EFFECTS OF COMPUTER BASED INSTRUCTION ON TECHNICAL COLLEGE STUDENTS' INTEREST AND ACHIEVEMENT IN FABRICATION AND WELDING TECHNOLOGY

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Abstract

This study investigated effects of computer based instruction (CBI) on achievement and interest of Technical Colleges' students in fabrication and welding technology. The study was a pretest, posttest, non-equivalent control group quasi-experiment which involved groups of students in their intact classes randomly assigned to experimental and control groups. Four research questions and four hypotheses, tested at 0.05 level of significance guided the study. The sample size was 82 students from which 42 students constituted the experimental group taught using CBI, and 40 students constituted the control group taught with traditional teaching methods. The instruments used for data collection were Fabrication and Welding Achievement Test (FABWAT) and Fabrication and Welding Interest Inventory (FABWII). The data collected were analyzed using mean, to answer the research questions while ANCOVA and t-test statistics were used to test the hypotheses. The study found difference between the mean achievement scores of the experimental and control groups was statistically significant ($F_{1,\ 79}$ = 329.524, $\rho<.05$) in favour of experimental group. The study also found the difference between the mean interest scores of the experimental and control groups after treatment was statistically significant ($F_{1,\ 79}$ = 17.617, $\rho<.05$) in favour of experimental group. In view of the positive effects of CBI, it is recommended among others, that the method should be adopted to teach fabrication and welding technology in the technical colleges.

Keywords: Computer Based Instruction, Students' Interest and Achievement, Fabrication and Welding Technology.

Introduction

In any teaching and learning process, students have psychological and social needs, and interest that direct and focus their attention towards improving achievement in learning. As a result, students are attracted to those activities which they view as having the potential to meet their needs and that appear interesting. In the 21st century, visual materials are being used in every field and students are mostly in the effects of technological tools such as television, computers and audio-visual phones with special effects which are highly stimulating. This situation makes it more difficult to get students interest and to give permanent knowledge at schools without using visual contents to teach in the classroom (Halis, 2002). In this instance, the usage of computers in the classrooms has become inevitable and the ratio of the usage of Computer Based Instruction (CBI) has been on the increase.

Computer based instruction is an instructional method which uses computer to deliver instruction to students. In a computer based instruction classroom, students interact with computer as a key element of the learning process. It uses combination of text, graphics, sound, animation and video in the learning process (Kulik & Kulik, 1991). Kaur (2013) refers to computer based instruction as an interaction between students, a computer controlled display and a response entry device for the purpose of achieving educational outcomes. The use of computer based instruction in the classroom motivates and gets students to take active part in the learning process and helps to develop creativity, problem solving skills and self-reliance in students (Serin, 2011). The flexibility of learning through computer based instruction allow a wider range of stimuli thus, increases students' engagement in learning. Akcy,Durmaz, Tuysuz and Feyzioglu (2006) remarked that the use of computer based instruction gives opportunities to both students and teachers to learn by their speed and combine active learning with computer technology. It also motivates students to

learn better by providing the students with immediate feedback and reinforcement and by creating an exciting and interesting game-like atmosphere (Kaur, 2013).

Numerous studies have reported the effectiveness of computer based instruction. Bayrak and Bayram (2010) in their study on the effectiveness of computer based instruction on academic achievement of students in science and technology course found significant difference in the mean achievement scores of experimental and control groups in favour of the experimental group after treatment. Olori and Igbosanu (2016) investigated the effect of computer based multimedia presentation on senior secondary students' achievement in agricultural science. The result of the study revealed that the computer based multimedia presentation was found to be more effective than the conventional method because there was a statistically significant difference in the mean achievement scores of students taught using the computer-based multimedia presentation compared to those taught using the conventional method in favour of the experimental group. Similarly, Adedoja and Fakokunde (2015) studied the effects of computer based instructional puzzle on students' learning outcomes and retention in social studies. The study revealed a statistically significant main effect of treatment on students' achievement and retention in social studies. Serin (2011) investigated effects of computer based instruction on achievement and problem solving skills of science and technology students. The result of the study revealed that there was a statistical significant increase in the achievement and problem solving skills of the students in the experimental group that received the computer based science and technology instruction. These findings provide evidence that technological advancement in the use of computer based instruction have brought new learning and teaching opportunities to the extent that computers have proved their position in all aspects of science and technology instruction.

