



## Research Articles

### EFFECT OF COMPUTER AIDED INSTRUCTION ON STUDENTS ACADEMIC PERFORMANCE IN ELECTRICAL INSTALLATION AND MAINTENANCE WORKS TRADE IN GOVERNMENT SCIENCE AND TECHNICAL COLLEGES IN GOMBE STATE, NIGERIA

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Received 27<sup>th</sup> March 2019; Accepted 20<sup>th</sup> April 2019; Published online 30<sup>th</sup> May 2019

#### ABSTRACT

The study was to determine the effect of computer aided instruction (CAI) on students' academic performance in electrical installation and maintenance work trade (EIMWT) in government science and technical colleges in Gombe state, Nigeria. Two specific purposes, two research questions and two null hypotheses guided the study. The study adopted pre-test, post-test, non-equivalent control group quasi-experimental research design. The population of the study was 270 NTC students from seven government science and technical colleges in Gombe state offering EIMWT. The sample of the study was 110 NTC II EIMWT students from two technical colleges in Gombe state selected through purposive sampling technique. Electrical installation and maintenance work trade academic performance test (EIMWTAPET) was used as instrument for data collection; the instrument was validated by three experts and has reliability coefficient of 0.78. The experimental group was taught using CAI package while control group was exposed to traditional teaching method. Mean and standard deviation was used to answer the research questions while t-test was used to test the hypotheses at 0.05 level of significance. Findings of the study reveals that Students taught electrical wiring tools and accessories using CAI had a higher mean score in post-test than those students taught using the lecture method in the test. The two null hypotheses were rejected. Based on the findings it was recommended among others that, Ministry of education should give more attention to computer literacy and operation in the technical colleges and relevant CAI packages should be developed for use within the Gombe state.

**Keywords:** Computer Aided Instruction, Academic Performance, Quasi-experiment.

#### INTRODUCTION

Technical vocational education (TVE) provides the development of qualitative skills, knowledge and attitude that will bring forth individuals who are resourceful and productive, Federal Government of Nigeria (FRN, 2004) in national policy of education. In recent years, concerns have been shifted by developing countries to develop technical vocational education (TVE) to exploit the skills and knowledge of their citizens and utilize them effectively in national economic development. Technical colleges are among the institutions that provide technical and vocational education in Nigeria. They are designed to impart necessary skills that lead to the production of craftsmen and artisans who will be enterprising and self-reliant (FRN, 2004). Programs offered in technical colleges are skill oriented and performance based (Odu, 2001). These programs allow for effective training of students in a wide range of trade subjects that help the students to achieve various instructional objectives in different domains of learning (Igbo, 1997). Among the TVE trades offered at technical college level is Electrical Installation and Maintenance Work Trade (EIMWT) which provides training that leads to production of skilled craftsmen and artisans who can be enterprising in the world of work. According to NBTE curriculum, students are expected to achieve the following objectives on graduation: perform various experiments using resistors, capacitors and inductors, undertake both domestic and industrial installation, install electrical machines, prepare and joint of electrical cables,

install/connect batteries for charging, decouple, rewind and recouple basic electric machines (NBTE, 2003). These objectives can only be achieved through student centered teaching approach which ensures active participation of students during instruction. However, conventional teaching methods which are mostly teacher-centered and give more significance to teachers' activities than students' participatory learning are widely used in teaching technical subjects (Samaila, Makinde and Zambwa, 2016). Atadogo, Mari and Danjuma (2016) stated that teacher- centered method is traditional method of teaching where the teacher passes the information verbally and also write notes on the board while students serve as passive receivers by listening and taking notes. In conventional teaching approach students has difficulties in understanding subject matter due the fact that they passive during the lesson. Contrary to the conventional teaching method approach, the national policy on education specifies that teaching of all TVE trades should be practical based. Computer aided instruction (CAI) is a student-centered teaching-learning process which is used to teach students in different subjects. Instructional contents are presented to the learners using computer through interactive process, computer aided instruction programs involve drills and practice, computer simulations, tutorials and dialogue etc (Imhanlahimi and Imhanlahimi, 2008). CAI is a set of computer application packages used to deliver course content which lead to development of knowledge and problem solving skills through practice (Ismail, Muhsinand Murat, 2012). Computer Aided Instruction provides students with course materials, guides students thinking, responds to students' question, assesses students' performance and manages students' path through a course. Computer Aided Instruction has many advantages which include self-paced learning,

