EFFECT OF COMPUTER AIDED INSTRUCTION IN TEACHING METALWORK IN TECHNICAL COLLEGES OF NIGER STATE

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CERTIFICATION

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DEDICATION

This project is wholly dedicated to my Father Mr. James Morohunranti Oyedepo for hissupport and encouragement, my mother Mrs. Cecilia Olufunmilayo Oyedepo for her spiritual support and moral guidance, my supervisor Mr. Kalat and mallam Dauda, my Family member s for their love, care and supports, and to my friends who is one way have contributed positively to my life.

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CHAPTER ONE

INTRODUCTION

1.1 Background of Study

Advancements in information technology, which has resulted in increasing computer power, lower and declining cost of computers and ease of use, and the expansion of communication infrastructure has resulted in the widespread adoption of computers use in almost all spheres of human activity. Education is one of the spheres where computers are playing an expanding role and are increasingly looked upon as the instructional tool of the 21st century. The expansion in the adoption of computer is happening as the educational process also witnesses a paradigm shift. The educational process is moving from a teaching centered process to learning centered one, which involves both students and teachers as active participators in the search for knowledge and the construction of meaning from it. Computers play a unique role in this paradigm shift, offering unique benefits to the educational process. These benefits (Sheppard et al,1998; Yang & chin, 1996) include: inherently better and more interactive instructional process, more cost effective delivery, richer and more diverse learning resources, possibility of extending the reach of education to a broader population, flexibility in the use of instructional material and improved student motivation. Computers are particularly noted for their motivational value, as their intrinsic features such as immediate feedback, animation, sound, active interaction, and individualization have a better motivational potential than any other media (Yang & Chin, 1996:25). Computer use in education is permeating all the levels of the educational process, and more particularly higher education, where almost all disciplines use computers in certain form in the instructional process.

Technical/Vocational education is the foundation of nation's wealth and development. It is a type of education that is meant to produce semi-skilled, skilled and technical manpower

necessary to restore, revitalize, energize, operate and sustain the national economy and substantially reduce unemployment (Federal Government of Nigeria, 2000). It is a form of education involving, in addition to general education, the study of technologies and related sciences and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social life (FGN, 2004). This specialized education is offered in technical institutions saddled with training of lower and middle level manpower, including technical colleges. Technical Colleges in Nigeria are established to produce craftsmen at the craft (secondary) level and master craftsmen at the advance craft (post-secondary) level (Federal Ministry of Education, 2000). The courses offered at the technical colleges leads to the award of National Technical Certificate (NTC) and Advance National Technical Certificate (ANTC). The curriculum programmes of technical colleges according to Federal Government of Nigeria (2004) are grouped into related trades. These includes, the computer trades, electrical/electronic trades, building trades, wood trades, hospitality trade, textile trades, printing trades, beauty culture trades, business trades and mechanical trades.

Mechanical trades is a general name used in describing trades that have direct bearing with metal welding/forming and or servicing/repairs of machines or machine related equipment and appliances. The trades in this group include agricultural implement and equipment mechanics work, auto body repair and spray painting, auto electrical work, auto body mechanics works, auto mechanics works, auto body building, auto parts merchandising, air-conditioning and refrigeration mechanics works, mechanical engineering craft practice, welding and fabrication engineering craft practice, foundry craft practice, instruments mechanics work and marine engineering craft. Based on the high rate of industrialization in Nigeria, the aspiration of the mechanical related trade students in technical college are very

high. They have very high hope of being employed by the industries, at the same time, advancing in their academic pursuit.

1.2 Statement of Problem

Technical college graduates upon graduation are supposed to have three options. These options according to the National Policy on Education (FGN, 2004) is to either secure employment in the industries, pursue further education in advance craft in a higher technical institutions or set up their own business and become self-employed. Unfortunately, despite all effort by the government to ensure qualitative education at the technical colleges and bring about high quality products both in academic and employability, there have been persistent reports of high failure rate among graduates of the colleges (FGN, 2001; NABTEB, 2006). One probable cause of the high failure of students in recent years according to NABTEB (2002) chief examiners' report is partly due to teaching methods employed by instructors to teach the students. In most technical colleges, Oranu (2003) observed that the teaching methods used in teaching are mostly lecture and the demonstration methods. According to Sofolahan (1991) the continue use of these traditional teaching method to teach in our schools reduces the ability of students to grasp relevant concepts than when exposed to lessens involving hand on experience. The methods are based on the learning theory of behaviorism. They thus encourage students to be passive, direction followers and product oriented. On this same vain, the Federal Ministry of Education (1993) in her reports on technical colleges revealed that student in technical colleges are always put-off or not been interested in vocational education because of the non-motivating and unchallenging methods and approach used by their teachers. As technology is changing, the mechanical related trade students must change with it so that their level of thinking on diagnoses, repairs and maintenance should be commensurate with maintenance need of today's industrial need, in other words, only

teaching methods that equip students with the higher order thinking skills for easy adaptability and flexibility. Such as the computer aided instructional teaching approach is one viable option in the present globalize economy.

1.3 Purpose of the Study

This study was designed to find the effect of computer aided instruction in teaching of metalwork in technical college. Specifically, the objectives of the study were:

1. To find out the effect of using computer aided instruction (CAI) in teaching metalwork on the academic achievement of the student.
2. To find out the differences in academic achievement of male and female students taught with computer aided instruction (CAI)

1.4 Research Questions

The following research questions have been formulated to guide the research work.

