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The Effect of Computer-Assisted Instructional Package for Teaching Metalwork Technology (MWT) at Nigeria Certificate in Deucalion (Technical) Level

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Abstract

This study identified the effects of using Computer-Assisted Instructional (CAI) package for teaching Metalwork Technology (MWT) at the Nigerian Certificate in Education (Technical) level. Two research questions and two research hypotheses were formulated to guide the study at 0.05 level of significance. The study used post- test only type of quasi experimental research design. Two hundred and eighty students of 200 level NCE (Technical) programme were used as respondents in the study from seven institutions in the North-central geo-political zone of Nigeria. One hundred and forty students each were assigned to the control and experimental groups respectively. Both the control and the experimental groups were taught MWT using the lecture and CAI package methods respectively and administered with Metalwork Technology Achievement Test (MWTAT) in a post-test. The data from the post-test were analyzed using the mean and standard deviation to answer the two research questions and t-test statistics was used to test the two hypotheses in the study. The study found that the subjects in the experimental group performed better than their counterparts in the control group in the post-test with mean score of 23.76. The subjects in the Federal Colleges of Education and Polytechnics performed better than those in the State Colleges of Education and Polytechnics. The study also found significant differences in the performances of the control and the experimental group and between those in the Federal-owned and State- owned institutions. Some recommendations made in the study include Colleges of Educations and Polytechnics offering NCE (Technical) programme should have well equipped computer centers for teaching and learning metalwork technology. Institutions should adopt the CAI package for teaching students metalwork technology.

Keywords: Computer-Assisted Instruction, Education, Effect, Teaching, Metalwork Technology (MTW), Metalwork Achievement Test (MWAT)

Introduction

Technical Education is a comprehensive term referring to those processes 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 (FRN, 2004). The goals of technical education are to provide the technical knowledge and vocational skills necessary for agricultural, industrial, commercial and economic development of the nation (FRN, 2004). By the above definition and goals, technical education becomes one of the most important paths for the realization of the industrial, agricultural and economic development of the nation.

Poor academic performance of students generally has attracted the attention of educationists and researchers as a major problem to science and technological development in Nigeria. Similarly, Ezeliiora (2003) asserted that science and technology education have recorded poor academic performance of students in various courses or subjects at most of the levels of our educational system over the years. In view of these deteriorating trends in the performance of students generally in schools and colleges in the sciences, technology and mathematics courses, there is no doubt that, the situation needs urgent attention.

With the advances in technology and the advent of computerization and digitalization, various methods of instruction have been devised and used in teaching and learning to solve most instructional problems in developed countries. Though, in Nigeria, most of these innovations are yet to be fully employed in most institutions. Computers ease instructional problems and can be exploited to enhance teaching and learning in all schools. This is an area where an array of promising technological and educational development is currently emerging (Wajiga, 2006). Research indicate that ICT can change the teaching and it is especially useful in supporting student centered approaches to instruction, developing the higher order skills and promoting collaborative activities (Haddad, 2003). Recognizing the importance of ICT in teaching and learning, majority of the countries in the world have provided ICT teacher training in a variety of forms. Several efforts have been made by many countries to train teachers for effective use of computer as a tool for enhancing teaching and learning (Uko & Ebute, 2013). While Ibrahim (2012) further disclosed that computer is important in educational setting. The major importance include motivation, transformation of abstract idea to reality, facilitate understanding and comprehension of the subject matter and facts, address the needs of the users, thereby, making learners to learn on their own rate. Supporting this fact, Kara and Yakar (2009) observed that, Computer-Assisted Teaching do not only improve success but also develop higher level thinking abilities in students' learning.

Teaching and learning of technical subjects especially Metalwork Technology continue to suffer as a result of over dependence on lecture method alone. It is essential technical education teachers devise other means by which knowledge and skills could be imparted to learners taking the advantage of modern technologies. This is the concern of this study.

Statement of the Problem

The Nigerian Government at various levels, individuals and corporate bodies attach great importance to the teaching and learning of technical education courses generally and Metalwork Technology in particular at the NCE (Technical) level. Emphasis has been placed on this area of educational system to meet the scientific and technological objectives of the nation. Yet, these objectives have not been fully achieved over the years due to some problems bordering on teaching methodologies at the Colleges of Education and other tertiary institutions in Nigeria. By the views of Osioma (1996), Vocational and Technical Education in this country has come of age, but much is not shown for it given the level of support by various governments and organizations worldwide.

