writing using word processors, and other applications. The use of computers in education is growing at a rapid rate, with use of computers for educational purposes more than doubling between 1984 (36.2%) and 1997 (84%) (National Center for Education Statistics, 1999). These terms refer either to stand-alone computer learning activities or to computer activities which reinforce material introduced and taught by teachers. As the use of computer increases in the educational and training domains, many people have recognized the importance of evaluating its effects on student outcomes such as learning, performance, and satisfaction. Often, these results are compared to those of conventional classroom instruction in order to determine which method is “better.” However, major differences in technology and presentation rather than instructional content can obscure the true relationship between Web-based instruction and these outcomes. Computer-based instruction (CBI), with more features similar to Web-based instruction, may be a more appropriate benchmark than conventional classroom instruction. As a result of the rapid development of the information and communication technology, the use of computers in education has become inevitable. The use of technology in education provides the students with a more suitable environment to learn, serves to create interest and a learning centred-atmosphere, and helps increase the students’ motivation. The use of technology in this way plays an important role in the teaching and learning process (İşman, Baytekin, Balkan, Horzum, and Kıyıcı, 2002). In parallel with the technological advances; technological devices, particularly computers began to be used in educational environments to develop audiovisual materials such as animation and simulation, which resulted in the development of the computer-based instruction techniques. The best example of the integration of science and technology is the Computer-Based Instruction technique. The use of computers in the teaching and learning activities is defined as Computer-Based Instruction (CBI). CBI enables the students to learn by self-evaluating and reflecting on their learning process. CBI motivates children to learn better by providing them with the immediate feedback and reinforcement and by creating an exciting and interesting game-like atmosphere. The studies in the field reveal that the students’ achievements increase when the CBI technique is provided as a supplement to the classroom education. CBI is more effective on less successful children. The reason for this is that the computer-based instruction enables the children to progress at their own pace and provides them with appropriate alternative ways of learning by individualizing the learning process (Senemoğlu, 2003). The most familiar function of the science education is to teach the children the science concepts in a meaningful way and enable them to lean how they can make use of these concepts in their daily lives (Çepni, Taş, & Köse, 2006). Criticism of CBI generally focuses on two issues. First, it is argued that much of the available software lacks an adequate foundation in educational theory. Second, it is argued that the software is difficult to implement and use. Most CBI studies focus either on educational effectiveness for a particular subject or the student's experience in using the software. Extant studies do not show a clear pattern of support for either of those issues. This paper reports on two separate uses of CBI at a small, private university: in a principles of financial accounting course and in a principles of microeconomics course. Although both instructors used CBI to supplement the student's in-class experiences, each used different computer programs and different methodologies. This paper describes the educational use of CBI in these two different courses and the implementation and use experienced by the instructors. Also, in addition to educational effectiveness and the student's experience this study reports on the impact that using CBI has on student evaluations of both the course and the instructor. The computer based teaching has had an impact on the development of the educational technology to a great extent in the 21 Century, and this has resulted in the production of the software for the computer-based instruction. The primary purpose of the educational software is to solve the learning problems in the science courses encountered by the primary school students, to increase their motivation and achievements and to protect them against the negative effects of the rote-memory based educational system. There are software-supported educational products designed to be used in the computer-based and computer supported teaching practices. These are the products that the teachers use as complementary materials for taking notes about their students and observations; making tables; developing materials; doing calculations, and preparing simple educational software. The educational software is used as a teaching material in the teaching of a part of a subject or the whole subject (Alkan, Deryakulu, and Şimşek, 1995; İşman, 2005). According to Alessi and Trollip (2001), it is possible to divide educational software into five different types such as tutorial, drill and practice, simulation, educational games and hypermedia type. For effective and productive teaching, these techniques should be used with some classroom activities. These are: presentation, demonstration, practice and evaluation of learning (Özmen, 2004). The use of computer technology enables learners be active in the learning process, to construct knowledge, to develop problem solving skills and to discover alternative solutions (Özmen, 2008). The presentation of teaching materials by means of the computer technology helps students to process and develop information, to find alternative solutions, to take an active part in the learning process and to develop their problem solving skills. Most of the scientific and technological advances are realized by the people whose problem solving skills have been developed. In addition, these advances give rise to positive changes in the lives of people owing to the ways and techniques developed by means of the power of the problem solving skills. The use the problem solving skills is inevitable at every stage of our daily lives. As a result of the advances in today's technology and computer devices, it's getting indispensable to use this new technology in the solution of educational problems. The education and technology play an important role in the education of humans. Although the education and technology are different concepts, the use of both resulted in the emergence of a new discipline, the educational technology. Owing to the educational technology, the teaching and learning activities become enjoyable. Students learn willingly, by playing and enjoying during these activities (İşman, 2005). Among the primary and secondary school students, girls use computer 5 hours a week for the play purpose whereas boys spend 13 hours a week for the same purpose (Christakis, Ebel, Rivara, and Zimmerman, 2004). The use of computer in teaching and learning environments is very important as the children like it very much and can continue playing with it without ever getting bored. In our time, it is evident that visual materials such as TV and computer are utilized in every field. And it is also evident that computer attract students very much. The use of the audio-visual devices and animations with instructional materials results in the enjoyable and productive learning process. In this way, the learning process can become enjoyable and interesting for students as a result of abolishing traditional classroom learning activities. Technological developments give rise to new teaching and learning facilities. In our time, human beings keep on searching to find out how to use computer in educational activities in a more productive way rather than searching to reveal whether the use of computer in teaching and learning activities is effective (Kara & Yakar 2008).The use of computers in education is still in its infancy. However, the computer is bringing some exciting innovations to education. The following are the areas in which computer are helping the educators:

1. Computer takes over the most of the drudgery of schooling like classifying children according to abilities, preparing time table, schedules ,etc.
2. Computer allocates learning resources to individuals and groups.
3. Computers maintain progress cards and perceive them confidentiality.
4. They provide easy access to files of formation for references and guidance.
5. They provide direct interaction between students and the subject matter to be learned.
6. They engage the students in tutorial interaction and dialogue.

Educational technologies, especially computers play an important role in concretizing abstract concepts, which are difficult for children to learn, by means of animations (Akpınar, 2005). The computer-based Instruction makes teaching techniques far more effective than those of the traditional teaching methods as it is used for presenting information, testing and evaluation and providing feedback. It makes a contribution to the individualization of education. It motivates students and gets them to take an active part in the learning process. It helps to develop creativity and problem solving skills, identity and self-reliance in learners. CBI provides drawings, graphics, animation, music and plenty materials for the students to proceed at their own pace and in line with their individual differences. It serves to control lots of variables having an impact on learning, which cannot be controlled by means of traditional educational techniques (Kaşlı, 2000; Chang, 2002). Liao (2007) found out that CBI had a positive effect on individuals by comparing 52 research studies carried out in Taiwan in his meta-analysis study. Senteni (2004) also found out that CBI enabled the students to increase their motivation and achievements and to develop positive attitudes. According to research studies in literature, the use of computer-based education increases students' attitudes and achievements significantly (Berger, Lu, Belzer, and Voss, 1994; Geban, 1995). There is a lot of research on CBI both in Turkey and in the world. Different results have been arrived at in these studies. Some of these studies reveal that CBI serves to establish more effective learning situations than traditional teaching methods which involve teacher presentation, question and answer techniques, and discussions etc (Boblck, 1972; Hughes, 1974; Cavin & Lagouski, 1978; Choi & Gennaro, 1987; Niewiec & Walberg, 1987; Huonsell and Hill, 1989; Jedege, Okebukola, and Ajevole, 1991; Geban, Ertepınar, Yılmaz, Altın, & Şahbaz, 1994; Crook, 1994; Child, 1995; Gance, 2002; Çekbaş, Yakar, Yıldırım, & Savran 2003; Yenice, 2003; Carter, 2004; Moodly, 2004; Preciado, 2004; Li and Edmonds, 2005; Brooks, 2005; Bryan, 2006; Çepni, Taş, and Köse, 2006; Wilder, 2006; Başer, 2006; Chang, Sung and Lin, 2006; Liao, 2007; Ragasa, 2008; Hançer and Yalçın, 2009; Lin, 2009). It has been found out that CBI serves to develop meta-cognitive skills in students and helps them to learn in a meaningful way instead of rote-memory learning as well as it enables them to increase their achievements (Renshaw and Taylor, 2000). According to some studies there is no significant difference between the CBI and traditional teaching methods (Bayraktar, 2001; Alacapınar, 2003; Çetin, 2007).

The World Wide Web can be used to provide instruction and instructional support. Web-based instruction offers learners unparalleled access to instructional resources, far surpassing the reach of the traditional classroom. It also makes possible learning experiences that are open, flexible, and distributed, providing opportunities for engaging, interactive, and efficient instruction (Kahn, 2001). Phrases such as “flexible navigation,” “richer context,” “learner centered,” and “social context of learning,” are used in the literature to describe Web-based instruction. Furthermore, cognitive-based theories of learning have extended the design and delivery of Web-based instruction, applying the technical nomenclature to instructional practices (Bonk and Dennen, 1999). Indeed, Dills and Romiszowksi (1997) have identified more than 40 instructional paradigms seeking to advance and improve the online learning experience beyond the traditional classroom. Some researchers have argued, however, that the tried-and-true principles of instructional design, namely interaction and timely feedback, are often absent from Web-based instruction, particularly from individual Websites devised to teach (Eli-Tigi and Branch, 1997). The absence of a sturdy pedagogical underpinning for a Web-based “instructional” program can diminish an otherwise worthy opportunity to improve learning. Well-designed computer-based instruction developed in the 1970s and 1980s, for example, has been demonstrated to enhance learning outcomes when compared to classroom instruction (Kulik and Kulik, 1991). A central question, then, is just how effective is online instruction? In particular, how does it compare to both the conventional classroom and established forms of stand-alone computer-based instruction (CBI)? For the purposes of this review, online instruction is considered to be any educational or training program distributed over the Internet or an intranet and conveyed through a browser, such as Internet ExplorerTM or Netscape Navigator. Hereafter, it is referred to as Web-based instruction. The use of browsers and the Internet is a relatively new combination in instructional technology. While the effectiveness of traditional CBI has been reviewed thoroughly (Kulik, 1994; Lou, Abrami, and d'Apollonia, 2001), the effectiveness of online instruction has received little analysis. Part of the reason may be that so few cases have been detailed in the literature. This report serves, then, as an initial examination of the empirical evidence for its instructional effectiveness. Many educational institutions and organizations are seeking to take advantage of the benefits offered by distributed learning, such as increased accessibility and improvements in learning. Learning advantages have consistently been found whenever well-designed instruction is delivered through a computer. Fletcher (2001), for example, has established the "Rule of Thirds" based on an extensive review of the empirical findings in educational and training technology. This rule advises that the use of CBI reduces the cost of instruction by about one-third, and additionally, either reduces the time of instruction by about one-third or increases the effectiveness of instruction by one-third. The analyses for this rule were based primarily on stand-alone CBI, not the contemporary use of online technologies.

Unlike the fixed resources in conventional CBI, Web-based instruction can be conveniently modified and redistributed, readily accessed, and quickly linked to related sources of knowledge, thus establishing a backbone for "anytime, anywhere" learning (Fletcher and Dodds, 2001).