1. Is there any difference in the academic performance of the students taught metalwork using computer aided instruction (CAI) and those taught using the traditional (chalkboard) method?
2. Is there any difference in the academic performance of male and female students taught metalwork using computer aided instruction (CAI)

1.5 Research Hypotheses

The following hypotheses were formulated and tested at 0.05 of significance:

1. There is no significant difference in the mean scores of the students taught metalwork using computer aided instruction and those taught using traditional (chalkboard) method.
2. There is no significant difference between the mean scores of male and female students taught using computer aided instruction (CAI).

1.6 Significance of the Study

Since the study is aimed at finding the effect of computer aided instruction in teaching of metalwork in technical colleges in Niger State, the conclusion arrived at in the study is going to be of importance to teachers, students, examination bodies and curriculum planners.

1. Provide empirical evidence that will be useful for the improvement of the teaching and learning situation of Metalwork.
2. It will open up more avenues for future research in Metalwork as well as providing useful information required for further research related to CAI such as computer based instruction (CBI).
3. It will help students to have better understanding of what they have been taught in various aspect of Metalwork.
4. It will also help the students to learn at their own pace. This one of the advantages of computer aided instruction (CAI)

However, the use of well designed and developed computer aided instruction in teaching and learning process can;

- Add interest to the subject (Metalwork).
- Increase the understanding of the various topics in Metalwork.
- Save time by limiting the use of verbal explanation.

1.7 Scope of the Study

The scope of this study is to find out the effect of computer aided instruction in teaching metalwork in technical colleges of Niger State. The finding are representation of the situation of what is happening in government owned technical colleges in Nigeria as far as teaching with computer aided instruction is concerned.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Work related to present study were reviewed under the following sub-headings:

- History of Computer Aided instruction
- Brief history of Computers in Education
- Roles of Computers in Education
- CAI and Achievement
- CAI and Retention
- Summary

2.1 History of Computer Aided Instruction

In the mid-1950s and early 1960s collaboration between educators at Stanford University in California and International Business Machines Corporation (IBM) introduced CAI into select elementary schools. Initially, CAI programs were a linear presentation of information with drill and practice sessions. These early CAI systems were limited by the expense and the difficulty of obtaining, maintaining, and using the computers that were available at that time. Programmed Logic for Automatic Teaching Operations (PLATO) system, another early CAI system initiated at the University of Illinois in the early 1960s and developed by Control Data Corporation, was used for higher learning. It consisted of a mainframe computer that supported up to 1000 terminals for use by individual students. By 1985 over 100 PLATO systems were operating in the United States. From 1978 to 1985 users logged 40 million hours on PLATO systems. PLATO also introduced a communication system between students that was a forerunner of modern electronic mail (messages electronically passed from computer to computer). The Time-shared Interactive Computer-Controlled Information Television (TICCIT) system was a CAI project developed by Mitre Corporation and Brigham Young University in Utah. Based on personal computer and television technology, TICCIT

was used in the early 1970s to teach freshman-level mathematics and English courses. With the advent of cheaper and more powerful personal computers in the 1980s, use of CAI increased dramatically. In 1980 only 5 percent of elementary schools and 20 percent of secondary schools in the United States had computers for assisting instruction. Three years later, both numbers had roughly quadrupled, and by the end of the decade nearly all schools in the United States, and in most industrialized countries, were equipped with teaching computers.

A recent development with far ranging implications for CAI is the vast expansion of the Internet, a consortium of interlinked computers. By connecting millions of computers worldwide, these networks enable students to access huge stores of information, which greatly enhances their research capabilities.

2.2 Brief History of Computer in Education

Computers and related technologies are now in most of the schools in all around the world. Advancements in technology are inevitably reflected in educational systems. In most of the developed countries education has been penetrated by information technologies (IT); schools have computers, a large numbers of teachers use computers and new technologies while teaching, and more over textbooks have some parts devoted to new technologies. New technologies are integrated into disciplines and more disciplines are being influenced by the new technologies in an integrated way. Most of the educators and researchers try to use technologies in various subject matters, and this integration changes the nature, concepts and methods of work in each subject. For example, in mathematics education, the way of teaching and learning, the roles and functions of the most concepts have changed with the use of technology.

Although the wide-spread interest in computers as an instructional tool did not occur until the 1980s, computers were first used in education and training at a much earlier date. Much of the early work which computers introduced in education was done in the 1950s by researchers at IBM, who developed the first Computer Assisted Instruction (CAI) author language and designed one of the first CAI programs to be used in public schools. Students followed the commands on the computer screen receiving rewards for correct answers within the framework of behaviorist approaches. In 1959, PLATO, the first large-scale project for the use of computers in education was implemented by Donald Bitier at the University of Illinois (Carter, 2003). Atkinson and Suppes' (1959) work led to some earliest applications of computers at both the public school and university levels during the 1960s. By the early 1980s many educators were attracted to microcomputers because they were relatively inexpensive, compact enough for desktop use, and could perform many of the functions performed by the large computers that had preceded them.

The dominant use of computer-based instruction in the 1980s was typified by the employ of "behavioral-based branching" software that based greatly on drill-and practice to teach programmed content and/or skills. The educational software that ran on the computers of the early 1980s were at first based on Skinner's "methods of branching": first separating into small sections, rewarding combined responses, and teaching disconnected facts. Although the learning is passive where learners do not work together with problems and content, research studies indicate that learner did advantage from the technology when the learning objectives were behavioral.