Fabrication and welding technology is a skill based programme designed to equip the trainees with knowledge, attitude and skills to carry out sheet metal work, gas welding, arc welding and cutting jobs on all types of metals and produce simple finished structural steel work projects (National Board for Technical Education (NBTE), 2001). NBTE accredits the programmes in the Technical Colleges while the National Business and Technical Education Board (NABTEB) conducts the final national examination and awards certificates. Trainees who successfully complete all the courses/modules specified in the curriculum table and passed the national examinations in the trade are awarded National Technical Certificate (NTC) at craft level and Advanced National Technical Certificate (ANTC) at advanced craft level. The major goal of the programme in the Technical Colleges is to produce competent craftsmen and master craftsmen for industrial and technological development in Nigeria. However, besides the general unemployment situation in Nigeria, chief examiner's report of NABTEB examination conducted in the Technical Colleges in November/December 2012 revealed that candidates recorded poor performance in fabrication and welding technology (NABTEB, 2012). This high failure rate of Technical Colleges' students in the final NABTEB examination is persistent and is gradually increasing every year (Ogundola, Popoola & Oke, 2010). This deficiency has been implicated for the failure of some Technical College products to secure employment. Invariably, many of the Technical Colleges graduates who could not pass the final NABTEB examination are unemployed, committing crimes and all sorts of atrocities in the country. According to Kilishi et al (2014) people blame the rising level of crime in the country on the mass unemployment of youth.

One of the reasons advanced for the persistent poor performance of Technical Colleges' students in the final NABTEB examination has been poor teaching arising from the use of traditional teaching methods such as lecture and demonstration to implement the curriculum (Owoso, 2012; Oranu, 2003). Traditional teaching methods such as lecture and demonstration methods are teacher-centered and placed emphasis on knowledge transmission from the teacher to passive students and encourage rote learning (Boyle, Duffy & Dunleavy, (2003). Technological developments have resulted into big gap between teaching at schools and the ways students get information in the 21st century. Nowadays visual materials are used in all human endeavour, and students are under the effect of technological tools such as television, Ipad, Android phones and computers. Hence, when teaching and learning at schools are supported through various sounds, visuals and animations, more permanent, fun and productive learning takes place (Ercan, Bilen & Bulut, 2014). Perhaps, if technical colleges' students are taught fabrication and welding technology with computer based instruction, the students' interest and achievement would be improved.

Many studies have been conducted on the efficacies of computer based instruction in various disciplines in Nigeria and all over the world, however, studies known to the researchers on effects of computer based instruction on achievement and interest of Technical Colleges' students in fabrication and welding technology have not been reported in literature. In this instance, research which provide systematic cognitive analysis of computer based instruction activities is needed to determine whether its use will have differential effects on students' performance in fabrication and welding technology. Hence, what is the effects of computer based instruction on achievement and interest of Technical Colleges' students in fabrication and welding technology?

Purpose of the Study

The major purpose of this study was to determine the effects of computer based instruction on achievement and interest of Technical Colleges' students in fabrication and welding technology. Specifically, the study compared the mean achievement and interest scores of Technical Colleges' students taught fabrication and welding technology concepts using computer based instruction and those taught using the traditional teaching method.

Research Questions

The following research questions were raised to guide the study:

1. What is the comparative pretest mean achievement scores of Technical Colleges' students taught fabrication and welding technology using computer based instruction and those taught using the traditional teaching method before treatment?
2. What is the comparative mean achievement scores of Technical Colleges' students taught fabrication and welding technology using computer based instruction and those taught using the traditional teaching method after treatment?
3. What is the comparative pretest mean interest scores of Technical Colleges' students taught fabrication and welding technology using computer based instruction and those taught using the traditional teaching method before treatment?
4. What is the comparative mean interest scores of Technical Colleges' students taught fabrication and welding technology using computer based instruction and those taught using the traditional teaching method after treatment?

