ACADEMIC PERFORMANCE OF TECHNICAL COLLEGE STUDENTS IN ELECTRICAL INSTALLATION AND MAINTENANCE WORK USING COMPUTER AIDED INSTRUCTION (CAI)

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Abstract
This study investigated effect of Computer Aided Instruction on academic performance of technical college students in Electrical Installation and Maintenance Work in Enugu State. Two research questions and two null hypotheses guided the study. Quasi experimental research design was adopted for the study. The sample used for the study consisted of 22 NTC II students made up of 14 males and 8 females. Purposive sampling technique was used to select two schools from Udi and Enugu education zones. An intact class was used in each of the schools which were tagged experimental and control group respectively. The instrument used for data collection was a 50 objective questions developed by the researchers which was administered as pretest and posttest to the experimental and control groups respectively. Pearson correlation coefficient formula was used to establish the reliability of the instrument which yielded 0.81 coefficient reliability. The research questions were answered using mean scores whereas the hypotheses were analyzed using ANCOVA. The mean scores and ANCOVA were calculated using SPSS version 20. The finding showed that CAI significantly impacted on the students' academic performance. In view of the finding, it was recommended among others that CAI should be formally adopted in technical colleges, secondary and vocational schools for instruction in Electrical Installation and Maintenance Work to improve academic performance of students.
Keywords: Computer aided instruction, academic performance, Electrical Installation and Maintenance Work.

Introduction

The importance of steady power supply in national development cannot be overemphasized. This fact notwithstanding, the state of electricity in Nigeria is deplorable. This is to say that electricity in Nigeria is unreliable and not dependable. The result has been a gross retardation of development in various sectors in Nigeria. The cause of this is largely traceable to the obvious lack of qualified man power capable of manning the electrical power facilities across

the nation. Daso (2012) and Sylvester (2013) in support to this assertion noted that the need for electricians (technologists) that can handle the sorry state of electricity in Nigeria is one of the major technical needs of the Nigerian society. Electrical Installation and Maintenance Work was introduced in technical colleges to meet this need.

Electrical Installation and Maintenance Work (EIAMW) is one of the trade subjects offered mainly in technical colleges in Nigeria that has its major objective as to provide trained manpower in the applied science, technology and commerce at sub-professional grades (Federal Republic of Nigeria, 2014). Despite the importance of EIAMW in making robust human infrastructure to address the perils in the power sector and other related sectors, the trade has suffered gross negligence and relegation by the Nigerian society. The result of this has been poor performance of students in EIAMW and incessant power supply in Nigeria.

Poor performance of students in EIAMW subject in National Business and Technical Education Board (NABTEB), West African Examination Council (WAEC) and National Examination Council (NECO) examinations has become worrisome to technical educators and other stakeholders in education (parents/guardians, Government and students). An analysis of the results of students in some selected trade subjects in NABTEB examination from year 2006 to 2010 by Olatunde (2011), revealed poor performance of students in EIAMW across Nigeria. A review of the number of schools in Enugu State that registered her students for EIAMW in NABTEB examination and their corresponding performance from year 2010 to 2013 conducted by Enugu State Science Technical and Vocational Schools Management Board (ESSTVSMB) also revealed that performance of students is unsatisfactory.

The poor performance of students in NABTEB examination and in other examinations could be attributed to lack of application (employment) of instructional methods that are more pedagogical and suitable for teaching practical oriented subjects especially electrical/electronic and other related subjects at the college level in Nigeria. As a result, classroom and workshop instructions appear abstract with its attendant failures among students in NABTEB, WAEC, and NECO examinations which sadly extends into the 21st century.

Even when 21st century wears a domineering and intimidating posture in emphasizing technology advancement, many teachers of technology seem not to be conscious of the development. Indirectly, students' academic orientation and their subsequent performance in the job market are affected. Just as Busstra (2002) put it, ICT is causing a revolution and if any education sector does not join, it will not only be old-fashioned, but in a few years, it will be out of competition in the educational market.

One of the most recent technological media (ICT) introduced into the teaching-learning process is the Computer Aided Instruction-CAI (Ikwuka, 2012). Computer Aided Instruction as used in this study is synonymous to Computer Assisted Instruction. Computer Aided Instruction is a program of instruction or package presented as computer software for instructional purposes (Umaru, 2003). According to Umaru, CAI promotes individualized instruction, helps learners learn at their pace, saves time, gives feedback, favours slow learners, enhances motivation and is highly learner centered. Even at these advantages, the use of CAI appears not prominent among teachers of technology. Available literatures show that CAI has been found to improve on students' academic performance in subjects such as Biology (Orjika, 2012), Mathematics (Anyamene, Nwokolo, Anyachebelu & Anemelu, 2012), and Chemistry (Okoro & Etukudo, 2001). It is therefore pertinent to find out if CAI would also enhance students' academic performance and retention level in EIAMW. In this wise, this paper is put up to investigate the effect of Computer Aided Instruction on the academic performance and retention of technical college students in Electrical Installation and Maintenance Work. Specifically, the study investigated:

1.   Effect of CAI on academic performance of students in EIAMW.
2.   Effect of CAI on academic performance of male and female students in EIAMW.