During the 1990s, computers eventually started to have a major impact on instructional practices in schools. With the help of advances in technology and learning, science researchers consider learning with technology as means for construction problem-solving skills and for achieving learner independence. The cognitive approach to instructional

technology emphasized “looking at how we know rather than how we respond, and analyzing how we plan and strategize our thinking, remembering, understanding, and communicating” (Saettler, 1990, cited in http://www.ncrel.org/ tplan/cbtl/toc.htm, 2003). Besides, students would also to learn through playing games and simple simulations with the help of cognitive school of thought. The worth of using a word processor has been discovered by writing teachers and almost immediately students were using the advantages of word processor by writing, deleting, formatting and revising with effortlessness. Other subject matter teachers perceived the importance of the computer in creating a rich learning environment by using databases, spreadsheets, presentation, and research tools. Since 1995, rapid advances in computer and other digital technology, as well as the Internet, have led to a rapidly increasing interest in and use of these media for instructional purposes (Reiser, 2001). Swiftly there was a volume of information obtainable to students with a network of people all through the world that improved communication and the exchange of thoughts. Additionally, distance education courses are offered and in this way students in geographically isolated schools have extended learning opportunities in a diversity of subject areas. For example in United Nations, Kalu (2006) states “the proportion of instructional rooms with Internet access increased from 51 percent in 1998 to 93 percent in 2003” (p.3). Theoretical explanations could now be demonstrated and manipulated with the help of technology innovations. A complete innovative learning environment became possible.

Since the advent of the personal computers in the mid 1980s, computers have rapidly become one of the key instructional technologies used in both formal and informal education. The computer’s role has changed because of two factors: first, it can provide rich learning experiences for students and secondly, computer giving students the power to manipulate depth and way of their learning. Furthermore, teachers can use the computer as

an aid to manage classroom activities; it has a multitude of roles to play in the curriculum which can range from tutor to student tools.

2.3 Roles of Computers in Education

At this point, I thought that it would be helpful to offer some descriptions of learning activities involving computers. In the domain of instruction there are four broad classes of computer applications:

- as an object of instruction,
- as a tool,
- as an instructional device,
- as a means of teaching logical thinking.

The computer may itself be the object of instruction such as in computer literacy course students can learn about how computers are used in society and in computer programming course they can learn how to construct a program by using programming languages. In its role as a tool, the computer assists both teachers and students, such as calculator, typewriter, and presentation aid. Students can use computers to solve complex mathematical calculations as a pocket calculator or students can use word processing programs to complete term papers and assignments. Both teachers and students can use data presentation software which incorporates with computers to present the content of the subject-matters. In addition to this, students can use a database for inquiry of specific information. Computer assisted instruction (CAI) is the representative application of computers as an instructional device in instruction. Finally, computers can be used as a means of teaching tool. For example, in his book, The Children's Machine, Seymour Papert (1993) offered that, the computer should be an "object to think with" not a dispenser of information.

Kulik, Kulik, and Bangert-Drowns (1985) defined the terminologies used by educators and researchers "computer-assisted instruction, computer-based education, computer-based

instruction, computer-enriched instruction, computer-managed instruction" that can easily become puzzled by educators. The following definitions are a combination of those offered by the literature represent commonly accepted(although surely not the only) definitions of these terms:

Computer-based education (CBE) and computer-based instruction (CBI) are the broadest terms and can refer to virtually any kind of computer use in educational settings, including drill and practice, tutorials, simulations, instructional management, supplementary exercises, programming, database development, writing using word processors, and other applications. These terms may refer either to standalone computer learning activities or to computer activities which reinforce material introduced and taught by teachers.

Computer-assisted instruction (CAI) is a narrower term and most often refers to drill and-practice, tutorial, or simulation activities offered either by themselves or as supplements to traditional, teacher directed instruction. In a traditional approach one can say that Computer Assisted Instruction (CAI) is an expression of any subject matter by using computers, or in general sense it is an acquisition of knowledge in a more simple way to the student by the learning-teaching activities with the help of computers.

Computer-managed instruction (CMI) can refer either to the use of computers by school staff to organize student data and make instructional decisions or to activities in which the computer evaluates students' test performance, guides them to appropriate instructional resources, and keeps records of their progress.

Computer-enriched instruction (CEI) is defined as learning activities in which computers (1) generate data at the students' request to illustrate relationships in models of social or physical reality, (2) execute programs developed by the students, or (3) provide general enrichment in relatively unstructured exercises designed to stimulate and motivate students.

After providing a short reminding of the applications of computers, there is a need to mention the computer aided instruction and the utilization of CAI methods.

2.3.1 Defining of CAI

Computer aided instruction is concerned with the use of computers not only as achoice but to mediate the flow of information in the instruction process and the complementary means (Rushby, 1989; Usun, 2000). CAI was utilized in the education as an educational medium in which delivers instructional activities in the late 1950s. Papert (1993) stated that "…programming the computer to administer the 23 kinds of exercises traditionally given by a teacher at blackboard, a textbook, or a worksheet" (p. 5). Although the technology has been changing rapidly over the twenty years, computer-assisted instruction is still utilized in education. Drill-and practice, Tutorial, Games, and Simulation are commonly used CAI applications for educational purposes. Drill-and-practice programs lead learners through a series of examples to increase dexterity and fluency in a skill. Drill-and-practice is used predominantly for math drills, foreign language translation and vocabulary building. In these programs student is allowed several tries before the computer presents the correct answer. In computer-assisted tutorial applications that provide student different methods of answering a problem and immediate answers, exploratory software programs allow students opportunities to engage in mathematical investigations, and programming skills that develop logical reasoning in students.

Another type of computer application in education is simulating experimentations. In the simulation environment, students investigate simulations on the computer screen as a replacement for of observing and doing something real, either in a laboratory or in the field. For instance, one program popular in the early '90s was simulated a natural ecosystem. In this ecosystem simulation software, the students could change a number of characteristics of

the habitat, the consequences of which were then played out for them to observe and from which they were to draw conclusions (Setzer & Monke, 2001).