Compare these features to, say, a pre-Internet CD-ROM in which instructional messages were encoded in final form, availability was limited to specific computers, and immediate access to a vast array of related materials was not possible. However, many key instructional features, such as learner control and feedback, are shared between Web-based and conventional CBI. A reasonable assumption concerning the effectiveness of Web-based instruction, then, is that it should be at least “as good as” conventional forms of CBI. Qualities shared by the two delivery media include multimedia formats, self-pacing, tailored feedback, and course management functions. Additionally, the unique features of Web-based instruction, flexible courseware modification, broad accessibility, and online links to related materials, instructors, and fellow students, should make possible improvements in learning outcomes beyond CBI. Learning outcomes from conventional CBI, when compared to conventional classroom instruction, have demonstrated effects significantly above the “no-significant-difference” threshold (Fletcher, 1990; Kulik, 1994). Furthermore, Web-based instruction shares elements of good classroom teaching that are not necessarily available in conventional CBI. Chickering and Ehrmann (1996) outlined seven ways in which technology can leverage practices from the traditional classroom. For example, good practice encourages student contact with faculty, and Web-based environments offer ways to strengthen interactions between faculty and students through email, resource sharing, and collaboration.

Currently available CBI programs appear to address many of the past criticisms and appear to incorporate many of the suggestions made by both Walbert and Daniel. The programs reported on in this study are shown to be pedagogically effective within the two separate disciplines and have been successfully implemented and integrated into the student’s in-class experience.

Mechanism of Computer Based Instruction

There are two models for designing interactive educational programs. The first, instructional system design (ISD), the traditional model, determines a goal, sets objectives, delivers instruction, formulates test questions, evaluates learning. The second, hypermedia design (HDM) focuses on the student's goal and how the student chooses to access information. While ISD is concerned with design goals, HDM focuses on the user's goals. Web-based design should be based on whether the program is well designed and meets the needs of the intended users (Dewald, 1999).

There are many design models for CBI available today. One model, developed by Ina Fourie in 1994 consisted of seven phases:

1. Determination of the need and situation analysis.
2. Formulation of aims and performance objectives and development of items for evaluation.
3. Design of study material, including development of a teaching strategy and media selection and integration (e.g. the inclusion of sound and video).
4. Development and preparation including story boarding and programming.
5. Implementation and use
6. Assessment of student progress
7. Formative and summative evaluation on a continuous basis.

After each phase is completed, it must be evaluated before moving to the next phase. CBI design projects should consist of several members including a project manager, subject experts, advisors, evaluators, programmers, and graphic artists. The CBI must meet the needs of its users to be effective. Also, computer literacy can be a major problem. Students without technology skills will have to master basic computer knowledge before using the CBI successfully.

Good web-based instruction asks students to interact in some way and not just to memorize information. It must be flexible and allow for differences in learning abilities. It should encourage deep learning and not merely surface learning. Students must understand concepts and how they fit into the whole, be able to integrate parts, apply the information particularly, and receive feedback. Web-based instruction provides opportunities for interactivity to make it meaningful for the student (Dewald, 1999). Computer Based instruction (CBI) is defined as the use of computer to provide course content instruction in the form of drill and practice, tutorials, and simulations. Drill and practice is a common CBI form in which a type of repetitive, or "flash card," approach emphasizes rote memory. It is used extensively at all educational levels (Chambers and Sprecher, 1983).

Tutorials use the computer in a higher-level mode in which question-and-answer, dialogue-type learning in the traditional tutor mode is emphasized. Like drill and practice, it is used extensively at all educational levels. Simulations, the third type of CBI. Provide a model in which the student plays a role and interacts with the computer. Simulations have been used most often in higher education to model scientific processes. They are applicable to any field, however, and can be of significant help in illustrating concepts, in helping students to develop problem- solving techniques, or in allowing students to explore complex interactions.

These three categories - drill and practice, tutorials, and simulations - make up what has become known in the United States as computer-based instruction (CBI), computer-assisted instruction (CAI), or computer-based education (CBE).

Characteristics of Computer Based Instruction

A acts like a super teaching machine catering to the needs of a number of students at the same time. The characteristic aspect of the CBI is its capacity to initiate flexible interactions with the students that is not possible in the teaching machine. There are a number of ways in which this can be brought about. The computer is able to record and store all the responses of all 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 the information in planning to determine which branch to take (Sampath *et al*$_y$ 1990).

A typical CBI installation consists of individual learning booths, each with a console. The student is seated. Facing him on the console is a television screen for displaying information. Before he starts a programme, the student checks in with the computer by displaying his identity number. This connects him with his part of the learning programme. A complete package of information stored in the system is presented sequentially. This information could take the form of video-tape recordings, slides, motion picture films, filmstrips, etc. The student may question the computer and feed answers into it by means of a typewriter keyboard. The computer responds by printing out comments, answers and questions. Sometimes, the student may write directly on the cathode ray tube display screen with a "light pen'. His answer will be picked by the computer and evaluated. When he has finished, the computer assigns him the next program, records his progress and prints out a report for his teacher (Sampath *et al* 1990).

The CBI starts by identifying the way a student seems to learn best. It reviews his past history of learning and then presents a programme built on his strength. Sometimes the computer stores all the information gained from all students who have taken the computer course previously. This information may be re-analyzed and much of the teaching strategies, which were not effective, may be rejected and strategies which have succeeded may be continued

(Sampath *et al,* 1990). Computer-assisted instruction is, therefore, not merely a sophisticated type of programmed instruction but it also uses electronic data processing, data communication, concepts of audio-visual and media theory, communication theory, systems theory and learning theory. In contrast to CBI, computer-managed instruction (CMI) analyses the relationship between various factors pertaining to a pupil and suggests activities appropriate to individual students. This includes PLAN (Programme for Learning in Accordance with Needs) and IPI (Individually Presented Instruction). In general, students learn well with CBI in considerably less time (Sampath *et al,* 1990).

Computer based instruction makes use of multimedia software in the learning process including text, video technology, graphics, sound and Internet technology. Computer based instruction is heavily used in the growing field of distance education. Traditionally, computer based instruction, like programmed instruction, has been linear in nature. Web-based instruction on the other hand is nonlinear (Lawson, 1999). There are numerous unique features of CBI which make it an exciting field. One of the most useful is its adaptability for distance learning. Before the dominance of microcomputers, distance learning was mostly accomplished through programmed instruction or mail system supplemented by telephone contact. On the contrary, CBI provides regular and timely interaction with the instructor and current feedback. Students can repeal tutorials as often as needed and work at their own pace. CBI also can be used with greater numbers of students than a traditional classroom would hold. CBI and web- based instruction have opened avenues of access to individuals with disabilities that were not previously possible. Intelligent computer based instruction (ICBI) is programmed so that the CBI adapts 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. Web-based instruction is unique in that student and/or instructor can communicate with each other anywhere in the world within seconds via the Internet. Feedback from the instructor can be obtained immediately (Moursund, 1998).

Drill and Practice

Computer based instruction facilitates student learning through various methods. Different types of CBI simulation, tutorials, drill and practice, problems solving and games are discussed in the following pages. Although a computer can be used in many ways in the educational programmes, the following are some of the areas where it proves to be effective in the instructional process. The student sits at a specially designed electric typewriter, which is connected to a computer by telephonic lines. He identifies himself by a code number and his name. The machine types out the first question and the student responds. Soon the lesson is underway. The computer keeps track of each student's performance and can 'read back' to the teacher a summation of each student's work whenever the teacher wants it. Depending upon the programme, the student might be referred to a branching type of remedial exercise. As in programmed instruction, the student moves at his own pace, gets immediate feedback and receives individual tutoring. Drill and practice software differs from tutorial software in a key way: It helps students remember and utilize skills they have previously been taught, whereas a tutorial teaches new material. Students must be familiar with certain concepts prior to working drill and practice programs in order to understand the content. The typical drill and practice program design includes four steps:

(1) The computer screen presents the student with questions to respond to or problems to solve;

(2) The student responds

(3) The computer informs the student whether the answer is correct; and (4) if the student is right, he or she is given another problem to solve, but if the student responds with a wrong answer, he or she is corrected by the computer (Sharp, 1996).

Simulations and Games

These have come into effective use in education during the past decade. Simulations 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. Simulations are realistic imitations. According to Thorson (1979), simulation is a mode of education which demands that knowledge be integrated with reality and with behavior. It helps students to perceive values and ideas not as the material for armchair rhetoric, but rather as the bases of practical decisions and the touchstones of responsible actions.

Simulations are frequently planned in the form of competitive games to increase motivation and interest. Organized social simulation is called gaming, as for example, historical games. Simulated learning came into prominence during the Second World War when extensive use of this was made to train recruits in psychomotor skills such as aircraft flying, weapon system operation, etc. Now simulation is used in teaching various subjects as well as in areas like teacher training. Simulation may involve simulator trainers or mock-ups. which are really three-dimensional teaching aids e.g., an aircraft flight simulator. Role-playing is also a type of simulation, ranging from simple make- believe to play acting and drama. Educational simulation and games like all other well- organized learning experiences must be carefully designed with clearly specified objectives. The most obvious use of simulation is in extending the experience of pupils and in stimulating their interests. Simulation and gaming increases motivation and self-confidence and can accommodate students of different ages and levels of maturity. They approximate reality far more closely than conventional class methods. But some of these take considerable time and demand too much from the teacher. In simulation programs, students take risks as if they were confronted with real life situations without having to suffer the consequences of failure. Students can experiment with dangerous chemicals on the computer screen, for example, and not be in danger from the actual chemicals. With laboratory simulations, there is no expensive lab equipment to buy and students do not have to wait a long period of time for the effects of experimental conditions before they can observe the results. Moreover, students can repeat experiments easily as often as they wish. Simulations save time and money, reduce risks, and work well in decision-making situations. Many educators feel that a well-designed simulation software affords students the opportunity to apply classroom knowledge in more realistic situations than can otherwise be set up in a classroom, which enhances students' learning (Sharp, 1996). The strength of a simulation is to force students to retrieve or discover relevant knowledge, experiences and problem-solving skills under authentic situation. Exploratory simulations require students to take more responsibility in learning processes. Active learners are most likely to benefit from this kind of use of computer-based simulation. For non-engaged learners, it is suggested that this kind of simulation be used in small groups. Through cooperative learning and social interaction, some students will overcome difficulties which occur when they use simulation by themselves.

In education, simulations have become increasingly popular, especially in science, mathematics, and the social sciences. Many situations in the biological sciences cannot be done in a lab or in short time periods in the field. Simulations give students the chance to experience situations not normally available in classroom settings. Microcomputers, distance learning was mostly accomplished through programmed instruction or mail system supplemented by telephone contact. On the contrary, CBI provides regular and timely interaction with the instructor and current feedback. Students can repeal tutorials as often as needed and work at their own pace. CBI also can be used with greater numbers of students than a traditional classroom would hold. CBI and web- based instruction have opened avenues of access to individuals with disabilities that were not previously possible.