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self-directed learning, exercising of real sense and ability to represent content in a variety of media, it involves the use of multi-sensory organ in receiving instruction (Kulik and Kulik, 1985). According to Fletcher (1990) people remember 75% of what they see, hear and do. The fact that CAI can exercise various senses of human being and present information in different medium can enhance learning process hence it is important for technical teachers to adopt this teaching method which ensures active students involvement in learning and improves students' academic performance. Students' academic performance refers to the outcome of teaching and learning, it is the extent to which a student, teacher or institution has achieved their educational goals. Students' academic performance is commonly measured by conducting continuous assessment and examinations (Kanter, 2012). Bell (2012) stated that academic performance is capability of students to study and recall facts and be able to communicate knowledge verbally or on paper. In educational institutions, students' success is measured by their academic performance, or how well a student meets standards set out by the examination bodies and the institution itself. However, the continued decline in students' academic performance is due to several factors, which include: the physical environment, curriculum, students' socioeconomic background and teaching methods employed by the teachers in communicating the learning experiences to the students (Onweh and Akpan, 2014). Ogwu and Oranu, (2006) emphasized that unless the teacher stimulates students' interest in learning, students' academic performance will be minimal. Hence, it is essential that technical teachers use teaching method which ensures students' active involvement in learning and provide suitable learning environment to improve academic performance. However, the rapid change in technological development makes technical and vocational education to be geared toward lifelong learning. This implies that schools should change approach toward learning to learn, creativity, problem solving skills and higher order thinking (United Nations Educational, Scientific and Cultural Organization UNESECO, 2002). In this context there is need to shift from teacher centered methods of teaching to student centered methods of teaching which include CAI. Little is known about the use of CAI packages in our education system particular at technical college level, thus it is not out of place to conduct a study on the effect of CAI in electrical installation and maintenance work.

### Statement of the Problem

Over the past seven sessions, the academic performance of electrical installation and maintenance work trade students of Government science and technical colleges in Gombe State in National Business and Technical Examinations Board (NABTEB) have shown considerable and progressive deterioration. This problem was considered serious enough until in 2015/2016 and 2016/2017 academic sessions results revealed that students' performed badly because only 31% of the registered candidate scored credits passes and above. This rate of failure is alarming and if allow to continue will lead to production of incompetent graduates and the objectives of electrical installation and maintenance work trade con not be achieved. Bakare (2009) opined that students' academic performance depends on the type of teaching methods, teaching strategies and instructional techniques adopted by the teachers during instruction. According to Nnorom (2015) conventional lecture methods of teaching discourages creativity and does not give students ability to think beyond what was taught in class room, the students in turn became indifferent to learning. Onweh and Akpan

(2014) identified the use of ineffective teaching methodologies by teachers in teaching technical subjects as a major cause of students' poor academic performance. From the above, the limitation in the traditional method of instruction was failure to lay much emphasis on work skills, such as problem solving and critical thinking habits. Hence Students' poor academic performance in NABTEB electrical installation and maintenance work trade examination in recent years in Gombe state can be attributed partly to poor instructional method. In light of the need to integrate information and communication technologies (ICTs) in to teaching and learning to provide an interactive learning environment which is student-centered, there is need to find out if adopting computer aided instruction will lead to increase in students' academic performance. Hence this study on the effects of computer aided instruction on students' academic performance in electrical installation and maintenance work trade in Government science and technical colleges in Gombe State.

### Purpose of the Study

The purpose of the study was to determine the effect of computer aided instruction on students' academic performance in electrical installation and maintenance work trade in Government Science and Technical Collages of Gombe State. Specifically the study sought to:

1. Determine the academic performance of students taught electrical wiring tools and accessories using Computer Aided Instruction and students taught using lecture method in Government Science and Technical Colleges in Gombe State.
2. Determine the academic performance of students taught earthing system using Computer Aided Instruction and students taught using lecture method in Government Science and Technical Colleges in Gombe State

### Research Question

The study was guided by the following research questions:

1. What is the academic performance of students taught electrical wiring tools and accessories using Computer Aided Instruction and students taught using lecture method in Government Science and Technical Colleges in Gombe State?
2. What is the academic performance of students taught earthing system using Computer Aided Instruction and students taught using lecture method in Government Science and Technical Colleges in Gombe State?

