

Effect of Computer Aided Design on Students' Academic Achievement in Automobile Electricity Technology in Technical Colleges in Edo State

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Abstract

This paper investigated the effect of computer aided design on students' academic achievement of automobile electricity technology in edo state technical colleges. The population of the study consisted of 86 students of automobile electricity technology in Technical Colleges in Edo State. Quasi pre-test, post-test group design was used for the study. Automobile electricity technology Achievement Test (AETAT) containing a total of 50 multiple choice questions formed the instrument of the study. Means and standard deviations were used to answer the research questions while t-test was used to test the null hypothesis at 0.05 level of significance. The result of the data analysis showed that there was a significant difference between the mean achievement scores of students taught AET using conventional method($X = 40.58$) and those taught using CAD method ($X = 60.42$). Pretest and Post-test Mean Academic Achievement Scores of Male ($X = 83.92$) and Female ($X = 17.05$). AET Students Taught automobile electricity operation and layout Using CAD. The results showed that there is a difference between the mean achievement scores of male and female students when exposed to experimental condition in favour of the male students in technical colleges in Edo state. The analysis also returned ($t = 7.75$) to reject the null hypothesis at 0.05 level of significance. The study recommended among others that the use of CAD method of teaching should be adopted by technical teachers to improve the academic performance of Automobile electricity technology students in Edo State.

Keywords: Computer Aided Design method, Academic performance, Automobile Electricity Technology and Conventional method

Introduction

The major purpose of education is to equip recipients with knowledge and skills needed to function effectively, this contribute to the development of the society. Federal Government of Nigeria (2014) stated that the goal of education are purposely to develop the mental, physical and social abilities/ competencies and for the acquisition of appropriate skills as necessary for the individual to contribute to the development of the nation. These goals of education can be easily achievable through a well designed vocational and technical education programme.

Technical education is a comprehensive term used for those aspects of education systems involving the acquisition of practical skills, attitudes and knowledge related to occupations in

various sectors of economic and social life (NPE, 2014). Technical education prepares its recipients with skills, knowledge and attitudes necessary for effective employment in recognized occupation (Osami, 2013). According to Odogwu (2005) industrial technical education stresses preparation and participation for social value; it is pragmatic; thus trains both the head and the hands (Oranu, 2009). Federal Republic of Nigeria in her National Policy on Education (2013) described technical education as being a characteristic of education that promotes the acquisition of hands-on skills and applied scientific knowledge. Industrial technical education programme in Nigeria evolved response to technological and industrial needs of the people. It has received the backing of the National Policy on Education (NPE 2013). These fields of science, technology and engineering have gotten much to offer in the area of economic development and provision of modern conveniences to mankind. This is why governments, institutions and managements emphasized the need for practically oriented technical education curriculum and the need also to provide effective teaching of technical subjects in Nigerian schools (Nkeweke 2007). However, many government parastatals and institutions are continually becoming aware of the important roles that computer plays in the teaching and learning of technical subjects. The government is emphasizing on teacher's development as the key for implementing ICT in teaching and learning hence improving the standards of education. Indeed, as noted in an earlier study by Becker, (2001) among many other reasons for the uptake of ICTs in teaching, teacher attitude towards technology which stands out as one of the main reasons.

Technical colleges are established institutions where students are trained to obtain relevant knowledge and skills in different occupations for employment in the world of work (National Business Technical Education Board, NABTEB, 2016). Accordingly, the Federal Government of Nigeria FGN (2012), stated that technical college is a segment of technical and vocational education programme designed to train manpower in the applied sciences, technology and business particularly at craft, advanced craft and technician levels among others. This may involve manipulation of materials or objects in form of task performance, the simple use of spanner to tighten or unscrew a bolt and the complex process of using a set of tools in a process of dismantling and assembling of a motor electrical parts as applicable in automobile electricity trade programme. Thus, knowledge acquired from these technical trades could help the graduates' automobile electricity trade to secure gainfully employment. Technical colleges run different programmes among which are automobile electricity trade programme.