Based on these objectives, the study was designed to provide answers to the following research questions;

1. What is the difference in academic performance of students taught EIAMW with CAI and those taught with lecture teaching method as determined by their mean performance scores?
2. What is the difference in academic performance of male and female students taught EIAMW with CAI as determined by their mean performance scores?

In respect to these research questions, the following two null hypotheses were formulated and tested at 0.05 level of significance;

1. There is no significant difference between the academic performance of students taught EIAMW with CAI and those taught using lecture method of instruction with reference to their mean performance scores.

2. There is no significant difference between the academic performance of male and female students taught EIAMW with CAI as measured by their mean performance scores.

Methodology

Quasi experimental research design consisting of non-equivalent control group and experimental group was adopted for this study. Quasi experimental research design was used for this study because there was no random assignment of the subjects to treatment conditions. Nworgu (2015) in agreement to this said that in a situation where there is no randomization in the assignment of individual participants to treatment conditions, quasi experimental method is most suitable.

The population of the study consisted of four hundred (400) NTC II students (347 males and 53 females) in the twenty one (21) technical colleges in Enugu State. The sample consisted of 22 (14 males and 8 females) students who were purposively selected from the two colleges. Fifteen students (9 males and 6 females) were selected from Udi Technical College in Udi education zone and seven students (5 males and 2 females) from Technical College Akpuoga Nike in Enugu education zone. Intact class was used in each of the schools (Udi Technical College and Technical College Akpuoga Nike). The intact classes were designated experimental and control group respectively.

The instrument used for data collection was EIAMW Performance Test titled EIAMWPT which was developed by the researchers. The second term scheme of work for technical colleges was used. A fifty item multiple choice objective test that covered the entire EIAMW scheme was validated and its reliability determined using Pearson correlation coefficient formula that yielded 0.81.

The duration of the study was six weeks. The first week was used for pre-test administration, four weeks for teaching the EIAMW content and the sixth week for post-test administration. The research questions were answered using mean and hypothesis was statistically tested using Analysis of Covariance (ANCOVA) at 0.05 level of significance.

Result

Research Question 1

What is the difference in academic performance of students taught EIAMW with CAI and those taught with lecture teaching method as determined by their mean performance scores?

Answer to this research question is presented in Table 1.

Table 1

Pre-test and post-test Means and Standard Deviations of performance scores of students taught EIAMW with CAI and those taught with lecture method

Source of Variance	N	pre-test mean	SD	Post-test mean	SD	Mean gain	Remark
Experimental group	15	13.73	3.127	41.60	3.135	27.87	Positive effect
Control group	7	13.57	3.735	33.43	6.779	19.86	Positive effect
Difference in mean gains						8.01	

The data in Table 1 show positive effect for both experimental and control group. However, the mean gain of 27.87 (41.60-13.73) for the experimental group is higher than that of the control group which is 19.86 (33.43-13.57). This shows that CAI is more effective in enhancing students' academic performance in EIAMW than lecture method of instruction.

Research Question 2

What is the difference in academic performance of male and female students taught EIAMW with CAI as determined by their mean performance scores?

The answer to this research question is presented in Table 2

Table 2

Pre-test and post-test Means and Standard Deviations of performance scores students taught EIAMW using CAI with respect to gender

Source of variance	N	Pre-test mean	SD	Std. error gains	Post-test mean	SD	Std. error mean	Mean gains	Remark
Male	9	13.67	3.391	1.130	42.44	3.283	1.094	28.77	+effect
Female	6	13.83	2.994	1.222	40.33	2.658	1.085	26.50	+effect

Difference in mean gains		2.27

In Table 2, data revealed that CAI had positive effect on academic performance of students in EIAMW with respect to gender. However, the mean gain of 28.77 (42.44 – 13.67) for the male students is higher than 26.50 (40.33-13.83) for their female counterparts. This shows that CAI had more positive effect on academic performance of males than that of the female students.

Test of Statistical Significance of the Hypotheses

Hypothesis 1

H_o: There is no significant difference between the academic performance of students taught EIAMW using CAI and those taught using lecture method of instruction with reference to their mean performance scores.

The statistical test for hypothesis 1 is presented in Table 3.

Table 3
ANCOVA on performance scores of students taught EIAMW using CAI and those taught using lecture method

Source	Type III Sum of Squares	df	Mean Square	F-calculated	F-critical	Sig.
Corrected Model	2.078[a]	1	2.078	15.421		.001
Intercept	5.432	1	5.432	40.311		.000
Groups	2.078	1	2.078	15.421	4.35	.001
Error	2.695	20	.135			
Total	43.000	22				
Corrected Total	4.773	21				

Significant at 0.05 alpha level; df= 1& 20; critical p≥0.001, a. R Squared = .435 (Adjusted R Squared = .407)

The data presented in Table 3 show that the calculated F-value of 15.421 is greater than 4.35 F-critical value. Hence the null hypothesis was rejected at 0.05 alpha level of significance and, 1 and 20 degrees of freedom. This implies that there is significant difference in academic performance of students taught EIAMW using CAI and those taught using lecture method of instruction.