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Animation

Animation means, literally, to breathe life into something. A transformation is involved to move things. It plays significant role in stimulating learning. In the English language animation is mostly associated with the work of film makers. Action is created from a series of images and we have the illusion of something living. Animation is that stimulus to the mental, physical and emotional life of people in a given area which moves them to undertake a wide range of experiences through which they find a higher a higher degree of self-realization. (Boal, 1992)

Role of Teacher in CBI

The use of computer based instruction does not necessarily exclude the teacher roles from the classroom. Due to the advancement in technology, some teachers think that they might be replaced with the use of technology. As a result, they are supposed to show more responsibilities in teaching, no matter how effective CBI might be. The success of teaching greatly depends upon the teachers' participation. The teachers' roles do not decline, but rather will be strengthened. In other words, the teacher should be responsible for directing the learner to sort out the materials they need among the vast sea of information. The computer is a tool without inborn wisdom, mind of its own or inherent ability to learn or teach. It will perform various instructions given by a human user. All the language material and instructions for its presentation must be specified by the teacher. It is the teachers who can make the computer assume various roles. Furthermore, learning is a dynamic process. The computer, instead of merely presenting materials and questions, and collecting the processing the learner's responses actually takes decisions about the shape and structure of the material to be presented to the learner, it checks the learner responses and guides him to different parts of CBI packages or other activities. However, these decisions are put into the computer by the teacher. On the part of learners, since learners have different learning abilities, the computer can accommodate a substantial range of different learning styles. The computer only accept from the learner only responses typed in via the keyboard. It is the teacher who can cope with the different learners in terms of their different motivations, emotions (e.g, anxiety), learning strategies, etc. It is only a well prepared trained teacher who can be able to deliver using different learning languages and teaching method with the aid of the computer. CBI assures different roles in learning languages, yet we do not believe for a moment that the computer will take over the teacher. The teacher will play different roles. He first must be an instructor, giving information to what the learner should do with the computer. He also act as an assessor, assessing the learner and what progress the learner is making. And also he should be a supervisor, supervising what the learner does. He can also act as a counselor and friend, counseling the learner when faced with learning difficulties. He can as well be a manager as well as an information provider, managing resources and providing information requested by the learner. Certainly the teacher may play such roles in the classroom, but the extent varies from person to person or from time to time.

Although we cannot forecast the areas wherein computers may be helpful in future, the possibilities of their effective use in the educational scene are enormous (Sampath **et al,** 1990).

Methods of Teaching Technical Education

There are various traditional methods of teaching. These include the demonstration method, lecture method, discussion, role playing, problem solving, project method and field trip (Ogwo, 1996). Among other methods mentioned above, the demonstration and lecture method are mostly used in higher institution as well as technical colleges. The lecture method is the most widely practiced method of teaching. There is very little student participation. At the levels of education, teachers are in fact called "lecturers", the title seems to be more prestigious than the title "Teachers". The teacher or some knowledgeable person supplies information to the students. This teaching method is used and is most suitable in all levels of education. According to Ogwu (1996) when using teaching method, teachers launch into terminologies when giving examples, explaining concepts, pointing out relationships and as such, the method has been severally criticized by educators. He said that the lecture method has only limited in vocational and technical education. He said teacher should avoid giving lengthy lectures since such lectures could be dull, boring and reduce students stimulating interest. Ogwu (1996) added that the lecture method has been found suitable in teaching when the purpose of the lesson is to discriminate information, the material is scare and cannot be readily sourced by the learners, the material must be organized and presented in a particular way in a particular group of learners, the content of the lesson needs to be remembered for a very short period of time and where there is need to introduce contents to be executed using other methods in addition to these.

Computer Based Instruction and Programmed Instruction

The idea of programmed instruction was originally advanced by B. F. Skinner (Skinner, 1954), and the first practical implementation of programmed instruction to train people was achieved in 1960 by Basic Systems, Inc. In the early 1960s, the proponents of programmed instruction, including Skinner, defined programmed instruction as using (1) active response by the learner; (2)immediate reinforcement of correct responses; and (3) successive approximations towards the knowledge to be learned, in a sequence of steps so small that the learner can take each one with little difficulty. Skinner stated, from the start, that in order for programmed instruction to work well it is important to prevent the learner from seeing the correct answer before making his own response, and that to accomplish this, a teaching machine is necessary (Skinner, 1958). By 1961 this viewpoint had become widely accepted, and even Skinner agreed (Holland & Skinner, 1961; Rushton, E. 1963). During the years 1960 to 1962, through my company Basic Systems, Inc. He continued to develop methods and techniques, and wrote guides, for creating effective programmed texts (Mechner, 1961a). An illustration of the techniques he advocated originally is provided in Mechner, 1961b. Starting in 1960, Basic Systems entered into numerous contracts, with corporate and governmental customers for the production of large-scale training systems that used programmed text as the main medium. In the first year of operations, he recruited Basic Systems' technical staff and trained them in a methodology and techniques that have since become widespread. This methodology included:

1. Specifying the desired terminal behavior in the form of test items, before the program is written;

2. Analyzing the specified terminal behavior by identifying the critical "concepts" and "chains" (chains are skills, reasoning processes, procedures, etc.) that comprise the terminal behavior;

3. When the program is constructed, teaching concepts by proceeding from the specific to the abstract, or from examples to the more general case

4. Teaching chains by the backward fading method;

5. Constructing frames in such a way that a critical and relevant response is called for, in response modality that corresponds to the desired terminal behavior;

6. Ensuring that the structure of the frame enables the student to arrive at the correct response only by applying the intended knowledge or skill, rather than by providing him with a trivial prompt; and

7. Subjecting the program, during its development, to several cycles of empirical testing and revision, using typical members of the intended target population as test subjects. While there is no denying that the training systems developed by Basic Systems were very effective and highly praised (Holland, 1967), it also became increasingly evident to me that some serious problems of the programmed text medium had not yet been solved.

The popularity of programmed instruction (PI) reached its zenith in the mid- 1960's but declined steadily through the 1970's. This decline in popularity is attributable to a variety of recognizable and somewhat vague reasons. Three primary reasons were the nature of the material and processes, the higher publishing costs, and the attitudes of teachers. Programmed materials were perceived as boring often because of the way in which they were used. Also, their success was largely predicated on users' adequate reading ability, which notably declined during the same period. On the economic side, programmed materials were more expensive to produce because of their nonstandard typography. Because of lower sales, the development cost could not be spread out, forcing up the unit cost of programs, which further depressed their sales.

Concurrent to Pi's decline, the newest bandwagon in education, computer- assisted instruction, was gathering steam. This technological focus only accelerated the apparent demise of programmed instruction. Yet PI never really disappeared. Rather, it was transformed into new issues and technologies that dominated attention in the 1970's and 1980's.

Programmed instruction typically consists of self-teaching with the aid of a specialized textbook or teaching machine that presents material structured in a logical and empirically developed sequence or sequences. Programmed instruction may be presented by a teacher as well, and it has been argued that the principles of programmed instruction can improve classic lectures and textbooks. It allows students to progress through a unit of study at their own rate, checking their own answers and advancing only after answering correctly. In one simplified form of PI, after each step, they are presented with a question to test their comprehension, then are immediately shown the correct answer or given additional information. However the objective of the instructional programming is to present the material in very small increments. The more sophisticated forms of programmed instruction may have the questions or tasks programmed well enough that the presentation and test model—an extropolation from traditional and classical instruction—is not necessarily utilized. Programmed learning was later adapted by Robert M. Gagné, who invented programmed learning for use in teaching in schools. The difference between programmed instruction (PI) and programmed learning (PL) is that PI is intended to modify behavior, whereas PL is used for teaching facts and skills. Personalized System of Instruction or (PSI), developed by Fred S. Keller, was another idea for how to incorporate programmmed learning into the classroom. Programmed instruction resulted from early efforts to implement Skinner's basic research findings on learning at Harvard that led to "errorless discrimination" techniques being developed. Programmed instruction had some early success in aphasia rehabilitation. Programmed instruction continues to be used today. Recently, the application of programmed instruction principles was reapplied to training in computer programs, after some popularity in a series of books on functional programming, and combined with Benjamin Bloom's taxonomy to teach college students. Some have argued that there is a resurgence of research on programmed instruction due to use of computers and the Internet. Programmed instruction represents a model of how instruction should occur. Nowhere is this model more consistently applied than in computer based instruction (CBI). Even though programmed instruction (PI) and computer based instruction were developing independently in the 1960's, the instructional sequences and techniques of the former were borrowed by the latter. While PI (in its traditionally identifiable form) has declined in popularity, CBI is in big demand. Its continued development was fueled by the explosion of microcomputers in the 1980's and 1990's. The visual and auditory establishments afforded by the graphics and sound capabilities of microcomputers make the reinforcement of drill and practice programs initially more desirable, and the programs are able to keep records on a user's performance, but the fundamental instructional model is that of PI. Another popular form of microcomputer courseware is the tutorial mode, which replicates on the screen branching programmed instruction. The computer's program presents some information followed by questions on the screen, and, based upon the response, branches the user to alternate parts of the program. These programs, like intrinsic PI, may confirm the correct response, remediate an incorrect one, or move the user forward or backward in the program stream. Also, a number of authoring systems are available to help computer courseware authors circumvent the need for computer- language proficiency.

As stated above, the roots of computer based instruction can be traced back to programmed instruction. The key concepts of programmed instruction (tutorials, management, general enrichment, drill and practice, programming, and simulation programs) are present as well in CBI. When computers were first commercially presented in the 1950's, programmers had to work around the slow speed and small memory of the computer, which limited applications. As technology increased, the next phase of computer software came in the 1980's making computer applications easier to use for the consumer. In 1993, Glenn R. Jones established the first Virtual University offering bachelors and master's degrees totally over the Internet and was accredited by the North Central Association of Colleges and Schools. Today many colleges and universities offer courses and degrees via the Internet. In the 1990's, with computer speed and power much greater than ever before, the computer's role as a "trainer" has been greatly expanded. An enormous amount of learner-centered software is available in almost every subject area (Heifer, 1999). On the horizon currently is intelligent computer based instruction 1CAI), which makes use of artificial intelligence. This software actually adapts to the individual needs of the students. 1CAI works by gaining relevant information about the student's background and knowledge of the subject and then creating a profile of the user. Several ICAI applications are being developed currently including an intelligent multimedia tutoring system that teaches the use of hospital emergency room equipment, one that teaches students how to create broadcast news reports, and another that allows students to develop computer simulations for lifelong learning (Moursund, 1998).

Advantages of Programmed Instruction

Programmes are normally validated as part of the development process to ensure reliable and replicable learning results. They are developed to meet specific needs since the process usually begins with a needs assessment. Programming provides for adaptation of instruction to the characteristics and capabilities of individual users. Users can usually proceed at their own rate of learning. This avoids unfair comparisons with other users. Users are required to be active participants in the program, engaging in learning activities rather than passively receiving information. Programs can be sequenced to match the information processing requirements of the task to the structure of the content.

Different sequences or delivery strategies can be used to meet the same objectives allowing for further adaptation. The reinforcement resulting from the completion of a set of frames leaves the user with a sense of accomplishment or success, which in turn increases the motivation to learn. Programs can be used without supervision. Knowledge is usually gained more quickly than with traditional instruction. A wide variety of media or display devices can be employed to deliver the programs. Programmed instruction materials provide flexibility in arranging the user's workload, and they are well suited to many kinds of learning tasks and learning models. The feedback is continuous throughout the learning process. Slow learners do not become lost and discouraged as the material becomes more complex and detailed. Spelling generally improves due to constant repetition. The highly structured nature can help users move well beyond their normal level of progress. One of the major advantages frequently stated for programmed instruction is cost effectiveness (Bullock, 1978).

Advantages of Computer Based Instruction

Many of the advantages of programmed instruction are also advantages of computer based instruction and web-based learning. The advantages of computer based instruction include flexibility for students so that they can work at their own speed at the time that is best for them. With web-based instruction, they can work at home, at school, or anywhere there is a computer with an Internet connection. Used with distance learning, it allows students with handicaps or learning disabilities the opportunity to learn in a less restrictive environment. Also, students who enroll in course via CBI, including web-based classes, gain an opportunity to learn computer skills, which benefit them in many aspects of their lives (Christmann and Badgett, 1997).