Hypotheses

The following null hypotheses tested at .05 level of significance guided this study:

$H_{O1:}$ There is no significant difference in the pretest mean achievement of Technical Colleges' students taught fabrication and welding technology using computer based instruction and those taught using the traditional teaching method

H_{O2}: There is no significant mean difference in the achievement of Technical Colleges' students taught fabrication and welding technology using computer based instruction and those taught using the traditional teaching method after treatment

$H_{O3:}$ There is no significant difference in the pretest mean interest scores of Technical Colleges' students taught fabrication and welding technology using computer based instruction and those taught using the traditional teaching method

H_{O4}: There is no significant mean difference in the interest of Technical Colleges' students taught fabrication and welding technology using computer based instruction and those taught using the traditional teaching method after treatment

Methodology

The study used the quasi-experimental research design. Specifically, the non-equivalent pretest posttest control group design was used. Students in their intact classes participated in this study. The study

was conducted in NBTE accredited Technical Colleges offering fabrication and welding technology in Lagos State, Nigeria. The population for the study comprised all National Technical Certificate (NTC) II students studying fabrication and welding technology in all the five Technical Colleges offering Fabrication and welding technology in Lagos State in 2014/2015 academic session. The sample size was 82 students. Simple random sampling technique was used to select two technical colleges offering fabrication and welding technology in Lagos State. Intact classes of the two Technical Colleges were randomly assigned to the experimental and control groups. In all, the experimental group comprised 42 students taught with Computer based instruction and the control group comprised 40 students taught with traditional teaching method. The instruments used for data collection were Fabrication and Welding Achievement Test (FABWAT) and Fabrication and Welding Interest Inventory (FABWII).

*Automobile Mechanics Achievement Test (*FABWAT*)*

A test blue print was used to construct the FABWAT items in order to ensure content validity of the test. The items of FABWAT were drawn in line with the following six major classes of cognitive domain of Bloom's taxonomy of educational objectives: knowledge, comprehension, application, analysis synthesis and evaluation. 150 multiple-choice items were drawn for the FABWAT in the following topics: welding processes involving; gas and metal arc welding, preparation of joints for gas and metal arc welding, marking out processes in sheet metal work using steel rule, divider, scriber and compass and safety practices involve, cutting of sheet metal to size, metal forming to shape, joint making in sheet metalwork, riveting, drilling and punching of holes on joints for riveting using rivet sets, soldering and brazing processes. The FABWAT was subjected to face validation by five experts. A trial test was conducted on the FABWAT to determine the psychometric indices of the test. A total of 84 items of the FABWAT had good difficulty, discrimination and distractor indices. The test-re-test reliability technique was used to determine the coefficient of stability of the FABWAT. The reliability coefficient obtained was 0.719 using Pearson Product Moment Correlation Coefficient.

Fabrication and Welding Interest Inventory (FABWII)

The FABWII had twenty-five (20) items developed by the researchers. The response categories of the FABWII were based on four point rating scale: Strongly Agree, Agree, Disagree and Strongly Disagree. The response categories were assigned numerical codes of 4, 3, 2, and 1 for positively worded items while negatively worded items were assigned a reverse codes of 1, 2, 3, and 4. The items of the FABWII were subjected to face validation by five experts. The experts' suggestions were taking into consideration to produce the final draft of the FABWII used for the experiment. Cronbach Alpha was used to determine the internal consistency of the FABWII items. The reliability coefficient computed for the FABWII was found to be 0.92.

Techniques of Data Analysis

The data collected were analyzed using mean to answer the research questions while Analysis of Covariance (ANCOVA) and t-test statistics was used to test the hypotheses.

Computer Based Instruction Package

In developing the computer based instruction package, simulation and tutorial with, words, graphics, pictures and sounds to teach various concepts in fabrication and welding technology were downloaded from www.youtube.com. The materials downloaded were joined together by assistance of a computer experts to form the computer based instructional package which was written on a compact disc and installed onto Laptops.