Hypothesis 2

H_o: There is no significant difference between the academic performance of male and female students taught EIAMW with CAI as measured by their mean performance scores.

The statistical test for hypothesis 2 is presented in Table 4

Table 4
ANCOVA on academic performance of students taught EIAMW using CAI with respect to gender

Source	Type III Sum of Squares	df	Mean Square	F-cal	F-crit	Sig.
Corrected Model	.420[a]	1	.420	1.716		.213
Intercept	1.081	1	1.081	4.421		.056
Gender	.420	1	.420	1.716	4.67	.213
Error	3.180	13	.245			
Total	33.000	15				
Corrected Total	3.600	14				

Not significant at 0.05 alpha level; df= 1 & 13; critical p≤ 0.213; a. R Squared = .117 (Adjusted R Squared = .049)

Data presented in Table 4 show that the calculated F-value of 1.716 is less than 4.67 F-critical value. Therefore, H_o was not rejected at 1 and 13 degree of freedom and 0.05 alpha level of significance. Also, F-calculated value of 1.716 is statistically not significant since P-value of 0.213 is greater than 0.05 alpha level of significance. This entails that there is no significant difference in academic performance of students taught EIAMW using CAI with respect to their gender. Hence gender influence on academic performance of students in EIAMW when CAI teaching method is used is not significant.

Discussion of Results

The discussion of results of the study is done in line with the purpose of the study under the following headings:

- Effect of CAI on academic performance of students in EIAMW.
- Effect of CAI on academic performance of students in EIAMW in relation to gender.

Effect of CAI on academic performance of students in EIAMW

Tables 1 and 2 revealed that the academic performance of students taught EIAMW using CAI differed significantly from that of the students taught same lesson using lecture method in favour of the experimental group. Specifically, the experimental group had a mean gain of

27.87 while the control group had 19.86 mean gain. This gave a difference of 8.01 in favour of the experimental group.

This finding is in agreement with Paul, Moses, and Brandford (2013) who found that Junior High School students taught Pre-Technical Skills using CAI achieved academically more than those taught same lesson using traditional method. In the same vein, this finding is supported by the findings of Orjika (2012) in a study that investigated effect of CAI Packages on secondary school students' academic achievement and interest in biology. Orjika found that students taught Biology using CAI Package performed significantly better than those taught using expository method. Also, in agreement to this finding, Doaa (2014) found that the experimental group (taught using CAI) differed significantly from control group in academic achievement in Basic Ballet Skills in favour of the experimental group.

The similarities between the findings of these studies and the current study reveal that the use of CAI in teaching trade subjects/courses and some career areas can improve students' academic performance.

Effect of CAI on academic performance of students in EIAMW in relation to gender

The study also sought to find effect of CAI on academic performance of students with respect to gender. The result shown in Table 2 indicate that male students exposed to EIAMW using CAI had mean gain of 28.77 in academic performance against their female counterparts with 26.50 mean gain. This accounted for the difference of 2.27 in the mean gains in favour of the male students. However, the result in Table 4 revealed that this difference in academic performance between the male and female students is not significant. Hence such differences in academic performance with respect to gender is a chance occurrence.

The deductions from the related literature reviewed support these findings of the study on effect of CAI on academic performance of students in EIAMW in relation to gender. For instance, Orjika (2012) found that gender has no significant influence on students' academic achievement and interest in Biology. Similarly, Anyamene et al (2012) revealed that post-test performance of male and female students taught Mathematics using CAI had no significant difference. Also, Ikwuka (2012) got same result when CAI was used to teach English Language.

This entails that CAI method of instruction evenly influenced both male and female students in EIAMW and some other career areas. Therefore, CAI method of instruction can be a powerful measure to check against bias in the learning process as a result of one's gender especially in technology related careers.

Conclusion

Based on the finding of this study, CAI is an innovative and effective mode of instruction with the capacity of improving students' academic performance in EIAMW.

Recommendations

The following recommendations were proffered based on the finding of this study.

1. CAI should be formally adopted in technical colleges, secondary and vocational schools for instruction in EIAMW to improve academic performance and retention ability of students.
2. Teachers should ensure constant and effective utilization of CAI for instruction in trade and trade related subjects/courses.
3. Training programmes on effective utilization of CAI for instruction should be organized periodically for teachers.
4. The schools should be provided with computers and internet facilities to enable students maximise the benefits of CAI.
5. Training on the development of different CAI software specifically for teaching trade subjects should be organized for indigenous computer programmers as one can hardly find locally produced CAI software. These trainings should suffice curricula reviews.

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