### Hypothesis

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

**H<sub>01</sub>:** there is no significant difference between the academic performance of students taught electrical wiring tools and accessories using Computer Aided Instruction and students taught using lecture method in Government Science and Technical Colleges in Gombe State.

**H<sub>02</sub>:** there is no significant difference between the academic performance of students taught earthing system using Computer

Aided Instruction method and students taught using lecture method in Government Science and Technical Colleges in Gombe State.

## METHODOLOGY

The study was conducted using quasi-experimental design. Specifically, the pre-test and post-test non-equivalent control group design was used. This implies that intact class (non-randomize groups) was used in the study. Quasi-experimental research design allows the use of intact classes (Creswell, 2012), the design allows the use of already existing class. The area of the study is Gombe state which is geographically located in latitude  $9^{\circ} 30'$  and  $12^{\circ} 20'$  North and longitude  $8^{\circ} 45'$  and  $11^{\circ} 45'$  East in the North-East geo-political zone of Nigeria consisting of eleven local government areas. The targeted population of this study was 270 NTC II EIMWT students of the seven Government Science and Technical Colleges that offers electrical installation and maintenance work trade in Gombe State in 2017/2018 academic session. The sample size for this study was 110 NTC II EIMWT students during the 2017/2018 academic session. Purposive sampling technique was used to select two out of the seven colleges in Gombe State which offers EIMWT in Gombe state. The reason for the selection was that these two colleges are equivalent; they have adequate computer sets, similarity in terms of school location, both are within Gombe metropolis and the two technical colleges are day and co-education colleges. Random sampling technique was used to assigned the colleges in experimental and control group. Electrical Installation and Maintenance Work trade Academic Performance Test (EIMWTAPET) was the instrument used for data collection in this study. The instrument consisted of 60 multiple choice questions which was developed by the researcher, the instrument was validated by two experts from department of electrical Technology Education in Modibbo Adama University of technology Yola and one expert from the department of Vocational and Technology Education in Abubakar Tafawa Balewa University Bauchi; and reliability index of 0.78 was obtained using Kuder Richardson's formula ( $k-R 20$ ) was obtained from the instrument. Data was collected with the help of two research assistants, SPSS was used for data analyses where mean and standard deviation was used to answer the research question while t-test was used in testing the hypotheses at 0.05 level of significance.

## RESULTS

### Research Question One

What is the academic performance of students' taught electrical wiring tools and accessories using Computer Aided Instruction and students taught using lecture method in Government Science and Technical Colleges in Gombe State?

The data presented in Table 1 below show that the experimental group taught electrical wiring tools and accessories using computer aided instruction had mean score 28.7 in the pre - test while students in the control group has a mean score of 27.4 in the pre-test. The pretest mean difference is very low. The mean score for the experimental group in post-test was 66.1 and that of the control group was 49.7. The mean difference is 16.4 which is in favour of experimental group. With this result, therefore, the answer to the research question one is that the academic performance of students in the experimental group taught electrical wiring tools and

accessories using computer aided instruction was higher in the academic performance test than the students in the control group taught using lecture method.

### Research Question Two

What is the academic performance of students' taught earthing system using Computer Aided Instruction and students taught using lecture method in Government Science and Technical Colleges in Gombe State?

Table 2 shows that the experimental group taught earthing system using computer aided instruction had a mean score of 30.6 and standard deviation of 7.5 while the students in the control group had mean score of 28.0 in pre-test. This indicated that there was small difference in pre-test. The experimental group taught using CAI had mean score of 65.4 in the post-test and the control group taught earthing system using lecture method had mean score of 50.7. This indicates that there is post-test mean difference of 14.7 which is favour of the experimental group. This result indicates that mean score of students in the experimental group is higher than the mean score of the students in the control group.

### Hypothesis One

There is no significant difference between the academic performance of students' taught electrical wiring tools and accessories using Computer Aided Instruction and students taught using lecture method in Government Science and Technical Colleges in Gombe State.