Research Procedure

Control of Extraneous Variables

- *Teachers' Variability:* Teacher's variability was considered as one of the extraneous variables that could affect the result of the experiment. Hence, to control the effect of the variable, the regular technical teachers in the participating Technical Colleges were trained on how to use the computer based instructional package to teach. The technical teachers in the participating Technical Colleges taught their own students. The researchers were not directly involved in administration of the research instruments and the treatment.

- *Teaching Guide (Lesson Plan) Preparation:* To control variability in the development of the teaching guide (lesson plans) and to ensure uniform standard in the conduct of the research, the researchers prepared the teaching guides. Two types of Lesson plan were developed, namely Computer Based Instruction Lesson Plan (CBILP) and Traditional Teaching Method Lesson Plan (TTMLP.

- *Administration of Pretest:* The FABWAT and FABWII were administered to the experimental and control groups as pretest before the treatment by the technical teachers in their various schools. This process provided the pretest measures on achievement and interest of the two groups before the treatment.

The teacher who taught the experimental group used the CBILP as a teaching guide to teach the experimental group. The computer based instruction package was provided to the students to learn the content of the instruction. The computer based instruction provided the lesson contents in the form of simulation and tutorial with words, graphics, pictures and sounds. (Figure 1 and 2 shows a screen shot of the computer package).

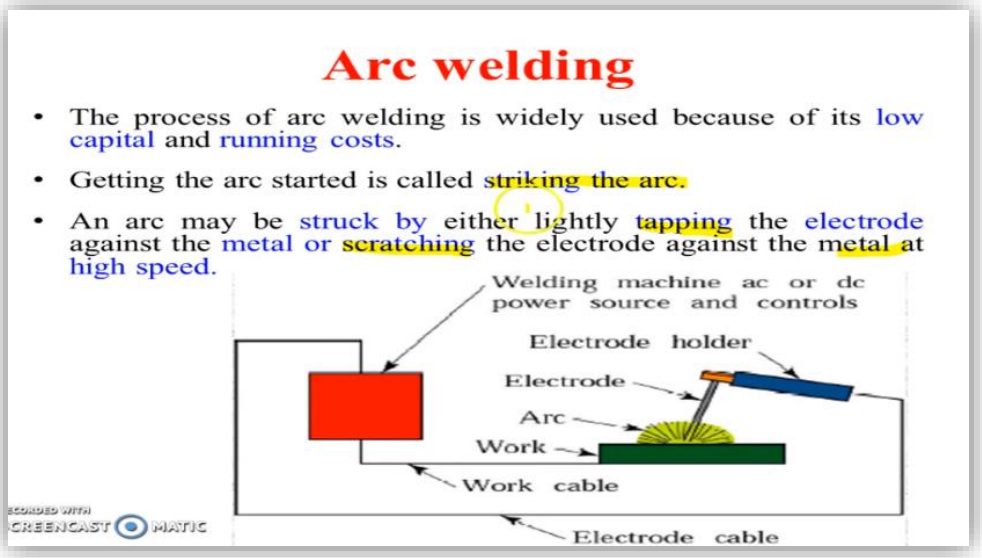

Figure 1: Screen shot of the computer based instruction package showing text and graphics of welding process

Figure 2: screen shot of the computer based instruction package showing welding process

The teacher who taught the control group used traditional teaching method to teach the students and as well wrote notes on the chalkboard for students to copy. The same topics taught to the experimental group were taught to the control group. Each lesson lasted for 90 minutes and the treatment last for 8 weeks.

Administration of the Posttest

At the end of the treatment, the FABWAT and FABWII were re-arranged and administered to all the experimental and control groups as posttest. Technical teachers administered the FABWAT and FABWII to the students to obtain the posttest scores on achievement and interest of the groups after the treatment.

Results

Students Achievement before Treatment

The pretest mean score of the experimental group (n=42) and control group (n=40) were 21.00 and 22.65 respectively, presented in Table 1.