Though, the problem of inability of this aspect of the educational system to meet the aspirations of educational planners and others are multidimensional, prominent among them are those associated with the instructional methods. The lecture method which has become almost a traditional method of instruction in higher institutions in Nigeria is widely being criticized. Its criticisms mostly surround its failure to meet the demands of students in learning practical skills (Adigun, 1997; Nnaobi, 2003). The failure of this method of instruction has resulted into ineffective teaching, poor academic performance by students, low learning rate, retention and poor performance on the job and making the realization of the scientific and technological objectives of the country difficult to achieve. In view of these ailing problems, the search for a modern and appropriate alternative to teaching becomes utmost importance which has necessitated this study.

Purpose of the Study

The main purpose of this study is to identify the effects of using Computer - Assisted Instructional Package for teaching Metalwork Technology at NCE (Technical) level. Specifically, the study sought to: -

1. Compare the academic performance of the students taught MWT with the two methods of instruction (CAI Package and lecture method).
2. Compare the academic performance of the students taught MWT with the CAI package based on proprietorship of institutions (Federal/State Government).

Research Questions

The study attempts to answer the following questions:

1. What is the academic performance of students taught MWT with the two methods of instruction (CAI package and lecture method)?
2. What is the academic performance of students in Federal and State Colleges of Education and Polytechnics that are taught MWT with CAI Package?

Research Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance.

Ho₁: There is no significant difference in the mean performances of students taught Metalwork Technology with Computer - Assisted Instructional Package and those taught with the traditional lecture method.

HO₂: There is no significant difference in the mean performances of students in Federal and State Colleges of Education and Polytechnics taught Metalwork Technology with Computer - Assisted Instructional Package.

Research Methodology

Research Design

Post-Test only quasi experimental research design was used for the study. Sambo, (2008) described Post- Test quasi experimental design as the Ex- Post Facto research design which requires two assigned groups of subjects, each assigned to different conditions and utilizes post-test only without any pre-test to generate data for the study. The researchers compare the data of the subjects that experience the treatment and those that did not experience the treatment and establish the cause of the difference between the groups in the study.

Area of Study

This study was carried out in the Colleges of Education and Polytechnics that offer Metalwork Technology at NCE (Technical) level in the North-Central geo-political zone of the country. These institutions include Niger state College of Education, Minna, Niger state; College of Education, Ankpa , Kogi State; College of Education, Katsina Ala. Benue State; College of Education, Oji, Benue State; Nasarawa State College of Education, Akwanga, Nasarawa State, Federal College of Education, Pankshin, Plateau State and Plateau State Polytechnic, Barkin-ladi, Plateau State.

Population and Sample of the Study

The population for the study consisted of all the 200 level students of Metalwork Technology of NCE (Technical) programme in all the institutions in the North-Central Geo-political zone of the country. The stratified random sampling technique was used to generate 280 subjects from the classes of the participating institutions for both the experimental and control groups to represent the entire population of the study.

Validation of the Research Instrument (MWTAT)

The developed Research Instrument (MWTAT) was subjected to face and content validation by four (4) Metalwork Technology lecturers each from the seven (7) participating institutions using a 46-item researcher developed test instrument. All observations and suggestions were noted and corrected to prepare the final draft of the package used for the study.

The Reliability of the Research Instrument (MWTAT).

The scores of the students' performance in both the control and experimental groups in the pilot study were used to establish the reliability of the test instrument (MWTAT) using Pearson's product moment correlation coefficient to determine the reliability coefficient. The reliability (r) values obtained were 0.97 and 0.98 for the control and experimental groups respectively.

Methods of Data Collection

The research instrument (MWTAT) which was researcher-made achievement test consisting of 46-items objective test was administered to both the experimental and control groups for the study.

Methods of Data Analysis

Data collected from both the experimental and control groups in the post test were analyzed using Mean, Standard deviation and t-test Statistical tool. The data were analyzed to answer the research questions and test the hypotheses at 0.05 level of significance. Data used in the study were analyzed using Statistical Package for Social Sciences (SPSS) software.

Results

Research Question One

What is the academic performance of students taught MWT with the CAI package and that of the students taught with lecture method at NCE (Technical) level? The analysis required to answer this research question are presented in table 1.

Table 1: Mean Score and Standard Deviation of Control and Experimental group In Post-Test MWTAT.