In the tutorial mode, computers act as the teacher by presenting information in small units to the students and then reinforcing it with questions or tasks. Then computer analyzes the student's responses and gives feedback or remedial instruction based on his or her response. For example Mavis Beacon Teaches Typing is a tutorial program which guides students to learn touch-typing skills (Smaldino, Russell, Heinich, &Molenda, 2005)

The final mode is games. Smaldino et al. (2005) defines game as "…an activity in which participants follow prescribed rules that differ from those of real life as they strive to attain a challenging" (p. 121). Therefore, a game may or may not be instructional. If it contains academic skill practice then it is defined as an educational game. Game software provides elements of competition into learning activities. With computer games, students are competing against their own previous scores or against the designer of the game as they indicate their understanding of educational content. Game assumes that students have already gained the knowledge of the content and generally it is designed based on the time-limitation to encourage students to respond quickly (Ugwu, 2005). As an example, King Arthur's Magic Castle educational game was designed based on the problem solving strategies to emphasize entertainment (Smaldino et al. 2005).

The above modes of CAI are the ones that are widely used in the educational practices. However there are other utilization methods of CAI: such as Discovery and Problems solving programs. The goal of quality education seems to have the computers as new learning/teaching resource rather than a teacher's aid in the future.

With the usefulness of Internet since 1990s, Distance Education, Virtual Reality (VR), Electronic-Books (e-Books), and Electronic Learning (e-Learning) have become the future of learning (Robertson, 2004).

2.3.2 Benefits of Computer Aided Instruction (CAI)

Although the research studies on the effectiveness of computers in the field of education reveals contradictory results, majority of the research studies indicates that CAI brings several possible advantages as a teaching/learning tool. The main strength of the computer as a learning medium is its ability to process information quickly. This makes it possible for the computer to accept and act upon a variety of different kinds of response from the learner and to provide information in textual, graphical, and animated form (Rushby, 1989). According to Kaput (1992), there are three advantages of usage of technology in teaching and learning metalwork; interactivity, connectivity and controlling of learning environments. Furthermore computer suggest opportunities for learner-control, improved enthusiasm, associations to the real world, and enhance student achievement as measured in variety of ways, including, but not exclusively limited to, "standardized achievement tests". Ertmer (1999) (as cited in Day, 2006) stated that "CAI benefits most students when compared with traditional instruction because it increases student interest, reduces anxiety, provides more time on task, and provides instant feedback for the student". Besides, CAI could also benefits students with the following: self-sufficient learning, independent learning, the exercising of various senses and the ability to represent content in a variety of media. In computer-aided environment students can fix their pace of learning. That is to say, with self-paced learning, learners can progress as slowly or as quickly as they like through a program. In addition to this, if students want to replicate some task or review some material again, they can do so as many times as they wish. The program will not tire out or complain about repetitions as sometimes teachers do. Also, students can leave out a topic if content is already known or understood, making the learning process more efficient.

CAI provides a self-directed learning to students, and allows learners to become empowered to take increasingly more responsibility to choose, control, and evaluate their own learning activities which can be pursued at any time, in any place, through any means, at any age. Simply put, learners can decide what they want to learn and in what order.

According to Fletcher (1990), "people remember 20% of what they hear, 40% of what they see and hear and 75% of what they see, hear and do". Therefore, the more senses are used through which we obtain information, the easier to keep in mind. The fact that the computer can exercise various senses and present information in a variety of media can enhance the learning process. As a result, students can retain knowledge.

Further, CAI is visually attractive, when it presents concepts using demonstrations that are made attractive by animation, color, and sound. Besides this, computer aided instruction captures and holds the students' attention by providing opportunities for competition where the opponent is the student's previous performance (Mahmood, 2006). CAI also eliminates the misconceptions by providing immediate feedback, since immediate feedback prevents learning concepts incorrectly.

As Cotton (2001) indicated teachers can benefit from CAI since it can be programmed with concept, level and ability specificity; that is, the students are not challenged outside his or her demonstrated ability range, nor are they allowed moving to a higher level until they have mastered the level on which they are working.

2.3.3 Limitation of Computer Aided Instruction

Although the computer-aided instruction has been used in the educational systems of developed and developing countries over twenty years, there are limitations that have restricted the effective use of computers. These issues include: finance, lack of hardware and software, lack of teacher preparation and competency, limited number of educational software, and the lack of curriculum integration.

One of the important concerns of the implementation of CAI is how to finance it. Hardware and software are expensive entries for most of the poor school institutions. In the under developed and developing countries case this could be a big obstacle for the effective use of computers in the educational settings.

A significant concern for integration of technology into mathematics education is the teacher's negative attitude and the incapability to use it. Successful teachers in technology integration regularly make considerable changes in their teaching methods and in students' achievement (Roschelle, Pea, Hoadley, Gordin, & Means,2000). Roschelle et al. (2000) also added, "One of the biggest barriers to introducing effective technology applications in classrooms is the mismatch between the content of assessments and the kinds of higher-order learning supported most effectively by technology" (p. 91). Beside this, there are limited numbers of qualified educational software in the markets.

As a last barrier to effective use of CAI is the curriculum integration. Curriculum integration is the use of computers to support and enhance learning and teaching in the mathematics lessons. Thus, computer-aided instructional activities should be incorporated into national metalwork curriculum in order to have the benefits of CAI.

2.4 CAI and Achievement

The widespread usage of computers by educators to support teaching has been dramatic over the last thirty years. A lot of research has been conducted on the effects of computer use on student achievement, attitude, and other variables. However, many educational stakeholders still continue to search the evidence on the positive effects of CAI on student learning before implementing the computer technologies into educational settings. In the case of TRNC, the researcher of this study believed to examine the available literature on the effectiveness of computer aided instruction which is an area that needs a concrete evidence to show the

effectiveness of computers in education. Thus, the following serves to represent a sample of the studies on the impacts of computer-assisted instruction on achievement and learning.