Computer based instruction proves better than all other aids in several respects. There is not only saving of time in learning but it also performs miracles in processing the performance data. This latter characteristic 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 by any other medium. The dynamic interaction between the student and the instructional programme is not possible to be secured in any other medium. With CBI, materials can be completely individualized. Before computer can be of any use, they must be carefully programmed to perform desired functions. This requires thorough planning of every step and prior thinking. Computers are simple-minded. They demand instructions spelled out in explicit detail. Human beings are brilliant but rather sloppy thinkers; computers are stupid but accurate.

The field of CBI is based in number of disciplines, but its primary origins lie in computer science and psychology. From computer science and its predecessors, mathematics and engineering, came the computers and the programs that enable them to function. From psychology came the knowledge of learning theory, instructional strategies, and motivation. Complex applications of these concepts were not always applied in the design of CBI modules in the early experiments due to the major problems encountered as a result of the newness of computing hardware, its costliness, and the difficulties in writing programs. Thus, the early experiments in CBI were primarily confined to fairly simple uses, such as drill and practice and tutorials.

Computer based instruction satisfied many of the theoretical requirements for a good" learning environment advanced by leading psychological theorists such as Skinner (1968). Thus, it involves the individual actively in the learning process, which supposedly facilitates learning (Mckenzie *et al,* 1978). It also permits the learner to proceed at his own pace. Finally, reinforcement of learning in such situations is immediate and systematized, which again should result in more effective learning according to established theories of instruction.

The critical CBI experiments of the 1960s and 1970s, however, yielded mixed results. Other than the substantial learning gains exhibited by children using drill and practice CBI modules, and the results obtained in the TICCIT (a registered trademark of the Hazeltine Corporation) study, little evidence was gained from these large-scale experiments that clearly indicated the superiority of CBI over regular classroom procedures.

In addition to the large-scale CBI experiments, however, a sizable number of CBI projects have been evaluated by this time. The results of these smaller-scale studies, covering a variety of educational levels and diversity of fields, have yielded surprisingly consistent results in a number of different areas. The findings of all relevant studies are presented below, categorized by the content of the finding

Disadvantages of Programmed Instruction

Programmed instruction, especially linear materials, are often said to be boring. In a way, this is true. Many are tedious, especially if you diligently work through hundreds or even thousands of linear frames. However, this claim is based on the common misconception that learning is necessary fun (Bullock, 1978). Writing and validating programmed instruction is time consuming and may be more expensive to produce than other print materials. It usually consumes more paper. It is difficult to programmed materials for reference. They are not well structured for access. Branching texts can be awkward to use, especially if you lose your place in the sequence. The highly structured organization of the material can discourage independent inquiry and creative thought.

Machine-based programs are usually unique to one machine; they cannot be displayed on another type of leaching machine. Efforts to standardize on a common format have failed. Program questions usually emphasize only content knowledge and do not accommodate emotions or feelings. (This may or may not be a disadvantage). Good programs are difficult to prepare on a local basis.

Many programs overemphasize short-answer questions that do not require understanding of the information. Little interaction among users usually occurs while working on programmed instruction because of the pacing characteristic. However, programmed instruction can be used successfully in small groups. There is not as wide a selection of high quality programmed materials available today as in the 1960's, cheating is possible with virtually all programs especially linear ones.

Disadvantages of Computer Based Instruction.

Disadvantages include the need to own or have access to a computer with the necessary RAM and operating system, lack of computer skills of many students, physical problems such as carpel-tunnel syndrome and eye disorders (caused by sitting in front of the computer screen for long periods of time without blinking), non-availability or prohibitive cost of educational software, and the lack of human interaction in the learning process (Fourie, 1999). It is imperative that the computer based instruction software be designed well from the start. Computer based instruction must bridge different learning styles to be fully effective; therefore, it should offer different types of examples and ways to solve problems. Instructors and students using CBI and web-based learning must be sure to give frequent feedback. Delays in communication may actually hinder students' success in comprehending the material (Fourie, 1999).

Another approach is to combine the traditional classroom with CBI or the Internet. Studies have shown that combining technology with the standard classroom approach actually improves student performance (Christmann and Badgett, 1997).

Although computers open the possibility of educating the students completely by individualized programmes, its chief limitation lies in the fact that it is prohibitively expensive. Computers may also inject a non-human quality into educational programmes. This new technology may 'dehumanize' man. Further all individualized instruction and CBI instruct the students in such a way, that all will achieve the same level of competency.

Gender and Academic Achievement in Learning

Over the last two decades there has been an increasing emphasis placed on issues of gender equity in the classroom. This interest has been motivated by observations suggesting that girls were at a disadvantage within the New Zealand education system. Two lines of evidence supported this conclusion. First, historical evidence suggested that girls had lower success rates in school leaving examinations and were less likely to enter tertiary education with these differences being particularly marked in the areas of science and mathematics (Forbes, 1987; NZCER, 1988). Second, studies of classroom interaction patterns suggested that males are more prominent and dominant in both teacher/pupil and pupil/pupil interactions (Middleton, 1988; NZCER, 1988). This evidence has been interpreted as suggesting that male classroom behaviour may act to discourage female educational achievement. The most comprehensive review of these issues, as they apply to the New Zealand educational system, was reported in the analysis given in the report of the 1988 Royal Commission on Social Policy. The report concluded that: “The major findings of the research are limitations on the aspirations and life chances of most young women at their completion of secondary school and their limited participation in tertiary education. The research shows clearly that the New Zealand education system does not offer the majority of girls a fair chance to develop their abilities.” (NZCER, 1988, p181). There were, however, two potential limitations of this review. First the review failed to quantify the extent to which there were gender differences in educational achievement or to examine the extent to which these differences had been reducing. Second, much of the report was based on research findings reported by the early 1980s. Both features suggest that the report may have been somewhat out of date as an account of gender differences in the New Zealand education system in the late 1980s.

The tendency for males to have poorer achievement emerges as a special case of a more general tendency for children prone to disruptive and inattentive classroom behaviours to be at risk of later educational under achievement. Accordingly, the appropriate policies are not those centred around the politics of gender in the school system but rather policies that develop practical classroom management practices to address the issue of children with disruptive and inattentive classroom behaviours in a way which minimises the risks of educational under achievement faced by these children. There is a very important difference between policies that address male disadvantage and policies that address the issue of disruptive classroom behaviours. In particular, whilst the majority of children with disruptive classroom behaviours are male there is nonetheless a minority of females who present with these problems and who are at risk of educational under achievement (Anderson et al, 1987; Cohen et al, 1987; Fergusson et al, 1993; Offord et al, 1987). Policies that focus on male disadvantage would, in effect, ignore the difficulties faced by these at risk girls. All of these considerations suggest the need for policies and debates about educational achievement to move away from the narrow confines of gender based theory and toward a more broad based developmental model that takes into account the wide range of individual and social factors that impinge on individual academic achievement.

Finally, we believe that this study provides a case history of the way that enthusiastic extrapolation of research findings in education may mislead rather than enlighten. We have been aware of a discrepancy between the claims that females were educationally disadvantaged and the school performance of this cohort for over a decade. However, in an intellectual climate which was dominated by strong claims that females were educationally disadvantaged it has been difficult to convince others of the discrepancy between educational theory and classroom reality. Indeed, on the occasion on which we pointed out evidence of male educational disadvantage (Fergusson, Lloyd & Horwood, 1991) it was argued that our results were due to methodological error and analytic imprecision (McDonald, 1994). It is clear now that our cohort has ceased its secondary schooling that this was not the case and that, in fact, from the point of school entry to the point of school leaving, males in this (and other contemporary) cohorts have been at a small but consistent educational disadvantage. The irony of this situation is that over the entire school career of our cohort, views of gender differences in education have been dominated by a model that has promoted the view that girls were being unfairly treated and disadvantaged by the New Zealand education system.

This may well have been so up to the mid 1980s but it is clear that by the mid 1990s, any female educational disadvantage (up to the point of school leaving) has largely disappeared and has been replaced by an emerging male educational disadvantage

Computer Based Instruction and Learning Theories

There are many definitions of learning, derived from the differing explanations supplied by psychologists to account for it. For the purpose of this study, however, learning is defined as the process through which experience produces changes in the nervous system, resulting in changes in behaviour. Here the researcher is concerned with those theories of learning that have had the greatest effect in the past on learning with the aid of a computer, as well as with those theories which appear to hold the greatest promise for future use in CBI. Learning is a complex phenomenon. There are many different types of learning, ranging from the simplest response (such as withdrawing your hand after touching a hot toaster - learnt very rapidly!) to the type of thought that results in the solution to a complex scientific problem. Thus, some theories of learning have concentrated on the acquisition of simple low-level behaviours, and as a result, have been of most help in understanding that type of learning situation. As might be expected, such theories have fallen short when higher-level types of learning have been under consideration. Conversely, other theories have been concerned with global approaches that have aided understanding of higher mental processes involved in complex learning. But unfortunately, these theories seldom have been of significant help in accounting for the detailed components and antecedents of such behaviour. Since CBI is applicable to a broad range of learning tasks, only the major theoretical representatives of both ends of learning continuum are being considered. Psychology is a relatively new science, having emerged from the field of philosophy and physiology in the late 1800s. The new psychologists adopted the rigorous scientific method of physiology, while attempting to understand philosophically based problems such as consciousness, memory, and, in general, the workings of human mind. Unfortunately, little progress was made, and as a result, the concept of behaviourism emerged from within psychology and dominated the entire field from about 1913 until the 1970s. Behaviourism emphasized that progress was to be made in psychology only through the elimination of such research topics as memory and mind while concerning oneself solely with observable phenomena - behaviour. Skinner's theory of operant conditioning had a tremendous influence on the development of the early CBI systems (Shlechter, 1991). The basic learning principles of Skinner's theory are personalized instruction, controlled operant, immediate feedback, linear sequence of learning, and instructional prompts (Shlechter, 1991). Another approach to instruction, devised by Crowder (1962) and involving the use of a branching sequence in CBI for training Navy personnel was the basis for adaptive sequencing. There are three basic assumptions about the behavioral learning process: (1) behavior rather than internal thought processes is the focus, (2) environment shapes behavior, and (3) the principle of contiguity and reinforcement are central to explain the learning process (Grippin & Peters, 1983). Several educational practices can be traced to the behavioral type of learning. The systematic design of instruction, behavioral objectives, notions of the instructor's accountability, programmed instruction, computer-assisted instruction, and competency-based education are all solidly grounded in behavioral learning theory. Adult technical and skills training also draws from behaviorism. Training researchers continue to endorse, explicitly or implicitly, a methodological behaviorism that stresses the importance of objective, observable performance as the primary indicator of training output (Bosco & Morrison, 2000). The concept of behavioral objectives continues to serve as a method for defining the content of instruction. In the 1960's and 1970's, as behavioristic learning theory was peaking in its influence on training research and practice, learning theorists were becoming less satisfied with behavioral conceptions of learning and memory and increasingly interested in the study of internal knowledge structures and cognitive processes that underlie task performance (Bosco & Morrison, 2000). The positive effects of behavioral objectives and the learning process are now discussed in cognitive rather than behavioral terms. John Watson introduced this concept, and soon stimulus-response (S-R) psychology became the American tradition.

At about this time in the field of learning, Thorndike developed the law of effect, emphasizing the importance of reward (reinforcement) in learning. Later, in the 1930s, Skinner proposed the concept of operant conditioning, in which even the stimulus (S) was deleted from S-R, with now only the response (R) followed by reinforcement forming the critical learning elements. Over the years, Skinner's research was so well done and convincing that his views came to dominate the field (Chambers and Sprecher, 1983).