Groups	No. of Subjects	Mean	Standard Deviation
Control	140	18.06	3.80
Experimental	140	23.76	5.36
Total	280	41.82	9.16

The result presented on table I shows that, the mean scores of students performance in MWTAT by the control group had a mean score of 18.06 with standard deviation of 3.80 while that of the experimental group had a mean score of 23.76 with standard deviation of 5.36. The experimental group thereby performed better than the control group.

Research Question Two

What is the academic performance of students in Federal and State Colleges of Education and Polytechnics that are taught MWT with CAI package at NCE (Technical) level? The analysis required to answer this research question are presented in table 2.

Table 2: Mean Score and Standard deviation of Students in State and Federal Colleges of Education and Polytechnics in Post-Test MWTAT.

Groups	No. of Subjects	Mean	Standard Deviation
State COE &Polytechnic.	100	22.34	4.55
Federal COE &Polytechnics.	40	27.33	5.65
Total	140	49.67	10.20

The result presented in table 2 shows that, the scores of students in MWTAT in state owned and federal-owned Colleges of Education and Polytechnics obtained a mean score of 22.34 and standard deviation of 4.55; a mean score of 27.33 and a standard deviation of 5.65 respectively. The students in Federal Colleges of Education and Polytechnics performed better than the students in State Colleges of Education and Polytechnics.

Hypothesis One

There is no significant difference in the mean performances of students taught MWT with CAI package and those taught with lecture method at NCE (Technical) level. The analysis required to test this hypothesis in the study are Presented in table 3.

Table 3: Post-Test Mean, Standard Deviation and t-values of Control and Experimental Groups.

Groups	No. of subjects	mean	SD	df	Prob. level	t-value calculated	t-critical value	decision
Control	140	18.06	3.80	278	0.05	3.44	1.96	Significant
Experimental	140	23.76	5.36					

The result in table 3 shows that, the mean performances of students taught with lecture method (control group) was 18.06 and standard deviation of 3.80. The students taught with the CAI package (experimental group) obtained a mean score of 23.76 and a standard deviation of 5.36. The table also revealed that, the calculated t-value obtained was 3.44 while the t-critical value at 0.05 level of significance was 1.96. Since the calculated t-value of 3.44 is greater than the t-critical value of 1.96, there is a significant difference between the performances of the control and the experimental groups. This hypothesis is hereby rejected in favour of the experimental group students since they obtained a higher mean score in MWTAT.

Hypothesis Two

There is no significant difference in the mean performances of students in Federal and State Colleges of Education and Polytechnic taught MWT with the CAI package at NCE Technical level.

Table 4: Mean, Standard Deviation and t- value of Students in State and Federal Colleges of Education and Polytechnics in Post-Test MWTAT.

Groups	No. of subjects	mean	SD	df	Prob. level	t-value calculated	t-critical value	decision
State Institutions	100	22.34	4.55		0.05	2.17	1.98	Significant
Federal Institutions	40	27.33	5.65	138				

The analysis required to test this hypothesis in the study are presented in table 4. The result in table 4 revealed that, the mean performances of students in the state Colleges of Education and Polytechnics had mean score of 22.34 and a standard deviation of 4.55. The mean performance

of students in Federal Colleges of Education and Polytechnics was 27.33 and standard deviation of 5.65. The table also revealed that, the calculated t-value obtained was 2.17 while the t-critical value at 0.05 level of significance was 1.98. Since the calculated t-value was 2.17 higher than the t-critical value of 1.98, the hypothesis was rejected. Therefore, there is a significant difference between the mean performances of the students in State institutions and those in the Federal institutions. The difference is in favour of the students in Federal Colleges of Education and Polytechnics who obtained mean score of 27.33 compared to mean score of 22.34 obtained by the students in the State Colleges of Education and Polytechnics.

Findings

In research question one, the results of the students' academic performances in MWT using the MWTAT revealed that, the students in the experimental group performed better than those in the control group. This was owed to higher mean score obtained by the students in the experimental group as compared to that of the students in the control- group.

The findings in research question revealed that, the students in Federal Colleges of Education and Polytechnics performed better than their counterparts in State Colleges of Education and Polytechnics in the MWTAT. This was because the students of Federal Colleges of Education and Polytechnics obtained higher mean score of 27.33 as compared to the mean score of students in state Colleges of Education and Polytechnics that had mean score of 22.34.