The result Table 3 below Indicated that The students in the experimental group, which were Taught Electrical Wiring Tools and Accessories Using Computer Aided Instruction had mean score (mean=66.1, S=7.4) at the end of treatment compared to the students in control group taught using lecture method had mean score of (mean= 49.7;SD= 9.1) with t-value=10.4 at 108 degree of freedom. This calculated t-value of 10.4 is statistically significant since the significant level of 0.000 is less than .05 of alpha significance level. This shows that students who were exposed to the CAI significantly performed better in their academic performance test when compared to students in the control group who were taught using lecture method. The null hypothesis stating there is no significant difference between the academic performance of students' taught electrical wiring tools and accessories using Computer Aided Instruction and students taught using lecture method in Government Science and Technical Colleges in Gombe State is rejected. The result shows that the Computer-Assisted Instruction is better at improving students' academic performance.

### Hypothesis Two

There is no significant difference between the academic performance of students taught earthing system using Computer Aided Instruction method and students taught using lecture method in Government Science and Technical Colleges in Gombe State.

The data presented in Table 4 summarized the outcome of the t-test analysis on the differences between Academic Performance of Students Taught Earthing System Using Computer Aided Instruction and Students Taught Using Lecture Method. It compared the Post-test mean scores obtained by the CAI group and the lecture method group.

**Table 1: Mean And Standard Deviation of Students' Scores Taught Electrical Wiring Tools and Accessories Using Computer Aided Instruction and students taught using lecture method**

Groups	N	Pre- test		Post-test		Post-test Mean difference
		X	S	X	S	
Experimental	54	28.7	10.3	66.1	7.4	16.4
Control	56	27.4	9.6	49.7	9.1	

$n$ =Sample size of individual group, X=mean, S=standard deviation

**Table 2: Mean and Standard Deviation of Students' Scores Taught Earthing System Using Computer Aided Instruction and students Taught Using Lecture Method**

Groups	N	Pre- test		Post-test		Post-test Mean difference
		X	S	X	S	
Experimental	54	30.6	7.5	65.4	8.7	14.7
Control	56	28.0	8.3	50.7	7.5	

$n$ =Sample size of individual group, X=mean, S=standard deviation

**Table 3: t-Test of Difference between Academic Performance of Students Taught Electrical Wiring Tools and Accessories Using Computer Aided Instruction and Students Taught Using Lecture Method**

Groups	n	X	S	t-value	df	Sig.	Remark
experimental	54	66.1	7.4	10.4	108	.000	significant
Control	56	49.7	9.1				

\* Significant  $p \leq 0.05$   $n$ =Sample size of individual group, X=mean, S=standard deviation

**Table 4: t-Test of Difference between Academic Performance of Students Taught Earthing System Using Computer Aided Instruction and Students Taught Using Lecture Method**

Groups	N	X	S	t-value	Df	Sig.	Remark
experimental	54	65.4	8.7	9.5	108	.000	Significant
Control	56	50.7	7.5				

\* Significant  $p \leq 0.05$   $N$ =Sample size of individual group, X=mean, S=standard deviation

The data shows that a calculated t-value of 9.5 resulted in statistically significant difference between the academic performance of students in the experimental group and the students in the control group. This calculated t-value of 9.5 is statistically significant since, the significant level of 0.000 is less than the alpha significant level of .05, at 108 degrees of freedom. Hence, the null hypothesis stating there is no significant difference between the academic performance of students taught earthing system using Computer Aided Instruction method and students taught using lecture method in Government Science and Technical Colleges in Gombe State was rejected.

## Findings

The following findings emerged from the data collected, analyzed and hypothesis tested:

1. Students taught electrical wiring tools and accessories using computer aided instruction had a higher mean score in post-test than those students taught using the lecture method in the academic performance test.
2. The study revealed that students taught earthing system using computer aided instruction had a higher mean score than students taught lecture method in the academic performance test.
3. There was significant difference between the academic performance of students' taught electrical wiring tools and accessories using Computer Aided Instruction and students taught using lecture method in Government Science and Technical Colleges in Gombe State.

4. The study revealed that there was significant difference between the academic performance of students taught earthing system using Computer Aided Instruction method and students taught using lecture method in Government Science and Technical Colleges in Gombe State.