Automobile electricity technology as a teaching subject in technical colleges is aimed at studying technical competencies in trade related areas which comprises of a storage battery, generator, starting (cranking) motor, lighting system, ignition system, and various accessories and controls. Yakubu (2014) observed that for a graduate to create job in the automobile electricity works, the graduate must have the following skills: the battery, the starter, and the alternator among others which are at a higher degree of demand in our society. Uwaifo (2015) also observed a career in automotive electricity technology will provide you with the skills to maintain, test, diagnose and repair automotive electrical components and systems in motor vehicle. Automobile electricity trade are electrical systems use in vehicles, including engine management, ignition, radio, carputers, telematics, in-car entertainment systems, and others. Ignition, engine and transmission electronics are also found in trucks, motorcycles, off-road vehicles, and other internal combustion powered machinery such as forklifts, tractors and excavators. It is a skill-oriented subject taught with emphasis on theory and practice. The philosophy of automobile electricity trade is to train competent craftsmen and master craftsmen in automobile industry.

Moreso, Automobile Technology trade is one of the Vocational Training offered in Government Technical Colleges across Nigeria. Classification of automobile trade in GTCs according to NBTE (2011) includes: Agricultural Implement Mechanics, Auto Electric Works, Vehicle Body Building and Motor Vehicle Mechanic's work (MVM). Motor Vehicle Mechanic's work (MVM) is designed to produce competent automobile craftsmen for the technological and industrial development of Nigeria. According to Ede and Olaitan (2010), the establishment of automobile technology and other occupational trades in GTCs is geared towards imparting basic knowledge as well as training skills leading to the production of skilled craftsmen who will be self-reliant and sufficiently competent to meet the demands in the world of work. The main component of automobile technology is structured on foundation and trade modules. These components according to NBTE (2011) includes: Service Station Mechanic; Engine Maintenance; Engine Reconditioning; Transmission; Suspension, Steering, Braking Systems and Auto-Electricity.

In other words, automobile technology students are expected to diagnose, service and completely repair any fault relating to the conventional automobile, assemble main unit to the manufacturers specification. The automobile is an indispensable means of transportation in modern societies. According to Gscheidle (2006), automobile also known as motor vehicle is a complex

technical system in which various subsystems operate in harmony to discharge a defined function. In the view of Omeji (2005), automobile electricity is a wheeled vehicle that carries its own motors, and has seats for both the driver and passengers. Assorted brands and models of automobiles therefore abound today on the Nigerian roads and are used for either public or convenience and luxury of personal transportation. The fast movement of technological change will render the current teaching method and training facilities of automobile electricity trade obsolete if computer technology is not introduced into it..

Computer assisted design (CAD) is the use of computer-based software to aid in design processes. CAD software is frequently used by different types of engineers and designers. CAD software can be used to create two-dimensional (2-D) drawings or three-dimensional (3-D) models. Computer-Aided Design is a new teaching and learning strategy in which the topics to be taught is carefully planned, written and programmed in a computer which could be run at the same time in several computer units. The instructions are also programmed in a computer disc, this could be played in either audio or video system for the student to learn the programmed at his /her leisure time and at his/her own pace. The potential benefit of Computer Aid design (CAD) cannot be underestimated in the contemporary world. The use of computers in the teaching and learning process is an important advancement in making high quality education universally available. This great change has resulted in a fresh perspective, innovativeness and creativity in the teaching and learning process. The utilization of CAD in teaching and learning particularly in automobile electricity trade will enables students to learn at their pace, encourage continuous interaction, promote flexible time scheduled for the students,' enhance automatic adjustment to ability levels of students motivation and could create an active learning environment.