It was not until the past few years that psychologists again began to be disturbed by the lack of progress in understanding what many believed to be fundamental problems in the field, i.e.; cognitive events such as thinking, memory, perception, and mental process in general. At about this time, computers became prevalent in higher education. The emphasis on information processing (in which computers were considered to be analogous to the brain and in which concepts such as memory replaced stimulus-response bonds) was accompanied by a general social and professional acceptance of the value of such machines. This provided the groundwork for revolution. The revolt occurred with experimental psychologists combining with linguistics and computer science professionals to form the new field of cognitive science. This field, concerned with understanding mental processes and making extensive use of the modeling capabilities of computers, brought on entirely new light to bear on the topic of learning.

In the following pages, the researcher will first review those topics in learning theory on which there is general theoretical agreement. Following this, she will examine the major concepts of Skinner's operant conditioning, the basic tenets of cognitive theories, and the emerging role of Bandura's social learning theory. In each case, the investigator will attempt to relate these concepts to CBI courseware design and indicate appropriate instructional strategies for drill and practice, tutorials and simulations. Most theorists agree that certain conditions are necessary in order for learning to occur. These conditions include contiguity, reinforcement, and repetition (practice). The basis for behavioristic theory was that a stimulus (S) that elicited a response (R) that was immediately followed by positive reinforcement would result in increasing the probability that the response would occur upon further presentation of the stimulus. Thus, S-R - reinforcement became the learning model. Skinner agreed with the contiguity principle, but emphasized the importance of the immediacy of the reinforcement following the response. The cognitive theorists have, in general, agreed with Skinner on this point. For the purpose of this study, the primary concept is the importance of reward (positive reinforcement) immediately following a student's correct response to a problem in a learning situation.

There is also general agreement among theorists that repeated occurrences of the response followed by reinforcement are necessary in order for learning to occur and for the materials to be retained.

CHAPTER III

METHODOLOGY

This chapter discusses the research methods and procedures to be employed in the collection of data for the study. It includes the following areas: The Research design, Area of the study, Population of the study, Sample of the study, Instrument for data collection, Validation of instrument, Administration of the instrument, and Method of data collection.

The Research Design

The study adopted quasi-experimental research design in which pre-test and post test design with the experimental and control groups was used. In this design, an intact class will be used for the study. This research design is necessary because it is not possible for the researchers to randomly sample the students and assign them to groups without disrupting the academic programme of the schools involved in the study (Ali, 1996). In this design, subjects are randomly assigned to experimental and control groups. Representation of the design was made as follows:

The Pre-Test Post-Test Control Experimental Design

$$Ge = O_1 \quad X \quad O_1$$

$$Gc = O_1 \qquad\quad O_1$$

Where:

Ge = Experimental Group

Gc = Control Group

O_1 = Pre-Test on Students in the Experimental and Control Group

O_1 = Post-Test on Students in the Experimental and Control Group

X = Treatment with computer based Instruction (CBI)

Source: Campbell and Stanley (1963)

In this design, a pre-test was given before the application of the treatment to both groups to make sure they are equivalent and the same test was administered as a post-test after applying the treatment to see whether the computer-based instruction had any influence on the experimental groups and which kind of instruction have more influence on the subjects than the other.

Area of the study

The study was carried out in Delta State. The area of the study covered 5 Technical colleges in Delta State. The Technical Colleges includes; Government Technical college Agbor, Government Technical College Otogor Ughelli, Government Technical College Ozoro, Government technical college , Issele-Uku, and Technical High School, DSC Warri.

Population

The population for the study comprised 180 first year Basic electricity students in all the Technical Colleges in Delta State (See Appendix E for distribution of Students according to Gender into various Schools).

Sample

Simple random sampling was used to select one school. The school selected was Technical High school, Warri. And the total of students that offered Basic Electricity in Technical High School is 40. Therefore, the Sample size is 40 students which was subdivided into two groups of 20 students each, i.e. experimental and control group.

Instrument for data collection

The researcher made a thorough study on the selected Basic electricity units called the Basic Electricity Achievement Test (BEAT) comprising multiple choice items, matching items, and items of short answers and the techniques of test construction. In consultation with the class teacher, the researcher-made test (Appendix - C) was given to the sample as pre-test and immediately after the treatment (teaching) was over, a post test will be administered to the experimental as well as control group, were used to collect data for the study. The items were based on the selected electrical/electricity units on; (1) Capacitors (2) Values of resistior(s) (3) Basic principles of air-conditioning. These units were taught during the experiment to both experimental and control groups, and were intended to measure the outcomes of learning. The test was administered to both groups.

Validation of Instrument

This instrument used for the study was validated by three lecturers in the department of Industrial and technology education, Federal University of Technology, Minna. All the test items were based on the text of unit taught to the sample students.

Administration of the Instrument

There were two different treatment patterns applied during the experiment. Both The groups were taught through routine method by the same teacher. The Computer based Instruction (CBI) was used as supplementary strategy for the experimental group. During the experiment period, the experimental group received the treatment of independent variable, i.e. computer based instruction consisting of tutorials, drill and practice, simulations. The control group was kept busy in other activities such as guided practice in order to control the variable of time and to realize the primary objective of the study. The experiment continued for three weeks. The post-test was administered 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.

Method of Data Analysis

The achievement scores of the study was obtained from the pre-test and post test. After obtaining the scores, the lists were prepared for each group. The means, standard deviations, differences of means were computed. Significance of difference between the mean scores of both the groups on the variable of pre-test and scores on post-test was tested at 0.05 level by applying analysis of Variance (ANOVA).

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

This chapter presents the analysis of the data collected for this study. The presentation and analysis is done in tables and arranged according to the research questions and hypothesis formulated for the study.

Research Question 1

Will there be any difference in the achievement of Students taught Basic electricity using Computer Based Instruction and those taught using traditional method?

Table 1

Mean and Standard Deviation of the Pre-Test and Post-Test Scores of the Experimental Group Using Computer Based Instruction and Control Group Using the traditional Method.

Groups	Numbers (N)	Instructional Techniques	Pre-Test $\bar{X}$	Pre-Test SD	Post-Test $\bar{X}$	Post-Test SD
Experimental	20	Computer Based Instruction	52.15	12.32	65.1	13.97
Control	20	Lecture Method	52.00	8.96	58.55	9.93

The data in Table 1 shows that the experimental group had a mean of 52.15 with a standard deviation of 12.32 in the Pre-test and a mean of 65.1 with a standard deviation of 13.97 in the Post-test, making a Post-test Pre-test, gain of 12.95. On the other hand, the control group had a mean of 52.00 with a standard deviation of 8.96 in the Pre-test and a mean of 58.55 with a standard deviation of 9.93 in the Post-test, making a Post-test Pre-test gain of 6.55. This means that the experimental group performed better than the control group.

Research Question 2

What is the mean achievement of both the control and experimental group before using Computer Based Instruction to teach Basic electricity to the student?

Table 2

Significance of Difference between the Mean Scores on the Pre-Test of the Control group and Experimental Group.

Groups	Numbers (N)	Pre-Test (Mean) $\bar{X}$	Pre-Test (SD) $\bar{X}$
Experimental	20	52.15	12.32
Control	20	52.00	8.96

The data on Table 1 indicates that the mean scores of the Pre-test in electrical/electronics of the experimental group was 52.15 with a standard deviation of 12.32. The difference between the two means shows no significant difference between them. Hence, both groups could be treated as having equal entry behavior.

Research Question 3

What is the difference in the achievement of male and female students taught Basic electricity with Computer based Instruction?

Table 3

Significance of Difference Between the achievement Scores on Pre-Test and Post-Test of Male and females of the Experimental Group.

Group	Number	Pre-Test Scores		Post -Test Scores	
		$\bar{X}$	SD	$\bar{X}$	SD
Males	16	52.69	12.71	66.38	15.00
Females	4	50.00	12.08	60.00	8.17

Analysis of the data in Table 3 shows that the males had a mean of 52.69 with a standard deviation of 12.71 and a mean of 66.38 with a standard deviation of 15.00 in the Post-test, making a Post-test Pre-test gain of 13.69. On the other hand, the females had a mean of 50.00 with a standard deviation of 12.08 in the Pre-test and a mean of 60.00 with a standard deviation of 8.17 in the Post-test, making a Post-test Pre-test gain of 10.00. It is clear that there is no significant difference between the Post-test mean scores of male and female students in the experimental group. Hence, gender difference has no effect on the use of computer based Instruction for instruction.

HO_1

There is no significant difference between the mean achievement scores of students taught

Basic electricity using Computer Based Instruction and those taught using tradition method.

Table 4

Analysis Of Variance of the Post-Test of the Control Group and Experimental Group taught with Basic Electricity

Source Of Variation	df	Sum of Squares (SS)	Mean Squares	F-Cal	Critical Value of F	Significances	Decision
Between Groups	1	429.03	429.03	2.92	4.08	0.05	Accept HO_2
Within Groups	38	5580.75	146.86				
Total	39	6009.78					

Table 4 shows that the F-cal (2.92) is not equal or exceeds F-critical value of (4.08) necessary for rejection of null hypothesis at 0.05 level of significance; therefore the null hypothesis is accepted. Hence, there is no significant difference in the mean performance of students taught Basic electricity using Computer Based Instruction and those taught with traditional method.

HO_2

There is no significant difference in the mean achievement scores of both the control and experimental group before using Computer Based instruction to teach Basic electricity to the students.

Table 5

Analysis Of Variance of the Mean Scores on the Pre-Test of the Control Group and Experimental Group.

Source Of Variation	df	Sum of Squares (SS)	Mean Squares	F-Cal	Critical Value of F	Significances	Decision
Between Groups	1	0.225	0.225	0.0019	4.08	0.05	Accept HO_2
Within Groups	38	4410.56	116.07				
Total	39	4410.78					

Table 4 shows that the F-cal (0.0019) is not equal or exceeds F-critical value of (4.08) necessary for rejection of null hypothesis at 0.05 level of significance; therefore the null hypothesis is accepted. Hence, there is no significant difference in the mean performance of both the control and experimental group before using Computer Based Instruction teach Basic electricity to the students.

HO_3

There is no significant difference in the mean achievement Scores of male and female students taught Basic electricity Using Computer Based Instruction.

Table 6.

Analysis of Variance of the Post-Test of Males and Females in the Experimental Group.

Source Of Variation	df	Sum of Squares (SS)	Mean Squares	F-Cal	Critical Value of F	Significances	Decision
Between Groups	1	130.05	130.05	0.6547	4.41	0.05	Accept HO_3
Within Groups	18	3575.75	198.65				
Total	19	3705.8					

Table 6 shows that the F-cal (0.6547) is not equal or exceeds F-critical value of (4.41) necessary for rejection of null hypothesis at 0.05 level of significance; therefore the null hypothesis is accepted. Hence, there is no significant difference in the performance of male and female students taught Basic electricity with Computer Based Instruction to the students.

Findings

On the basis of the data collected and analyzed for this study, the following findings were made with respect of the research questions.

1. It was revealed that the students of the experimental group and control performed equally in the Pre-test. This means that both groups were having the same entry behavior/knowledge before the treatment.
2. The findings also revealed that students taught with Computer Based Instruction (experimental group) scored higher in the Post-test than those taught with conventional lecture method (control group).
3. There was no significant difference in the mean scores of male and female students taught with Computer Based Instruction.

Discussions of Findings

The discussions of the findings are based on the research questions posed for the study.

The findings from Table 1 of the study confirms that both the experimental and control groups were compared based on the mean score of the Pre-test. The Pre-test results provided basis on which it could be reasonably assumed that both the experimental and control group had equivalent entry knowledge at the commencement of treatment. The results also afforded premise to justify the comparison of the performance of the experimental and control groups on an equal level.