The findings in research hypothesis one revealed that, there was a significant difference in the academic performances of students taught MWT with CAI package and those taught with the lecture method at NCE (Technical) Level. This hypothesis was rejected since the calculated t-value (3.44) was greater than the table t-value (1.96) obtained at 0.05 level of significance. The findings in research hypothesis two revealed that, there was a statistical significant difference in the mean performances of the students in State Colleges of Education and Polytechnics and those in the Federal Colleges of Education and polytechnic taught MWT with CAI package. This hypothesis was rejected because the calculated t-value (2.17) was greater than the t-critical value (1.98) at 0.05 level of significance. The significant difference was in favour of the students of Federal Colleges of Education and Polytechnics since they obtained higher mean score compared to their counterparts in the State Colleges of Education and Polytechnics.

Discussion of Findings

In research question one; the findings revealed that, the students in the experimental group taught MWT with CAI package performed better than those students in the control group. This finding was in line with that of Sanni (1997) which revealed that, the students in the experimental group taught Basic Statistics with CAI performed better than those students in the control group that were not exposed to the CAI lesson. The finding of Sanni was in conformity with the experimental group students' mean scores that were greater than that of their counterparts in the Control group.

Similarly, this finding was also in agreement with the study of Fagbemi (2003) in which the experimental group also had higher mean score than the control group. The findings revealed that, the students in the experimental group taught with CAI performed better than the students in the control group that were not exposed to CAI lessons.

However, the finding was the same with the view of Adesina in Yalams and Enoch (2003) who were of the opinion that, state-owned institutions were worst affected in terms of operational facilities, instructional materials, quality and quantity of teaching staff, staff remuneration etc. The performances of students in such institutions cannot be the same or better than institutions where these facilities and staff were available and adequate in number and quality.

In hypothesis one, the findings revealed that, there was a significant difference in the academic performances of students taught MWT with CAI package and those taught with lecture method. This finding was in agreement with the study of Akour (2009) who conducted a research to investigate the effects of traditional instruction (TI) plus Computer-Assisted Instruction (CAI) versus TI alone on College students' Achievement in Introductory Computer Science course. An analysis of covariance on the post-test scores with pre-test scores as covariates showed that, the TI plus CAI group performed significantly better than the TI alone group. The findings indicated that, there was a statistically significant difference in the performances of the subjects in the experimental and the control groups. The finding of the study on this hypothesis was also in agreement with the findings of Gambari (2003) which revealed that, there was significant difference between the post-test scores of students in the experimental group exposed to Computer-Aided Learning (CAI) and control group not exposed to CAI. The significant difference was confirmed when the students in the experimental group obtained higher mean score than the students in the control group.

In hypothesis two, the findings revealed that, there was a significant difference between the performances of the students in state-owned institutions and those in the federal-owned institutions taught MWT with CAI package. The finding was also in agreement with the study of Nwocha and Tanko reported in Umeoduagu (2000) on the State of resources for Communicating Science, Mathematics and Technology in State Schools in Niger State. The study revealed that, the state and private schools lacked adequate human and materials resources for teaching and learning Science, Mathematics and Technology. They observed that, the situation is similar to other states and negatively affects the performance of students in such schools.

Conclusion

Based on the findings of this study, it has been observed that developed CAI package used in the study for teaching improves students' academic performance in MWT at NCE (Technical) level. The developed CAI package used in the study for teaching has significant influence on students' academic performance in MWT at NCE (Technical) level and ownership of institutions also has significant influence on the academic performance of students taught MWT with CAI package at NCE (Technical) level. This could be in terms of facility provision and quality of staff employed.

Recommendations

The following recommendations are made based on the findings of the study.

- i. The proprietors of Colleges of Education and Polytechnics offering NCE (Technical) programme should ensure that, the institutions have adequate number of functional computer systems for teaching and learning. The centre should also have internet facilities and other Information and Communication Technology (ICT) facilities.

- ii. All students of higher institutions should be computer literate to enable them use computers for instructions and learning. All lecturers in institutions of higher learning should be computer literate to be able to develop Computer-Assisted Instructional packages and use them to teach students,
- iii. Educational institutions such as Colleges of Education and Polytechnics should organize seminars, workshops and conferences on teaching methods for Lecturers. This will keep them abreast of current and relevant teaching methods that will meet the needs of contemporary society and students.
- iv. Colleges of Education, Polytechnics and other educational institutions should use CAI package for teaching Metalwork Technology.
- v. Educational institutions and other educational agencies like Nigeria Educational Research and Development Center (NERDC), National Commission for Colleges of Education (NCCE), National Board for Technical Education (NBTE), and National Teachers Institute (NTI) etc, should adopt the CAI package as a model for designing similar packages for teaching other courses.

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