The evolution of different types of equipment and new working automobile electricity material are possibilities in the 21st ' century. There will be decrease in the importation of automobile electrical products and increase in the production of automobile electrical products in automobile industry in Nigeria. To make the concepts of automobile electricity subject more concrete and real, it becomes imperative to employ Digital natives' theory. According to Prensky (2011) Digital natives are those born and raised in a digital and media-saturated world. They are immersed in this technology from their early years and so, it is a naturally acquire skills. It is acquired in the same way they pick up their first language. Currently, the Digital natives are being taught by immigrants who are, in effect, not of the same language. It is therefore, becomes

necessary for technical teachers to re-structure the classroom and workshop learning environment in way that incorporates computer based technology such as computer aided Design (CAD). Research studies carried out by Mustafa, Ashhan&Turgay, (2011), and Yusuf (2009) among others revealed that CAD package could improve academic achievement in some subjects, there is need to examine the effect of CAD on academic achievement of automobile electricity technology students in technical colleges in Edo State.

Academic achievement represents the outcome that indicates the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in schools. In teaching and learning situations, academic achievement is synonymous with academic performance. They could be seen as the outcome of students' effort in examinations. Tella, (2010) posited that academic achievement is used to measure student's success in educational institutions or how well students meet standard set out by examining bodies or the institution. Uwameiye, (2014) contended that a student's academic achievement is dependent on several factors such as, learning environment, instructional methods and teaching strategy, teachers' attitude and enthusiasm, as well as students' attitude and background. When suitable teaching method is employed during instructional delivery.

In studying students' academic achievement, sex cannot be ignored. Sex is an ascribed attribute that socially differentiate feminine from masculine. It connotes male and female or boys or girls in a given group of students. There is a general belief that boys are superior to girls in terms of cognition and logical reasoning as a result of certain factors and even superior in academic reasoning Shaibu and Mari, (2014).). But Uwameiye and Osunde, (2005) disagreed with this claim. The author posited that difference academic achievement between male and female students does not exist. With the advancement in technology, computerization and digitization, various methods of instruction have been devised and used to solve most of these instructional problems.

Statement of the Problem

Joshua, Ekpoh, Edet, Joshua, and Obo (2004) revealed that despite the huge resources expended by Nigerian stakeholders, mass failure in public examinations, especially in Science and Technology related areas which include automobile electricity technology, is still being recorded every year. Recent statistics of academic achievement among students of automobile electricity technology over a period of five years (2016-2021) corroborates this. It was observed by chief-

examiners of automobile technology (NABTEB, 2017) that this mass failure could be attributed to teachers' use of unsuitable instructional methodologies, especially traditional method, which is teacher-centred, in teaching the subject.

Hence, teachers need to adopt learner-centred instructional approaches that emphasize contextualized and constructive processes, and equip the students with higher-order thinking skills for easy adaptability and flexibility. This stresses that teachers in technical colleges would adopt innovative instructional methods that would improve the academic achievement of students in automobile electricity technology in technical colleges. To achieve this, various researchers have recommended that the Computer assisted design method could improve the achievement of students in technical colleges in Nigeria. In spite of the use of conventional method by teachers in technical colleges to ensure qualitative education at the technical colleges and bring about high quality products of students, there appears to be no improvement in the academic achievement of students in automobile electricity trade in Technical Colleges in Nigeria. The question now is, how students' academic achievement can be improved in automobile electricity technology in technical colleges in Edo state? It is this gap that necessitated this study. This could be possible through a paradigm shift from conventional method (traditional method) to Computer aided design teaching method that could enhance technical and workplace skills in line with modern technology instructional approach. Hence there is the need to investigate the effect of Computer Assisted Design on academic achievement of automobile electricity technology students in technical colleges in Edo State.

Purpose of the Study

The purpose of the study was to determine the effect of CAD on students' academic achievement of automobile electricity technology in technical colleges in Edo State. Specifically, the study determined the:

1. Mean academic achievement scores of automobile electricity technology students taught skills in Automobile Electricity Technology with CAD and those taught with conventional teaching method in technical colleges in Edo state; and
2. Mean academic achievement scores of automobile electrical technology of Male and Female students taught skills in Automobile Electricity Technology with CAD in technical colleges in Edo state.