The findings in Table 2 show clearly that the experimental group had higher mean scores than the control group in the Post-test. The findings of this study agreed with the findings of

Harrison (1993), who in their individual studies discovered that students who receive Computer Based Instruction shows greater increases in their achievement scores than students who received traditional approach, this findings may be attributed to several factors such described by Dence (1980) who found out that students' positive attitudes toward the computer and computers motivate students and help them maintain high interest. The increase in students scores n achievement tests indicate that the retention of content learnrd using Computer Based Instruction is superior to retention following traditional instruction. (Capper and Copple 1985; Grimes 1977; Kulik, Bangert, and Williams 1983; Kulik. Kulik, and Bangert-Drowns 1985; Rupe 1986).

Finding from Table 3 of this study shows that male and female student when taught with Computer Based Instruction showed that they performed equally in the Post-test. This finding is in consonant with that of Sack (1994) who found that there were no overall gender differences in the actual use of computer nor did computer use increase across the course of study. Even though the 1988 meta-analysis of 82 studies of Computer based Education conducted by Roblyer, concluded that there is slight difference in favour of boys over girls on the use of Computer Based Instruction.

Finding from Table 4 of this study confirms that the performance of the experimental group was significantly better that the control group in the Post-test. The significant difference is attributed to the treatment. This is an indication that Computer Based Instruction has a positive effect on students' academic achievement. Thus, the null hypothesis that there will be no significant difference in the performance of students taught Basic electricity using computer Based Instruction and those with conventional method was accepted at 0.05level of significances. Bracey (1982) found that students reacted favourably to computer Based

Instruction (experiment group) scored higher in the Post-test than those taught with conventional lecture method (control group).

Findings of Table 5 of this study show that there is no significant difference between the mean scores of pre-test of the experimental group and that of the control group. Thus, the null hypothesis indicated that there is no significant difference in the mean performance of the control and experimental group before using computer Based Instruction to teach Basic electricity to the student was accepted at 0.05 level of significances. This means that the students of the experimental group and control performed equally in the pre-test, i.e, both groups were having the same entry behavior/knowledge before the treatment.

Findings from table 6 of this study shows that there was no significant difference between the mean scores of male and female students in the Post-test. Thus, the null hypothesis that there will be no significant difference in the performance of male and female students taught Basic electricity with Computer Based Instruction was accepted at 0.05level of significances. Swadener and Hannafin (1987) in their findings suggested that there is no differences in male and female students' performance when taught with Computer Based Instruction. The overall results of the study indicates, motivates them to learn increases their personal responsibility for learning and leads to increase in students' achievement.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary of the Study

The study was to see the effect of Computer Based Instruction on students' achievement in Basic electricity in Delta state. The purpose of the study were: (1) Determine the difference in achievement of students taught basic electricity using computer based instruction and those taught using traditional instructions**.** (2) Determine the mean achievement of both the control and experimental group before using computer based instruction to teach Basic Electricity to the student. (3) To investigate the difference in the achievement of male and female students taught Basic Electricity with Computer Based Instruction. To achieve the purpose of the study, the following null hypotheses were tested: (1) There will be no significant difference between the mean achievement scores of students taught Basic electricity using Computer Based Instruction and those taught using traditional method; (2) There will be no significant difference in the mean achievement of both the control and experimental group before using Computer Based instruction to teach Basic electricity to the students; (3) There will be no significant difference in the mean achievement scores of male and female students taught Basic electricity with Computer Based Instruction.

. A Technical college was used for the study. Students studying basic electricity constituted the population of the study. The student school colleges of technical college year one (TC1) technical high school college,Warri was used as the experimental and control group. Each comprised of 20 students.

There are two different treatment patterns applied during the experiment. Both the groups was taught through a routine method by the same teacher. The Computer Based instruction (CBI) was used as a supplementary strategy for the experimental group. During the experimental period, the experimental group received the treatment of independent variable, i.e., Computer based instruction which include tutorials and Drill and practice. The control group was kept busy in other activities such as guided practice in order to control the variable of time and to realize the primary objective of the study. The experiment last for three weeks. The post-test will be administered immediately after the treatment (teaching) will be over. The purpose of this test is to measure the achievement of the student constituting the sample of the study.

The achievement scores of the study was obtained from the pre-test and post-test. The means, standard deviations were used to analyze data. Analysis of Variance (ANOVA) was used to test the hypothesis at 0.05 level of significances.

Analysis of data revealed that the students taught with Computer Based Instruction as supplementary strategy performed significantly better. The Computer Based Instruction was found equally effective for male and female students.

Implications of the Study

The findings of this study have implication for basic electricity teachers, Curriculum developers, students, educational researchers and examination bodies. Having found that Computer based Instruction have a positive effect on students' achievement.

It means that basic electricity teachers should adopt this incorporating Computer Based Instruction as an appropriate approach for instruction in a regular class-room. Apart from the direct effect on students achievement. It will enable them acquire the right attitude for effective thinking and at the same time cater for the diverse learning styles of students. The implication of the findings of the study of curriculum developers is that they can develop appropriate curriculum that will make provision for the students' learning styles and induce the educational administrators and supervisors to promote Computer Based Instruction.

From the findings of the study, the examination bodies should be able to develop appropriate assessment instrument that will enable assess students performance based on the instructional approach (Computer Based Instruction) instead of the present method which is limited to only linguistic and mathematical abilities. From the findings of this study, educational researchers and scorers should be provided a base to plan and conduct further research

Conclusions

Based on the findings of the study the following conclusions were drawn.

Having found out that the use of Computer Based instruction has improved student academic achievement in Basic Electricity. Therefore, there is the need to identify the type of feedback that is most effective in specific educational settings. As previously highlighted, there are several factors to consider when designing computer-based feedback: student achievement levels, nature of the learning task, and prior knowledge. In addition, designers need to make decisions concerning the amount of learner control, attitudes toward feedback, and demands for efficiency. It is safe to conclude that it could be used to improve students' performance in basic electricity and other technical subjects. Teachers should therefore be encouraged to use it for instruction.

Recommendations

In the light of the findings revealed and conclusions drawn from the study, the following recommendations are made:

1. Teachers should adopt how to use Computer based instruction to teach and also to adopt Computer Based Instruction in teaching.

2. An experiment with the students from different cultural background such as urban and rural areas is needed to examine the effectiveness of the computer Based instruction, representing a wider range of intelligence, the plan and examine the results of this study an experiment involving different levels of education should be done to see if there be positive of Computer Based Instruction.
3. During the course of the experiment, it was observed that these students have very low computer literacy. Hence, government should provide more computer for classroom use.
4. The teachers of different subjects' areas, especially from the rural schools, are trained in the use of computers in the classroom.
5. The present study was conducted to see the effect of computer based instruction a supplementary strategy in teaching Basic electricity; such studies are needed to be planned and conducted in other subjects areas such as Automobile mechanics, Metal Work, e.t.c

Suggestions for Further Research

The following have suggested for further research:

1. The Effect of Computer-Based Instruction on the performance and retention in Basic electricity
2. Computer Based instruction in classroom instruction: Implication For Industrial and Technical Education Teacher.
3. Computer-Based instruction: Current Treads and Critical Crisis.

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APPENDIX B

FORMAT OF LESSON PLAN 1 USE FOR COMPUTER BASED INSTRUCTION

(Experimental Group)

SUBJECT: Basic Electricity

TOPIC: Capacitors

CLASS: TC1

AGE: 14 – 18

DURATION: 45 minutes

INSTRUCTIONAL MATERIALS: A computer and the computer based instruction.

SPECIFIC OBJECTIVE: On completion of this lesson the students should be able to:

1. Define a Capacitor, and the types of capacitors, and its uses
2. Calculate Charge, Capacitance of a capacitor, and energy stored in a capacitor
3. Connect:

    a. capacitor in series

    b. capacitor in parallel

    c. series and parallel connection

ENTRY BEHAVIOUR: The student have been taught about electricity.

S/No	Teacher Activities	Student Activities
1.	Run the program for the student	Read through the tutorial materials
2.	Guide the students when the students are involved in any difficulty.	Answer the drill and practice and go through the simulation package
3.	Expose the students to some drill and practice and simulations	

EVALUATION:

1. What is the function of a capacitor?

ASSIGNMENT: What formula should be used to calculate the energy stored in a capacitor if the capacitance and voltage are given?

FORMAT OF LESSON PLAN 2 USE FOR COMPUTER BASED INSTRUCTION

(Experimental Group)

SUBJECT: Basic Electricity

TOPIC: The Values of Resistor(s)

CLASS: TC1

AGE: 14 – 18

DURATION: 45 minutes

SPECIFIC OBJECTIVES: On completion of this lesson the students should be able to:

1. Explain the colour coding system of resistors.
2. Calculate the resistance of a resistor using colour codes
3. Identify the tolerance of resistors
4. Calculate the value of the tolerance of a resistor using colour codes

INSTRUCTIONAL MATERIALS: A computer and the computer based instruction

ENTRY BEHAVIOUR: The students know what a resistor is?

S/No	Teacher Activities	Student Activities
1.	Run the program for the student	Read through the tutorial materials
2.	Guide the students when the students are involved in any difficulty.	Answer the drill and practice and go through the simulation package
3.	Expose the students to some drill and practice and simulations	

EVALUATION:

1. What is colour coding system of resistors?

ASSIGNMENT: Learn the table colour coding of resistor

FORMAT OF LESSON PLAN 3 USE FOR COMPUTER BASED INSTRUCTION

(Experimental Group)

SUBJECT: Basic Electricity

TOPIC: Basic principles of Air-conditioning (A/C)

CLASS: TC1

AGE: 14 – 18

DURATION: 45 minutes

SPECIFIC OBJECTIVES: On completion of this lesson the students should be able to:

1. Define air-conditioning and the types of Air-conditioner system
2. Various components and functions of an air-condition
3. Working principles of an air-condition.

INSTRUCTIONAL MATERIALS: A computer and the computer based instruction.

ENTRY BEHAVIOUR: The student have been taught about electricity.

S/No	Teacher Activities	Student Activities
1.	Run the program for the student	Read through the tutorial materials
2.	Guide the students when the students are involved in any difficulty.	Answer the drill and practice and go through the simulation package
3.	Expose the students to some drill and practice and simulations	

EVALUATION:

1. Define an Air-Condition?
2. List and explain the types of an Air Conditioner System?

ASSIGNMENT: Explain the working principle of an Air-Condition System?

FORMAT OF LESSON PLAN 1 USE FOR COMPUTER BASED INSTRUCTION

(Control Group)

SUBJECT: Basic Electricity

TOPIC: Capacitors

CLASS: TC1

AGE: 14 – 18

DURATION: 45 minutes

SPECIFIC ACTIVITIES: On completion of this lesson the students should be able to:

1. Define a Capacitor.
2. Calculate Charge, Capacitance of a capacitor, and energy stored in a capacitor
3. Connect: capacitor in series, capacitor in parallel, and series and parallel connection

INSTRUCTIONAL MATERIALS: Chalk Board, Battery, Cable, Capacitors, and Textbooks.

ENTRY BEHAVIOUR: The student have been taught about electricity.

S/No	Teacher Activities	Student Activities
1.	Define a Capacitor.	Watch and listen to the teacher.
2.	Work some calculations on charge, capacitance of a capacitor, and energy stored in a capacitor	Ask questions when confused.
3.	Show how capacitors can be connected in series, parallel, and series-parallel and perform calculations.	

EVALUATION: What is the function of a capacitor?

ASSIGNMENT: What formula should be used to calculate the energy stored in a capacitor if the capacitance and voltage are given?