There is a large enough data to show the usefulness of educational technologies that they are capable to improve the students' achievement. Most of the studies of computer use in metalwork education have largely examined clearly pioneering situations, usually linked to development projects of same type. Equally, the focus of these studies has been mainly on student cognition and computer interaction.

The meta-analyses of the 1980s produced the conclusion that, programs of computer based instruction have positive evidence in the evaluation literature (Kulik, 1994).

Similarly, Burns and Bozeman (1981) provides the results of a meta-analysis of 40studies that compared the effectiveness of traditional instruction alone with a combination of traditional instruction and computer-aided instruction on students' metalwork achievement. Results showed that the combined traditional-CAI approach was significantly more effective. Specifically they drew the following conclusions:

1. A mathematics instruction combined with the CAI was significantly more effective in developing student achievement, than was an instruction only traditional teaching methods with raising arithmetic achievement by .37 standard deviation

2. CAI with drill and practice were significantly more effective in promoting increased student achievement among high achievers and low achievers and in both elementary and secondary graders. Whereas the moderate achievers were effected by the supplementary CAI. (p.37)

Likewise, Hassel bring (1984) summarized results of research studies and meta analyses on the effects of computer-based instruction on student achievement and attitudes, where results favor the use of Computer Based Instruction over traditional instruction.

Mevarech and Rich (1985), conducted a three-year study on the effects of CAI on disadvantaged third, fourth, and fifth grade Israeli students. The study divided the participants into two groups; one group receiving traditional mathematics instruction supplemented by CAI and the other receiving traditional mathematics instruction only. Results which compared the type of instruction to grade level and gender on the Israeli Ministry of Education's Arithmetic Achievement Test, showed that at all three grade levels, CAI students scored significantly higher on arithmetic achievement than students who received traditional instruction only.

Mokros and Tinker (1987) conducted studies to conclude how middle school students learn graphing skills through microcomputer-based laboratories. Results of the study pointed out that the scores on graphing items were significantly improved in students' ability to interpret and use graphs from pretests to posttests when the microcomputer-based laboratory were used.

In introducing computer-assisted instruction tools a method of teaching in schools, it becomes important to investigate what attitudes students have regarding computer aided learning. Looper (2006) defined the attitude as "...a mental position relative to a way of thinking or being". Shaw and Wright (1967) described attitude as "an enduring predisposition to behave in a consistent way toward a given class of objects".

According to Ruffin (2000), students' positive attitude toward CAI plays a key role for the success of CAI implementation. Most of the researchers were concentrated on the "attitude toward computers" as a demographic variable in the CAI related studies. For example, Kulik and Kulik conducted a meta-analysis study in 1991 to investigate the relation between computer-based instruction and achievement, attitudes. Results showed that CBI usually produced positive effects on learners of all ages, from children to adults. The authors also

add, CBI produced small but positive changes in student attitudes toward teaching and computers.

In his dissertation study Bush (1991) hypothesized that "students utilizing CAI will have a significantly higher positive attitude-toward computer-attitude instruction than non-computer user" and the statistical analysis resulted in no significant differences between the groups which did not support the overall literature suggesting that attitudes towards computers will improve if subjects have experienced computer-assisted instruction as a form of treatment.

Szabo and Poohkay (1996) investigated the effects of animation in a geometry lesson and on the students' attitudes towards the CBI. Three groups of students were 47 participated in the study: text-only group, text with static graphics group and texts with animated graphics group. The animation group outperformed both of the other group on the posttest scores. However, attitudes toward CBI were higher for both of methods including illustrations when compared to the text only format (as cited in Sundruck, 2003).

Ruffin (2000) investigated the relationship between demographic variables and student attitudes toward computer-aided instruction. Attitude toward computers, average daily exposure to computers and computer-literacy courses are the significant variables that influence the attitude toward CAI.

Another study which was conducted by Vale (2001) support Ruffin's study, results of the study indicated that the length of time using computer in mathematics and the nature of the learning environment are two factors that impact the students' attitude toward computer-based mathematics. Furthermore, analysis of the study revealed that girls who rate themselves highly in "achievement in computing" are more likely to have a positive attitude towards computer-based mathematics although the overall results showed that girls perceived the CBL environment less favorably than boys.

2.5 CAI and Retention

Duration of active learning and distributed practice of academic content has influenced the level of academic retention (Belfiore, Skinner & Ferkins, 1995). The level of retention of metalwork knowledge also depends on the type of teaching method. Instructional methods that allow students to participate actively to learning process are the only significant variables which has an impact on the long-term retention. Lecture continues to be the most prevalent teaching mode in secondary and higher education; despite overwhelming evidence that it produces the lowest degree of retention for most learners. According to "Dale's cone of experiences" the highest retention rates are devoted to discussion, practicing by doing, and teach others with the respective percentages 50%, 75% and 90% (Lalley & Miller, 2006).

In one of the earliest study Edwards, Norton, Taylor, Weiss and Dusseldorp (1975, as cited in Spies, 1997) stated that only three research studies among 33 investigated the retention as a research variable in the frame of computer-assisted instruction. Results indicated that traditional is superior to CAI.

Hawlwy (1984) indicated that computers had a short term impact on mathematics achievement which was not maintained one month later. Cartnal (1999) compared the two different teaching methods based on retention rate and results indicated that no significant difference in students' retention mean scores for traditional and computer-assisted mathematics course. A study by Tawfik (2005) supports these findings that there were no significant relation between method of instruction (tradition instruction vs. CAI) and retention.