Research Questions

The following research questions guided the study:

1. What are the mean academic achievement scores in Automobile Electricity Technology with CAD and those taught with conventional teaching method in technical colleges in Edo state?
2. What are the mean academic achievement scores of automobile electrical technology male and female students taught skills in Automobile Electricity Technology with CAD in technical colleges in Edo state?

Hypotheses

The following null hypotheses were tested at .05 level of significance:

1. There is no significant difference between the mean academic achievement scores in Automobile Electricity Technology with CAD and those taught using conventional method in technical colleges in Edo state.

Method

Quasi-experimental design was adopted for the study. Specifically, the pretest, posttest non-randomized control group design was adopted for the study. The design was adopted because it was not possible for the researchers to randomly sample the subject and assign them to groups without disrupting the academic programme and the time table of the technical colleges involved in the study. The study was conducted in technical colleges in Edo State which is located in the south-south zone of Nigeria. The population of the study was eighty-six (86) automobile electricity technology students in technical colleges in Edo State.

Purposive sampling technique based on availability of professionally qualified staff, computer facilities for teaching, regular electricity supply and willingness of regular teachers to participate as research assistance. One intact class was used in each of the five technical colleges giving a total of four intact classes. Simple random sampling was used to assign two intact classes to experimental groups and the other two intact classes to control groups. The groups for the study were coded group X and group Y comprising two experimental class and two control class each. Experimental class (Group X) consisted of 43 students and control class (Group Y) consisted of 43 students. Experimental class (Group B) consisted of 70 male students and control class (Group B) consisted of 16 female students.

The data were analyzed using arithmetic mean and simple percentage in answering the research questions. The real limits of numbers of the response mode were used to categorize the

mean rating of responses. Decision was made in favor of any item that had a mean rating of 2.5 and above, while items that scored mean of 2.49 and below were taken as unimportant.

Intact class of automobile electricity technology Students	Male	Female	Total
Group A: Pre-Test and Post-Test Mean Academic Achievement Scores of Students taught Automobile Electricity Technology with CAD and those taught using Conventional Method.			
• Experimental Class	35	8	43
• Control class	35	8	43
Total	70	16	86
Group B: Pre-Test and Post-Test Mean Academic Achievement Scores of Male and Female Automobile Electricity Technology Students Taughtskills to maintain, test, diagnose and repair automotive electrical components and systems Using CAD			
• Experimental Class	70	nill	70
• Control Class	nill	16	16
Total	70	16	86

The instruments for data collection were Automobile Electricity Achievement Test (AEAT) adopted by the researchers from the NABTEB past examination questions between 2016 and 2019. AEAT contained 50 multiple choice test items with four options (A-D). The instrument was face and content validated by three experts; two in Technology and Vocational Education and one in Measurement and Evaluation, Faculty of Education, Ambrose Alli University, Ekpoma and University of Benin. The reliability of the instrument was established using test-retest method. Copies of the items were administered twice to 25 NTC year I automobile electricity technology students drawn from Government Science and Technical College Asaba, Delta State who were not part of the population. Reliability estimate method of test retest reliability using manual computation with the Pearson Product Moment correlation between the two sets of scores yielded a correlation coefficient value of 0.80.

The researchers sought and obtained permission from the authorities concerned for the involvement of their technical colleges and teachers in the study. The automobile electricity teachers were also trained on how to conduct the experiment treatment and were given prepared

lesson plans, automobile electricity digital tutor, flash drives, modem, projector machine and laptop. The control groups were given only lesson plan. Pre-test was administered to the two experimental groups after which the actual commenced on the second week. The primary focus of the teaching process was concentrated on automobile workshop, Service Station Mechanic; Engine Maintenance; Engine Reconditioning; Transmission; Suspension, Steering and Braking Systems, engine component /functions, single and multi-cylinder engines, four-stroke engines and valve operations. Each lesson lasted for 80 minutes and the treatment lasted for five weeks. At the end of the treatment, a post-test was administered on both groups using the AEAT and after a week interval. Data collected for the study were analyzed using mean scores and standard deviation to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. Result of the pre-test and post-test were used for data analyses using Statistical Package for the Social Sciences (SPSS).