FORMAT OF LESSON PLAN 2 USE FOR COMPUTER BASED INSTRUCTION

(Control Group)

SUBJECT: Basic Electricity

TOPIC: The Values of Resistor(s)

CLASS: TC1

AGE: 14 – 18

DURATION: 45 minutes

SPECIFIC OBJECTIVES: On completion of this lesson the students should be able to:

1. Explain the colour coding system of resistors.
2. Calculate the resistance of a resistor using colour codes
3. Identify the tolerance of resistors
4. Calculate the value of the tolerance of a resistor using colour codes

INSTRUCTIONAL MATERIALS: Chalk Board, Capacitors, and Textbooks.

ENTRY BEHAVIOUR: The students know what a resistor is.

S/No	Teacher Activities	Student Activities
1.	Explain the colour coding system of resistors	Watch and listen to the teacher.
2.	Calculate the resistance of a resistor using colour codes and identify the tolerance of resistors	Ask questions when confused.
3.	Calculate the value of the tolerance of a resistor using colour codes	

EVALUATION: What is colour coding system of resistors?

ASSIGNMENT: Learn the table colour coding of resistor

FORMAT OF LESSON PLAN 3 USE FOR COMPUTER BASED INSTRUCTION

(Control Group)

SUBJECT: Basic Electricity

TOPIC: Basic principles of Air-conditioning (A/C)

CLASS: TC1

AGE: 14 – 18

DURATION: 45 minutes

DATE:

SPECIFIC OBJECTIVES: On completion of this lesson the students should be able to:

1. Define air-conditioning and the types of Air-conditioner system
2. Various components and functions of an air-condition
3. Working principles of an air-condition.

INSTRUCTIONAL MATERIALS: Textbook and Chalkboard

ENTRY BEHAVIOUR: The student have been taught about electricity.

S/No	Teacher Activities	Student Activities
1.	Define air-conditioning and the types of Air-conditioner system	Watch and listen to the teacher.
2.	List the various components and functions of an air-condition	Ask questions when confused.
3.	Explain the working principle of an air-condition	

EVALUATION: Explain the working principle of an air condition?

ASSIGNMENT: List the components and functions of an air-condition?

APPENDIX C

BASIC ELECTRICITY ACHIEVEMENT TEST (BEAT)

1. Which part is referred of as the heart of an Air condition?

   (a)Evaporator (b) Compressor (c) Condenser (d) Expansion valve (e) Capillary tube

2. Which of the following instrument is used for measuring resistor?

   (a) multimeter (b) Ammeter (c) Voltmeter (d) Wattmeter (e) volts

3. What is the S.I unit of Capacitor?

   (a) Ohms (b) Volts (c) Watts (d) Farad (e) Joules

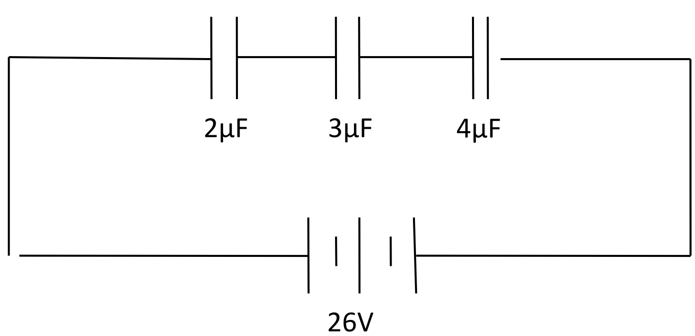
4. A resistor colour codes reading ; red, red, green, gold, has a tolerance value of ;

   (a) ±2% (b) ± 1% (c) ± 0.5% (d) ± 0.25% (e) ±5%

5. Which of the following appliances used to measure capacitor?

   (a) multimeter (b) wattmeter(c) voltmeter (d) ohms meter(e) ammeter

6. Calculate the energy stored in the capacitor in the diagram shown below;



   (a)$3.12\text{x}10^{-2}$J (b) 1.09×10^{-3}J (c) 1.09×10^{-4J}J (d) 3.12×10^{-4}J (e) 4.15×10^{-2}J

7. What is the standard unit for resistance?

(a) Volts (b) Ampere (c) Ohms (d) watts (e) Joules

8. The three major components of an air condition are?

(a) Condenser , Evaporator, and Capillary tube (b) Capillary tube, Expansion valve, and Condenser (c) Blown ,Fan, and Condenser(d) Condenser, Capillary tube, and Evaporator

9. Calculate the charge of the capacitor with capacitance of 6 μF and a voltage of 15V

(a) 9×10^{-5}C (b) 9×10^{-6}C (c) 2.1×10^{-5}C) (d) 9×10^{-6}C (e) 9×10^{-5}C

10. What part of the Air condition senses temperature regulation of the room?

(a) Compressor (b) blower(c) thermostat (d) condenser (e) expansion valve

11. The working fluid leaves the compressor as?

(a) Cool, low temperature gas(b) hot , high pressure gas (c) hot, low temperature gas (d) Cool , high pressure gas (e) Cool gas

12. What is the S.I unit of energy?

(a) ohms (b) joules (c) farad (d) watts(e) volts

13. A resistor with the four colour bands; Red, Violet, Brown, Silver has a value of?

(a) 27KΩ (b) 270KΩ **(**c) 27KΩ (d) 27000KΩ **(e)**7KΩ

14. What part of an air condition does dissipation occurs?

(a) Condenser (b) Evaporator(c) Accumulator (d) Receiver (e) Drier Compressor

15. Which of these is the formula for calculating the capacitance of the capacitor?

(a)C=C1+C2+C3 (b)1/C=1/C1+1/C2+1/C3 (c) C=C1+1/C2+1/C3 (d) 1/C=1/C1+1/C2+C3 (e) C=C1+C2+1/C3

16. The following parts make up the electric motor in an air condition?

(a)Fan and blade (b) Blower and blade (c) compressor (d) condenser fan (e) Evaporator

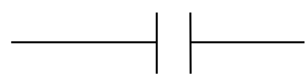
17. Resistors opposes the flow of?

(a)Power (b) Resistance (c) Current (d) Voltage (e) Circuit

18. What is the multiplier value of a yellow colour code?

(a)100 (b)1,000 (c) 10,000 (d) 100,000 (e)10

19. What symbols is represented in the diagram below ?



(a) Battery (b) Capacitor(c) Voltmeter(d) Lamp (e) Fuse

20. A Capacitor is used to perform the following functions ?

(a) Converting DC to AC (b) Converting AC to DC (c) Reduces DC voltage (d) Reduces AC voltage (e) Filtering ripples

21. The fins in a condenser act as?

(a) Discharge tube (b) Capillary tube(c) Radiator (d) Compressor (e) Evaporator

22. Which of the following represent the tolerance value in a five colour band resistor

(a)1st band (b) 2nd band (c) 3rd band (d) 4th band (e)5th band

23. The part of the air condition which remove heat and moisture from the air is called ?

(a)Evaporator (b) Compressor (c) Drier (d) Blower fan (e) Expansion valve

24. Two capacitors of 2 µF and 3 µF are connected in parallel. What is the equivalent capacitance of the Capacitor ?

(a)1 µF (b)1 µF (c) 5 µF (d) 4 µF (e)2.2 µF

25. Which type of air condition is made up of the outdoor and indoor unit ?

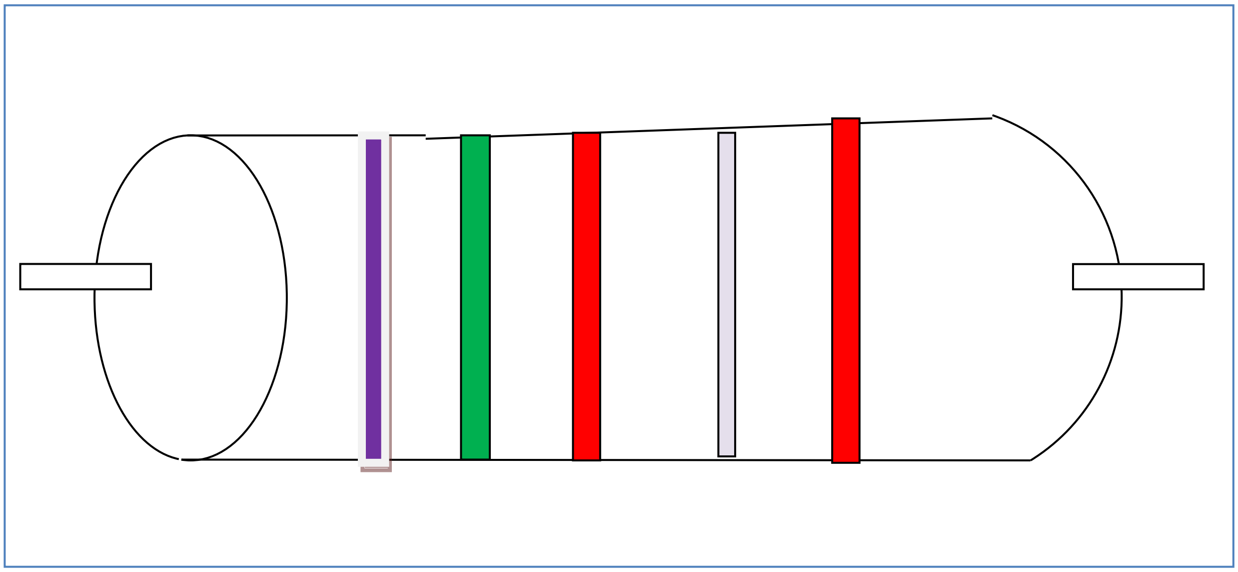
(a)Packaged air conditioner (b) Window air conditioner (c) Central air conditioner (d) Split air conditioner (e) HVAC air conditioner

26. Which of the following is not a type of capacitor ?

(a)Polyester film (b) Polygamy (c) Ceramic (d) Electrolytic (e) Tantalum

27. Which of the air conditioner is used in industries and factories ?

(a) Central air conditioner (b) Packaged air conditioner (c) Window air conditioner (d) Split air conditioner (e) HVAC air conditioner



IN ANSWERING QUESTION 29 AND 30,REFER TO FIGURE ABOVE

28. What is the value of the resistor?

(a) 752Ω (b) 853Ω (c) 7520Ω (d) 8000Ω (e)7152Ω

29. What is the specified tolerance of the resistor?

(a)1% (b) 2%(c) 5% (d) 10% (e) 8%

30. Which of the colour band represents the multiplier?

(a) Gold (b) Violet (c) Brown (d) Red (e) Green

31. What is the S.I unit of Capacitor?

(a) Farad (b) Volts (c) Watts (d) ohms (d) Joules

32. Which type of air condition is made up of the outdoor and indoor unit ?

(a)Packaged air conditioner (b) Window air conditioner (c) Central air conditioner (d) HVAC air conditioner (e) Split air conditioner

33. Which of the following represent the tolerance value in a five colour band resistor

(a) 2^{nd} band (b) 5^{th} band (c) 1^{st} band (d) 4^{th} band (e) 3^{rd} band

34. A Capacitor is used to perform the following functions ?

(a) Converting DC to AC (b) Filtering ripples (c) Reduces DC voltage (d) Reduces AC voltage (e) Converting AC to DC

35. The fins in a condenser act as?

(a) Discharge tube (b) Capillary tube(c) Compressor (d) Evaporator (e) Radiator

36. Which part is referred of as the heart of an Air condition?

(a)Evaporator (b) Condenser (c) Compressor (d) Capillary tube (e) Expansion valve

37. Which of the following instrument is used for measuring resistor?

(a) Ammeter (b) Voltmeter (c) Wattmeter (d) multimeter (e) volts

38. Resistors opposes the flow of?

(a)Resistor (b) Current (c) Voltage (d) Circuit (e) Power

39. What is the multiplier value of a yellow colour code?

(a)10000 (b)1,000 (c) 100,000 (e)100

40. Calculate the charge of the capacitor with capacitance of 6 μF and a voltage of 15V

(a) 9 x 10^{-6}C (b) 2.1 x 10^{-5}C) 9 x 10^{-5}C (c) (d) 9 x 10^{-6}C (e) 9 x 10^{-5}C

41. What part of the Air condition senses temperature regulation of the room?

(a) thermostat (b) blower(c) Compressor (d) condenser (e) expansion valve

42. The working fluid leaves the compressor as?

(a)Cool, low temperature gas (b) hot, low temperature gas (c) Cool , high pressure gas (d) hot, high pressure gas (e) Cool gas

43. A resistor colour codes reading ; red, red, green, gold, has a tolerance value of ;

(a) ±5% (b) ± 1% (c) ± 0.5% (d) ± 0.25% (e) ±2%

44. Which of the following appliances used to measure capacitor?

(a) voltmeter (b) wattmeter(c) multimeter (d) ohms meter(e) ammeter

45. What is the S.I unit of energy?

(a) ohms (b) farad (c) Joules (d) volts (e) watts

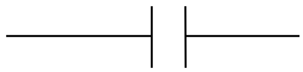
46. A resistor with the four colour bands; Red, Violet, Brown, Silver has a value of?