Table 1:
Pretest Mean Achievement Scores and Standard Deviation on the FABWAT and t-value

Group	n	Pretest mean $\overline{X}$	SD	df	t-value	ρ value
Experimental	42	21.00	4.73	80	-1.838	.070
Control	40	22.65	3.20			

Independent sample t-test was used to determine the significance of the difference in the pretest mean scores of the experimental and control groups. The result in Table 1, revealed that the difference between the mean scores of the experimental and control groups was not statistically significant, (t=.-1.838,ρ>.05). This established that there was no significant difference in the pretest mean achievement of Technical Colleges' students taught fabrication and welding technology using computer based instruction and those taught using the traditional teaching method before treatment. Hence, HO_1 was accepted.

Students' Achievement after Treatment

After the treatment, the posttest mean achievement score ($\overline{X}$ = 60.69; SD=2.58) of experimental group was higher than the posttest mean achievement score ($\overline{X}$ = 44.55; SD=4.91) of the control group as shown in Table 2.

Table 2:
Comparison of Mean Achievement Scores of Experimental and Control Groups in the FABWAT

Group	n	Pretest $\overline{X}$	SD	Posttest $\overline{X}$	SD	Mean Gain
Experimental	42	21.00	4.73	60.69	2.58	39.69
Control	40	22.65	3.20	44.55	4.91	21.90

Table 2 revealed that the mean gain (39.69) of the experimental group was higher than the mean gain (21.90) of the control group. This result shows that computer based instruction was more effective than the traditional teaching method in improving students' achievement in fabrication and welding technology.

Analysis of Covariance was used to test hypothesis two (HO_2) to find out whether the difference in the groups' means after the treatment was statistically significant. The results of ANCOVA is presented in Table 3.

Table 3:
Summary of Analysis of Covariance (ANCOVA) for Test of Significance of Treatment on Students' Achievement in Fabrication and Welding Technology

Source	Type III Sum of Squares	df	Mean Square	F	ρ-value
Corrected Model	5340.318[a]	2	2670.159	173.481	.000
Intercept	7721.526	1	7721.526	501.671	.000
Pretest	2.938	1	2.938	.191	.663
Treatment	5071.903	1	5071.903	329.524	.000
Error	1215.938	79	15.392		
Total	235307.000	82			
Corrected Total	6556.256	81			

a. R Squared = .815 (Adjusted R Squared = .810)

The result in Table 3 revealed that the difference between the mean achievement scores of the experimental and control groups was statistically significant ($F_{1, 79}$ = 329.524, ρ<.05). Hence, HO_2 was rejected, establishing that there was a significant mean difference in the achievement of students taught fabrication and welding technology using computer based instruction and those taught using the traditional teaching method in favour of the experimental group.

Students' Interest before Treatment

The pretest mean interest scores obtained from the experimental and control groups before the treatment made it possible to determine the groups' interest in fabrication and welding technology before treatment. The mean interest scores of the pretest for experimental group (n=42) and control group (n=40) were 52.04 and 52.60 respectively, summarized in Table 4.

Table 4:
Pretest Mean Interest scores and Standard Deviation on the FABWII and t-value

Group	n	Pretest mean $\overline{X}$	SD	df	t-value	ρ-value
Experimental	42	52.04	5.77	80	-.438	.663
Control	40	52.60	5.64			

An independent sample t-test result in Table 4, revealed that the difference between the mean interest scores of the experimental and control groups was not statistically significant, (t=.-.438,ρ>.05). Therefore, HO_3 was accepted. This affirmed that the groups mean interest scores were equivalent prior to the administration of the treatment.

Students' Interest after Treatment

The posttest mean interest score ($\overline{X}$ =68.45; SD=6.37) of experimental group taught fabrication and welding technology with computer based instruction was higher than the posttest mean interest score ($\overline{X}$ = 60.40; SD= 10.40) of the control group taught the same contents of fabrication and welding technology using traditional teaching method after the treatment as presented in Table 5.

Table 5:
Comparison of Mean Gain of Experimental and Control Groups in the FABWII

Group	n	Pretest $\overline{X}$	SD	Posttest $\overline{X}$	SD	Mean Gain
Experimental	42	52.04	5.77	68.45	6.37	16.41
Control	40	52.60	5.64	60.40	10.40	7.80

Table 5, revealed that the mean gain (16.41) of the experimental group was higher than the mean gain (7.80) of the control group. The result shows that computer based instruction was more effective than the traditional teaching method in improving students' interest in fabrication and welding technology.