Contrary to the above results, Brenluin (1992) conducted a study to examine the effects of computer-aided instruction on the understanding and retention of polygonal areas concepts in high-school geometry. The results of the study indicated that the rate of retention decay was significantly slower for the experimental group on all ability levels (remedial, average, and

accelerated). Further statical analysis revealed that the experimental group posted higher overall retention scores.

Similarly, Speis (1997) indicated that the generative approach with CAI is much more effective on the student's retention of multiplication facts over long term.

2.6 Summary

The above is a part of broad literature that is thought to be necessary to have a general theoretical and conceptual background on the computer usage and effectiveness in the field of education particularly in the mathematics teaching and learning activities. Technology has great impact on every dimension of our daily life.

Education is just one of these areas where computers were introduced as a teaching tool for the enrichment and support of subject matters. With the help of computers, students are expected to improve their understanding, creativity, problem solving skills, and retention. Thus they will have a chance to be more active learner.

Literature provides considerably much empirical findings about the effectiveness of computers against conventional style of teaching in the classrooms all over the world. Both the national and international studies strongly suggest that the positive relationship between the use of computer-assisted instruction and student achievement (Cotton, 1991; Ersoy, 2002a; Gökcül, 2007; Kulik, 2003; Papert, 1980; Parr, 2000; Usun, 2006).

Unlike the broad evidence in the world wide context, there is no such a scientific study in TRNC to investigate the integration of computers in education. Based on the works of a number of studies in the world, it was hypothesized that the introduction of educational software in mathematics lessons will provide viable alternative for enhancing learning in metalwork lessons.

In this way it is assumed to prevent the possible educational problems and to enhance the students' achievement, attitudes and retention in metalwork lessons.

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter described the research design, selection of sample and sampling techniques, instrument for data collection, validation of the instrument, reliability of instrument for data collection, method of data collection and method of data analysis.

3.1 Research Design

The Quasi experimental research design was used for the study involving the pre-test, post-test, and experimental and control group design.

Table 3.1 Format for pretest – posttest Design.

GROUPS	PRETEST	TREATMENT	POSTTEST
EXPERIMENTAL GROUP (R)	O	T1	O2
CONTROL GROUP (R)	O3		O4

Where R = Randomized subject

O = Measurement

T = Treatment

3.2 Population of the Study

The population of the study consisted of all year two students in all the five (5) government technical colleges in Niger states.

3.3 Sample of the Study

The sample of the study was drawn from the total population of the NTC II students offering metalwork in technical college. The schools were sampled using simply sampling techniques. This involves randomly selecting two technical colleges from the list of five (5) government owned technical colleges in Niger state. A total of forty NTC II metalwork students constitute the subject for the study. One of the schools was used as the experimental group whiles the other school was used as the control group.

Table 3.2 Schematic Presentation of the Format of the Sample of the Study

GROUP	SCHOOLS	NO. IN SAMPLE	TREATMENT
EXPERIMENTAL GROUP	**GOVERNMENT TECHNICAL COLLEGE MINNA, NIGER STATE**	**20**	**COMPUTER AIDED INSTRUCTION**
CONTROL GROUP	**GOVERNMENT TECHNICAL COLLEGE NEW-BUSSAU NIGER STATE**	**20**	**TRADITIONAL (CHALKBOARD) METHOD**

3.4 Instrument for Data Collection

The instrument used for data collection was general metalwork achievement test (GMWAT) which consists of ten (10) objective questions each with four (4) options (A-D), where the correct response attracts one (1) mark after which the overall scores were converted into percentage and further subjected to descriptive statistical analysis.

3.5 Validation of the Instrument

The test instrument was validated by three (3) experts in industrial technology education department of Federal University of Technology, Minna. For the face and content validity, the test instrument was further adjusted and they were then administered to the students.

3.6 Reliability of the Research Instrument

The instrument of the study was subjected to pilot test on a sample of twenty (20) students (ten (10) males and ten (10) females). This was randomly selected from the students in NTC II class for government technical college Iyagi Bida Niger state. The school is within the target population of the study, but not one if the schools used in the main study.

The scores were based on the performance of the students and were used to calculate the reliability. The reliability coefficient was 0.75 using Pearson's Product Correlation. (PPMC).

3.7 Method of Data Collection

The pre-test and post-test experimental design was used in the study. During the first visit to the control and experimental groups, a pretest-test was administered to them and their answers were analyzed. On the subsequent visit both the groups were given instruction on metalwork. Group A (experimental group) were taught metal and its properties using computer aided instruction, while Group B (control group) were taught using traditional (chalkboard) method, that is, without computer aided instruction (CAI) after which administration of the post-test was conducted to evaluate the effect of the knowledge.

3.8 Method of Data Analysis

The data collected for this study were analyzed using the statistical packages, mean, standard deviation, and t-test statistics. Data obtained from the pretest and posttest for both experimental and control groups were analyzed using T-test statistical analysis. The level of significance adopted for the analysis was $P \leq 0.05$. This level of significance formed the basis for rejecting or not rejecting each of the hypothesis formulated.

CHAPTER FOUR

PRESENTATION OF RESULTS AND DISCUSSION

This chapter consists of data analysis, presentation of results and general discussion of the results. The pre-test and post-test data collected from the study were statistically analyzed using mean, standard deviation and t-test. The procedure for testing the hypotheses of the study using the analyzed data is presented as follows;

4.1 Presentation of Results

The data analysis and results of this study are presented in tables 4.1A to 4.3A. the analysis and presentation of the results were done according to the research question and hypotheses.

4.1.1 Pretest Results for Experimental and Control Groups

The purpose of the pretest was to establish equivalence of the two groups before the experiment started. The data collected through pretest scores were analyzed and the results presented in tables 4.1A

Table 4.1A: Mean and Standard Deviation of Students' Performance in the Experimental and Control Groups.