(a) 27KΩ (b) 27KΩ **(**c) 270KΩ (d) 27000KΩ **(e)** 7KΩ

47. What part of an air condition does dissipation occurs?

(a) Condenser (b) Evaporator(c) Accumulator (d) Receiver (e) Drier Compressor

48. What symbols is represented in the diagram below ?



(a) Battery (b) Capacitor(c) Voltmeter(d) Lamp (e) Fuse

49. What is the standard unit for resistance?

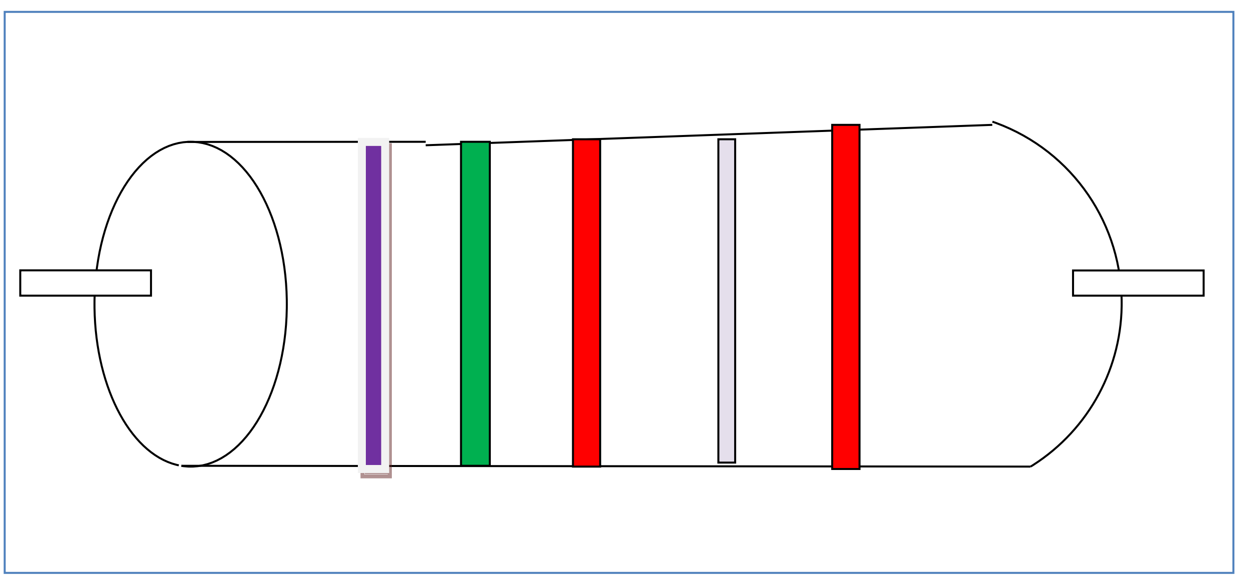
(a) Volts (b) Ampere (c) Ohms (d) watts (e) Joules

50. The three major components of an air condition are?

(a) Condenser , Evaporator, and Capillary tube (b) Capillary tube, Expansion valve, and Condenser (c) Blown ,Fan, and Condenser(d) Condenser, Capillary tube, and Evaporator

51. Calculate the charge of the capacitor with capacitance of 6 µF and a voltage of 15V

(a) 9 x 10^{-5}C (b) 9 x 10^{-6}C (c) 2.1 x 10^{-5}C) (d) 9 x 10^{-6}C (e) 9 x 10^{-5}C



c

IN ANSWERING QUESTION 29 AND 30,REFER TO FIGURE ABOVE

52. What is the value of the resistor?

(a) 2500Ω (b) 250000000Ω (c)520Ω (d) 250Ω (e) 521Ω

53. What is the specified tolerance of the resistor?

(a) 0.25% (b) 2%(c) 5% (d) 10.4% (e) 8%

54. Which of the colour band represents the multiplier?

(a) Gold (b) Brown (c) Red (d) Violet (e) green

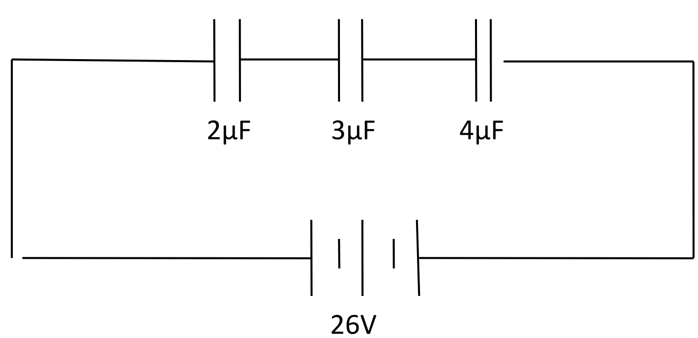
55. Which of these is the formula for calculating the capacitance of the capacitor?

(a)C=C1+C2+C3 (b)1/C=1/C1+1/C2+1/C3 (c) C=C1+1/C2+1/C3 (d) 1/C=1/C1+1/C2+C3 (e) C=C1+C2+1/C3

56. The following parts make up the electric motor in an air condition?

(a)Fan and blade (b) Blower and blade (c) compressor (d) condenser fan (e) Evaporator

57. Calculate the energy stored in the capacitor in the diagram shown below;



(a)3.12×10^{-2}J (b) 3.12×10^{-4}J (c) 1.09×10^{-3}J (d) 1.09×10^{-4J}J (e) 4.15×10^{-2}J

58. Which of the air conditioner is used in industries and factories ?

(a)Packaged air conditioner (b) Central air conditioner (c) Window air conditioner(d) Split air conditioner (e) HVAC air conditioner

59. The part of the air condition which remove heat and moisture from the air is called ?

    (a) Compressor (c) Evaporator (d) Blower fan (d) Drier (e) Expansion valve

60. Two capacitors of 2 µF and 3 µF are connected in parallel. What is the equivalent capacitance of the Capacitor ?

    (a)5 µF (b)1 µF (c) 4 µF (d)2.2 µF (e) 1 µF

APPENDIX D

FORMULA

The following formulae were used in doing statistical analysis

1. Mean

$$X = \frac{\sum X}{N}$$

X = Mean

$\sum$ = the Sum of

N = the scores

II. Standard Deviation

$$SD = \sqrt{\frac{\sum X^2 - \frac{\sum x^2}{n}}{n-1}}$$

III. Analysis of Variance

Step I = $SS_B = \frac{\sum(X_1)^2}{n_1} + \frac{\sum(X_2)^2}{n_2} + \dots + \frac{\sum(X_a)^2}{n_a} - \frac{(\sum X)^2}{N}$

Step 2 = $SS_T = \sum X^2 - \frac{(\sum X)^2}{N}$

Step 3 = $SS_W = SS_T - SS_B$

Step 4 = $df_W = N - a$

Step 5 = $df_B = a - 1$

Step 6 = $df_T = N - 1$

Step 7 = ANOVA table

Source Of Variation	df	Sum of Squares (SS)	Mean Squares	F-Cal	Critical Value of F	Significances	Decision
Between Groups							
Within Groups							
Total							

$$M.S_{\text{Within groups}} = \frac{SS_{\text{Within group}}}{\text{Degree of freedom}_{\text{within groups}}}$$

$$\text{F-ratio(F-cal)} = \frac{M.S_{\text{Between group mean}}}{\text{M.S Within group mean}}$$

APPENDIX E

DISTRIBUTION OF STUDENTS BASED ON GENDER INTO VARIOUS SCHOOLS

S/N	Schools/Colleges	Male	Female	Total
1	Government Technical College, Agbor, Delta State.	35	5	40
2	Government Technical College, Otorgor Ughelli, Delta State.	30	7	37
3	Government Technical College, Ozoro.	20	4	24
4	Government Technical College, Issele-Uku, Delta State.	33	6	39
5	Technical High School, DSC Warri	30	10	40
	Total			**180**

APPENDIX F

STATISTICAL DATA

Experimental Group				Control Group			
Pupils	Male or	Scores on	Scores on	Pupils	Male or	Scores On	Scorcs on
	Female	Pre-Test	Post-Test		Female	Pre-Test	Post-Test
1	F	60	60	1	F	47	50
2	M	57	67	2	F	60	63
3	M	47	76	3	M	47	57
4	F	60	53	4	F	60	70
5	M	53	73	5	M	37	40
6	M	50	80	6	M	50	57
7	M	73	47	7	M	57	67
8	M	63	67	8	M	57	53
9	M	33	70	9	M	60	63
10	F	57	50	10	F	53	50
11	M	30	73	11	M	57	57
12	F	50	60	12	M	33	67
13	M	40	40	13	F	37	57
14	M	43	53	14	F	53	47
15	M	47	90	15	M	43	60
16	M	37	83	16	M	50	47
17	M	70	87	17	M	63	53
18	M	73	60	18	M	53	70
19	M	47	63	19	M	63	60
20	M	53	50	20	M	60	83

APPENDIX G

STATISTICAL DATA

(Male Students)

Experimental Group				**Control Group**			
Pupils	Male or	Scores on	Scores on	Pupils	Male or	Scores On	Scorcs on
	Female	Pre-Test	Post-Test		Female	Pre-Test	Post-Test
1	M	57	67	1	M	47	57
2	M	47	76	2	M	37	40
3	M	53	73	3	M	50	57
4	M	50	80	4	M	57	67
5	M	73	47	5	M	57	53
6	M	63	67	6	M	60	63
7	M	33	70	7	M	57	57
8	M	30	73	8	M	33	67
9	M	40	40	9	M	43	60
10	M	43	53	10	M	50	47
11	M	47	90	11	M	63	53
12	M	37	83	12	M	53	70
13	M	70	87	13	M	63	60
14	M	73	60	14	M	60	83
15	M	47	63				
16	M	53	50				

APPENDIX H

STATISTICAL DATA

(Female Students)

Experimental Group			**Control Group**		
Pupils	Pre-Test Scores	Post-Test Scores	Pupils	Pre-Test Scores	Post-Test Scores
1	60	60	1	47	50
2	33	70	2	60	63
3	57	50	3	60	70
4	50	60	4	53	50
			5	37	57
			6	53	47