Results

Table 1: Pre-Test and Post-Test Mean Academic Achievement Scores of Students taught Automobile Electricity Technology

Academic Achievement						
Groups		Pretest		Post test		
	No	Mean	SD	Mean	SD	Mean Gain
Exp.Group	43	60.42	7.77	65.53	8.09	62.97
Contr Group.	43	40.58	6.37	34.46	6.37	37.52

Method.*Exp Group=Experimental Group; CONTR Group =Control Group

Table 1 shows the experimental group had mean gain of 60.42 which is higher than the 37.52 gained by the control group. The difference in the mean gain between experimental and control group is high which means CAD is very effective in experimental group.

Table 2: Pre-Test and Post-Test Mean Academic Achievement Scores of Male and Female automobile Electricity Students

SEX						
Groups		Pre-test		Post-test		
	No	Mean	SD	Mean	SD	Mean Gain
Males	70	83.39	9.13	84.45	9.18	83.92
Females	16	18.60	4.31	15.55	3.94	17.05

Table 2 show the male had mean gain of 83.92 which is higher than the 17.05 gained by the females. The results show that there is a difference between the mean achievement scores of male and female students when exposed to experimental condition in favour of the male students in technical colleges in Edo state.

Table 3: ANCOVA Summary for Differences in Academic Achievement of Students of Automobile Electricity Technology Students

Source	Type III Sum of Squares	Df	Mean Square	F	P-value
Corrected Model	27.406	2	63.703	3.829	.025
Intercept	61.793	1	61.793	12.512	.001
Pretest achievement	13.802	1	13.802	6.008	.016
Level	9.686	1	9.686	1.302	.257
Error	49.762	86	8.875		
Total	655.000	84			
Corrected Total	727.168	84			

Table 5 shows that the posttest means achievement of students in the experimental and control groups $F(1, 100) = 1.302, p > .05$. This means that there was no significant difference in the mean achievement scores of students in experimental and control group. Therefore, the null hypothesis was accepted.

Discussion

Finding of the study shows that automobile electricity technology students taught skills to maintain, test, diagnose and repair automotive electrical components and systems using CAD had higher mean posttest scores than those taught using conventional method. This finding is in agreement with that of Agrahari, and Singh (2013) which reported that the achievement of students exposed to CAD either individual or cooperatively performed better than those exposed to conventional teaching method. This could be as a result of utilization of computers which

strengthen their cognitive mechanism. The study reveals that there is a significant difference between the mean achievement scores of male and female skills to maintain, test, diagnose and repair automotive electrical components and systems technology students when they were exposed to experimental condition in favour of the male students.

This finding contrasts the finding of Eze, Ezenwafor and Obidile, (2018) that female students performed significantly better than their male counterparts in academic achievement using CAD. Hence such difference in academic performance with respect to sex is a chance occurrence. The results shows that the male automobile electricity technology students were effective in the academic performance in automobile electricity trade than their female counterpart.

Furthermore, findings of the study revealed that there is no significant main effect of treatment in the academic achievement of students in the experimental and control groups. This means that there was no significant difference in the mean achievement scores of students in experimental and control group.

Conclusion

Based on the findings of this study, it was concluded that CAD positively affects students' academic accomplishment and ability in the subject automobile electrical technology. It was found more compelling, effective, rewarding and valuable in teaching of automobile electrical technology students in technical colleges in Edo State.