Variables	Number of Sample (N)	Mean (X)	S.D
Experimental Group	**20**	**33.50**	**11.52**
Control Group	**20**	**30.00**	**10.49**

NS- Not significant at $p \leq 0.05$ level

Table 4.1A above shows the mean and standard deviation of the scores of the experimental and control group. The mean and standard deviation scores for both experimental and the control groups did not show any significant difference between one another. This implies that the groups are fairly comparable, which is suitable for the research.

Research Question 1

Is there any difference in the academic performance of the students taught metalwork using computer aided instruction (CAI) and those taught using the traditional (chalkboard) method?

The data presented in table 4.2A, comparing the experimental group, the mean scores being (76.50), as against the mean scores of the control (40.50). Comparing the experimental group and control group, the result revealed that there was significant difference in the mean achievement scores of the students taught Metalwork using Computer Aided Instruction and traditional (chalkboard) method.

From the above findings, it can be deduced that students taught metalwork using computer aided instruction performed better than students taught with chalkboard method. It therefore means that the use of computer aided instruction has enhancing effect on the teaching and learning of metalwork in technical college level of our educational system. The result from the study is in agreement with the findings of Mohd Khairezan Rahamat (2002) who stated that learning through computer aided instruction will bring a significant effect on the students' achievement and their learning styles. The result of the study is against the findings of Hart, Willams J (2006) who stated that there is no significant difference in the academic performance of students taught using computer aided Instruction and the traditional method.

Research Question 2

Is there any difference in the academic performance of male and female students taught metalwork using computer aided instruction (CAI)

The result in table 4.3A shows that there is no significant difference in the mean scores of male and female students taught metalwork using computer aided instruction. From this result, it can be deduced that the use of computer aided instruction is gender friendly and can be used to bridge the gap in the sex disparity in the males and females. This is against the

findings of George, Barry and Fraser (2002) who stated that boys achieve better than girls when taught with computer aided instructional material.

4.1.2 Presentation of the Posttest Results for the Experimental and Control Groups.

Hypothesis 1

Ho1: There is no significant difference in the mean scores of the students taught metalwork using computer aided instruction and those taught using traditional (chalkboard) method.

To test this hypothesis the posttest mean scores of the experimental and control groups were computed using one way T-test statistics analyzes. The results are presented in the table 4.2A below:

Table 4.2Ashows the t-test comparison of the posttest mean scores of the Experimental and Control Group

Variables	Number of Samples	Df	Mean (X)	S.D	t-value calculated	t-value critical
Experimental Group (GTC Minna)	**20**	**19**	**76.50**	**13.97**	**2.23**	**1.442**
Control Group (GTC NEW Bussa)	**20**		**40.50**	**11.72**		

Table 4.2A shows the t-test comparison of the posttest mean scores of the experimental and control group. From the table, the calculated t-value is greater than the critical t-value (t= 1.442, df =19, P>0.05). This indicates that there is a statistical significant difference between the mean scores of the experimental group (76.50) and the control group (40.50) at 0.05 levels. Hypothesis 1 is therefore rejected.

Hypothesis 2

Ho2: There is no significant difference between the mean scores of male and female students taught using computer aided instruction (CAI).

To test the hypothesis, t-test was used to compare the posttest mean scores of male and female students in the experimental group.

Table 4.3A: Comparison of the Posttest Mean scores of Males and Females Experimental Group 1.

Variables	Numbers of Samples	Df	Mean (X)	S.D	t-value calculated	t-value critical
Male	**10**	**9**	**72.00**	**17.512**	**1.443**	**2.26**
Female	**10**		**81.00**	**9.068**		

Not significant at 0.05 level.

Table 4.3A shows the t-test comparison of the posttest mean scores of the male and female students in the experimental group. From the table, the calculated t-value is lesser than the critical t-value (t= 1.443, df =9, P>0.05). This indicates that there is no statistical significant difference between the mean scores of the males in the experimental group (72.00) and the females in the females in the experimental group (81.00) at 0.05 levels. Hypothesis 2 can therefore be accepted in respect to the experimental group, which was taught metalwork using computer aided instructional package.

4.3 Discussion of Result

The aim of this study was to find out the effects of computer aided instruction in teaching of metalwork in technical college of Niger state. In order to carry out this research work, two (2) research questions were Formulated and tested.

The first hypothesis states that; there is no significant difference in the mean scores of the students taught metalwork using computer aided instruction and those taught using traditional (chalkboard) method.

From table 4.2A, comparing the experimental group, the mean scores being (76.50), as against the mean scores of the control group (40.50). comparing the experimental group and the control group, the result revealed that there was significant difference in the mean achievement scores of the students taught Metalwork using Computer Aided Instruction and traditional (chalkboard) method.

From the above findings, it can be deduced that students taught metalwork using computer aided instruction performed better than students taught with chalkboard method. It therefore means that the use of instructional media such as computer aided instruction (CAI) has an enhancing effect on the teaching and learning of metalwork in technical college level of our educational system. The result from the study is in agreement with the findings of Mohd Khairezan Rahamat (2002) who stated that learning through computer aided instruction will bring a significant effect on students achievement and their learning styles. The result of this study is against the findings of Hart, Willams J (2006) who stated that there is no significant difference in the academic performance of students taught using computer aided instruction and those taught with traditional (chalkboard) method.

The second hypothesis states that; there is no significant difference between the mean scores of male and female students taught using computer aided instruction (CAI).

The result in the table 4.3A shows that there is no significant difference in the mean scores male and female students taught metalwork using computer aided instruction. From this result, it can be deduced that the use of computer aided instruction is gender friendly and can be used to bridge the gap in the sex disparity in the males and females. This is against the findings of George, Barry and Fraser (2002) who stated that boys achieve better than girls when taught with computer aided instruction.