In the determining whether the difference in the mean interest scores of experimental and control group after treatment is statistically significant, ANCOVA was used, Table 6.

Table 6:
Summary of Analysis of Covariance (ANCOVA) for Test of Significance of Treatment on students Interest in fabrication and welding technology

Source	Type III Sum of Squares	df	Mean Square	F	ρ-value
Corrected Model	1358.170[a]	2	679.085	9.161	.000
Intercept	4618.112	1	4618.112	62.297	.000
Pretest	29.724	1	29.724	.401	.528
Treatment	1305.937	1	1305.937	17.617	.000
Error	5856.281	79	74.130		
Total	348613.000	82			
Corrected Total	7214.451	81			

a. R Squared = .188 (Adjusted R Squared = .168)

Table 6 revealed that the difference between the mean interest scores of the experimental and control groups after treatment was statistically significant ($F_{1, 79} = 17.617$, $\rho<.05$). HO_4 was therefore rejected, confirming that there was a significant mean difference in the interest of students taught fabrication and welding technology concepts using computer based instruction and those taught using the traditional teaching method in favour of experimental group.

Discussion

The aim of this study was to investigate the effects of computer based instruction on the achievement and interest of technical colleges' students in fabrication and welding technology. The scores obtained from FABWAT and FABWII administered to the experimental and control groups were compared. The findings of the study revealed that before the treatment there was no significant difference between the mean achievement scores of experimental and control groups in the FABWAT. This mean that the groups were equivalent in their achievement before treatment. On exposure of the two groups to treatment, however, result revealed a statistically significant difference between the mean achievement scores of experimental and control groups in favour of the experimental group. This finding is in agreement with the findings of Bayrak and Bayram (2010) in science and technology course, Olori and Igbosanu (2016) in agricultural science, Adedoja and Fakokunde (2015) in social studies, and Serin (2011) in science and technology. The finding supports the fact that the computer based instruction with animation and tutorial with words, graphics, pictures and sounds makes learning more concrete, interactive and engaging. Besides, computer based instruction improves student's mastery of knowledge independently according to the material contained in the program so that student can enrich the material relevant, increase the independence in the study of other materials and assist students to find solution to problems in learning independently (Lesteri 2015).

Computer based instruction is capable of supporting instruction with voice, image and animation to naturally increase students' commitment and involvement in learning and also lead to improved interest, and achievement. The findings of the study revealed a statistically significant mean difference in the interest of experimental group taught fabrication and welding using computer based instruction and those taught using the traditional teaching method in favour of experimental group. This finding is consistent with the finding of Nwanne and Agommuoh (2017) who found statistically significant difference between the mean interest scores of students taught physics with computer assisted instruction (CAI) and that taught using lecture method. Interestingly, providing opportunities for students to interact with course material through the use of computers and information technology tend to change the course from a competitive endeavour to one that is more student-centred, and focused on the cognitive development and construction of knowledge in the students (Brewer, 2003). Hence, one means of constructing knowledge is to create

meaning by doing. Creating support for knowledge construction through teaching with computer technology is a critical component to the success of developing self-motivated, intellectually stimulated learners. The use of computer based instruction in the classroom therefore, facilitates students' interaction with the learning environment and sustains students' direct interest which increases the strength of ego-involvement of the students and which does not allow the students to be distracted by trivial extraneous events in the perceptual environment.

Conclusion and Recommendations

The computer based instruction stimulated students' interest and improved students' achievement in fabrication and welding technology than the traditional teaching methods. In view of this positive effect of computer based instruction on students' achievement and interest in fabrication and welding technology, it is recommended that;

1. Technical College teachers should be encouraged to adopt the use of computer based instruction to teach fabrication and welding technology
2. Teacher education also needs to incorporate computer based instruction concepts in the teacher education curriculum to empower technical teachers to use the computer based instruction.
3. Seminars and conferences should be organized for in-service technical teachers in order to prepare them for the use of computer based instruction to enhance teaching of fabrication and welding technology in the Technical Colleges.

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