Recommendations

Based on the findings of this study the following recommendations were made:

- Teachers should ensure constant and effective utilization of CAD for instruction in trade and trade related subjects/courses in technical colleges, secondary and vocational schools to enhance academic achievement and retention ability of students
- School administration should provide opportunities for in-service training programme for automobile technology trade teachers in order to equip them with competencies needed in the use of CAD for instruction.
- Curriculum planners should formally adopt CAD for instruction in automobile technology trade in technical colleges and ensure its wide application.
- Government should provide (technical colleges, secondary and vocational schools) with computers and internet facilities to enable students maximize the benefits of CAD.

References

- Agrahari, A., & Singh, S. (2013). The impact of Information and Communication Technology (ICT) on achievement of students in chemistry at secondary level of CBSE and UP Board in India. *International Journal of Science and Research*, 2(8), 126-129.
- Anyamene, A, Nwokolo, C, Anyachebelu, F & Anemelu, V. C. (2012). Effect of computer-assisted packages on the performance of senior secondary students in mathematics in Awka, Anambra State, Nigeria. *American International Journal of Contemporary Research* 2(7). Retrieved from www.aijcrnet.com
- Audu, R. Azlan, B. A & Muhammad, M. (2014). An appraisal of technical skills possessed by technical college auto-mechanics graduates in Nigeria. *Industrial Engineering Letters* www.iiste.org ISSN 2225-0581(online) 4(8), 34-53
- Audu, R, Adnan, A, Mohd, Z. A & Sada, A. M. (2015). Effect of problem-based learning in teaching and learning of technical and vocational education and training. *International Journal of Scientific and Research Publication*, 5(5), 1-3.
- Bartwel, B. N. (2013). Psychological testing. New York: Macmillan Inc.
- Chika, J. G. (2018). Information and communication technology (ICT) as a vital tool in the education sector reform in Nigeria', *Nigeria Journal of Sociology in Education (NJSE)* 2(2), 182-190.
- Chris Isidore (2021) Computer chip shortage starting to hit automakers where it hurts
- Cotton, K. (2001). Computer assisted instruction. North-west regional educational laboratory. Retrieved from <http://www.nwrel.org/scpd/sirs/5/cu10.html>
- Emadi, Ali (2017). Handbook of Automotive Power Electronics and Motor Drives. CRC Press. p. 117. ISBN 9781420028157.
- Eze, T. I, Ezenwafor, J. I. & Molokwu, L. I. (2015). Effect of meta-learning teaching method on the academic performance of metal trades students in technical colleges in South-east Nigeria. *International Journal of Vocational and Technical Education* 7 (10), 101-108.
- Joshua, M. T., Ekpoh, U. I., Edet, A. O., Joshua, A. M. & Obo, F. E. (2004). Managing examination crisis: the menace of examination malpractice in Nigeria. Retrieved on 12th May 2013 from www.aceafrica.org.
- Mustafa, Ashhan & Turgay, (2011), and Yusuf (2009). Effect of computer aided design in teaching and learning of technical and vocational education and training. *International Journal of Scientific and Research Publication*, 5(5), 1-3.
- National Business and Technical Examinations Board (NABTEB), (2020). Chief examiners' report for SSCE May/June 2020. BENIN. NABTEB.
- National Business and Technical Examinations Board (NABTEB, (2021). Performance of candidates (May/June) in metalwork from 20018-2022. Benin. Statistics Unit, QAD, NABTEB.
- VinceC (2019-05-07). "Automotive History: Electronic Ignition – Losing the Points, Part 1". Curbside Classic. Retrieved 2022-10-03.
- Uwameiye, and Osunde, (2005) Teaching models via Vocational Technical Education: The Means for National development. *Educational Journal for National Development*, 249-253.
- Uwaifo, V.O. (2010). Technical education and its challenges in Nigeria in the 21st Century. *International Journal Ngo*. 5 (2), 40-44
- Yakubu, (2014). The need for competency in metalwork technology in Nigeria. *Journal of Engineering Trends in Educational Research and Policy Studies*. 5(8). Retrieved from jeteraps.scholarlinkresearch.com