CHAPTER FIVE

SUMMARY, CONCLUSION, LIMITATIONS AND RECOOMENDATION

This chapter focuses on the summary of the research work, the major findings of the work, the conclusion, recommendation and suggestion based on the findings.

5.1 Summary

The purpose of the study was to find out the effect of computer aided instruction in teaching metalwork in technical colleges of Niger state. The need to improve students' performance in metalwork prompted this research.

It was reasoned that computer aided instruction in teaching would produce a greater effect than using only chalkboard method.

In order to find solution to the research problems, two research questions were raised, based on these raised, based on the research question, two hypotheses were formulated and tested at o.o5 level of significance. The pretest-posttest experimental-control research design was used for study. One out of the two colleges formed the experimental group while the other school was used as the control group. The experimental group was taught with the use of computer aided instruction while the control group was taught with the use of chalkboard method.

The pretest was administered to the students before embarking on the teaching. An achievement test in metalwork was developed by the researcher and served as the instrument for data collection. The research instrument was validated by experts, it was tested in order to ensure the consistency and suitability of the items.

5.2.1 Major Findings of the Study

(i) Students in technical colleges perform better when taught using computer aided instruction than those taught with traditional (chalkboard) method.

(ii) The use of computer aided instruction in classrooms improves the performance of both male and female students equally. This implies that using computer aided instruction in teaching metalwork is gender friendly.

5.2.2 Contribution of the Findings to Knowledge

Students in technical colleges are likely to perform better if computer aided instruction is adopted in teaching and learning of metalwork, the software could also serve as a motivator for learning of vocational technical education generally. The major findings call for new direction and more commitment on the part of educational technologists.

5.3 Conclusion

From the findings, the conclusions are as follows:

(i) Instructional strategies employed by teachers in teaching metalwork in technical colleges have significant effects on students' achievement.

(ii) The use of computer aided instruction has positive effect on students' academic performance. This is shown by high level of performance recorded by the groups taught with computer aided instruction.

(iii) The male and female students were affected positively and equally by the use of computer aided instruction.

(iv) The use of chalkboard method in metalwork has low effect on the learner.

5.4 Recommendation

(i) The use of computer aided instruction for teaching and learning in schools should be encouraged by the school authorities.

(ii) Federal government should equip technical colleges with computer systems in order to enhance effective teaching and learning of metalwork.

(iii) Workshops and seminars should be organized for technical college teachers in order to make them computer literate.

(v) Finally, computer aided instruction which is gender friendly should be used in teaching of metalwork to avoid discrimination.

5.5 Suggestion

This study does not conclude researches on effect of computer aided instruction in teaching metalwork in Nigeria Technical Colleges. Rather it serves as the beginning of such researches. Thus, the research study introduces the way for producing computer aided instructional material in teaching metal on the topic: Metal and its properties. Therefore the subsequent researcher has to employ a more vivid analysis of available resources in order to be exposed to potential materials and ideas that can be used in teaching and learning metalwork in Nigeria technical colleges.

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APPENDIX A

POSTTEST QUESTION FOR BOTH CONTROL AND EXPERIMENTAL GROUP

1. Metals are good conductors of..... And.....

   (a) Rain and sand (b) wood and mud (c) electricity and heat (d) all of the above

2. Brass is a mixture of ..... and.....

   (a) Copper and aluminium (b) zinc and tin (c) copper and zinc (d)) tin and lead

3. The two basic kind of metals are ..... and.....

   (a) Brass and lead (b) ferrous and nonferrous metal (c) aluminium and zinc (d) tin and lead

4. The term ferrous comes from the word.....

   (a) Freedom (b) ferum (c) ferrium (d) ferrum

5. Ferrous metals are those metals which contain.....

   (a) Iron (b) oil (c) grease (d) diamond

6. Nonferrous metals are metals without.....

   (a) Oil (b) iron (c) shape (d) hion

7. Nonferrous metal includes the following except.....

   (a) Aluminium (b) copper (c) zinc (d) sodium

8. The following are properties of metal except.....

   (a) Beetleness (b) hardness (c) ductility (d) elasticity

9. The following are ferrous metal except.....

   (a) Carbon steel (b) lead (c) cast iron (d) wrought iron

10. Tin is used for.....

(a) Coating and plating (b) welding (c) pulling (d) cutting

APPENDIX B

Lesson Plan for Experimental Group

School: **Government Technical College Minna, Niger State.**

Class: **NTC II**

Subject: **Metalwork Technology**

Topic: **Metal and Its Properties**

Time: **10:00 – 10:40**

Duration: 40 Minutes

Instructional Material: **Computer Aided Instruction (CAI)**

Objectives: At the end of the lesson, the students should be able to

(i) Identify all the nine metals as to magnetic quality

(ii) Learn the colour and characteristics of all nine basic metals.

(iii)Learn the various properties of all the nine basic metals

Previous Knowledge: The students have learnt the workshop equipments and tools.

Instruction: The teacher introduces the lesson with questions from students previous knowledge.

Presentation

Step 1: The teacher discuss the history of Metal

Step 2: The teacher list all the basic metals

Step 3: The teacher discuss the properties of the Metals

Evaluation: The teacher evaluates lesson by asking the students questions to check their level of understanding from the lesson.

Conclusion: The teacher quickly summarizes the lesson by going through the topic related with emphasis on the stated objectives.

APPENDIX C

Answers to the Post-test Question for both Experimental and Control Group.

1. C
2. C
3. B
4. B
5. A
6. B
7. D
8. A
9. B
10. A