## Discussion of the Findings

The data presented in Table 1 provide answer to research question one. The findings revealed that students taught electrical wiring tools and accessories using computer aided instruction had higher mean score in post-test than those students taught using lecture method in the academic performance test. The implication of this finding is that computer aided instruction is effective in enhancing students' academic performance. This finding is in agreement with Igweh (2012) who state that computer tutorial and drill was found to be more effective than conventional teaching method in enhancing students' achievement in basic electricity. This finding also is in line with findings of Samaila, Makinde and Zambwa (2016) who pointed out that students' in the experimental group who were taught electrical and electronics devices using CAI have higher mean score than students taught electrical and electronics devices using lecture method. This is an indication that the treatment has positive effect on students' academic performance. The finding also agrees with Robinson (2017) who found out that students taught basic electricity using CAI in technical colleges performed better than those students taught using conventional method. Likewise Chado and Okwori (2015) in their study on the effect of computer assisted instructional package for teaching metal work technology at Nigeria certificate in

education (Tech) level agreed with this finding where it was discovered that students taught metal work technology using CAI performed better than those taught with lecture method. The implication of this finding therefore is that computer aided instruction is more effective than conventional teaching methods in enhancing students' academic performance in electrical wiring tools and accessories. The data presented in Table 2 provide answer to research question two. Findings revealed that students taught earthing system using computer aided instruction had higher mean score in post-test than students taught using lecture method. This finding concur with Cyrill (2014) who discovered that students taught using CAI performed better in post-test than those taught using demonstration method. Cyrill further stress that computer aided instruction provide students with exercises that reinforces learning and the interactive nature of computer aided instruction greatly improves students' academic performance. The finding is also similar to that of Igweh (2012) who pointed out that the use of computer tutorial and drill in teaching students Basic Electronics produces post-test achievement effect which is superior to those taught using lecture method. The finding is also in line with Robinson (2017) who gives clear indication that students taught basic electricity using CAI had performed better in post-test than their colleagues who were taught conventionally. This is an indication that computer aided instruction had greatly affected students academic performance in post-test. Similarly Chado and Okwori (2015), Samaila, Makinde and Zambwa (2016), Ahiatrogoh, Madjoub and Bervell (2013) in their different studies revealed that students taught using computer aided instruction had higher mean score in post-test than those taught with conventional teaching methods. This is an indication that computer aided instruction has positive effect on students' academic performance.

Finding with respect to hypothesis one indicated the null hypothesis was rejected. This means that there was significant difference between the academic performance of students taught electrical wiring tools and accessories using computer aided instruction and students taught using lecture method. This finding led to the conclusion that students who were taught using computer aided instruction performed better than those taught using lecture method. This finding is similar to the finding of Igweh (2012), Samaila, Makinde and Zambwa (2016) and Cyrill (2014) in their individual studies found that there was significant difference between the mean score of students taught using CAI and those students taught using conventional lecture method. The finding of Robinson (2017) also agrees with the finding of this study which revealed that there was significant difference between experimental group (taught using CAI) and the control group (taught using conventional method) in their post-test mean performance scores. This invariably means that students taught using CAI performed significantly better than students taught with conventional teaching method. The result shows that the treatment given to the experimental group had a positive effect on them as it shown by the higher mean score. This might be due to change in mode of instruction that is from teacher-centred (i.e. lecture method) to student-centred (i.e. computer-assisted instruction). The finding with respect to hypothesis two, the t-test analysis revealed that there was significant difference between the academic performance of students taught earthing system using computer aided instruction and students taught using lecture method. This finding is supported by the finding of Ahiatrogoh, Madjoub and Bervell (2013) who found that there was statistically significant difference between the academic achievement of students taught

using CAI and those taught using traditional method of teaching. This finding is inconsistent with Abdullahi (2014) who revealed there was no significant difference between the mean score of students taught Basic technology with CAI and those taught with conventional teaching method. The finding is in line with Ashilokum (2006) who found that there was significant difference in mean score of students taught technical drawing using computer AutoCAD software assisted instruction and those taught with conventional method.

## Conclusion

It was concluded that the study provided strong evidence on the effectiveness of computer aided instruction in teaching and learning and consequently improved students' academic performance. This study used Computer-Aided instruction (CAI) for teaching electrical wiring tools & accessories, and earthing system. It was established that students taught using CAI performed better than the students taught using lecture method.

## Recommendations

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

1. Ministry of education in Gombe state, Nigeria should give more attention to computer literacy and operation in the technical colleges and relevant computer assisted instructional packages should be developed for use within the Gombe state.
2. Technical teachers teaching EIMWT in Gombe state should adopt the use of computer aided instruction to complement other methods used in teaching.
3. Gombe state ministry of education should collaborate with federal government agencies such as NITDA to provide well equipped computer laboratories in Government science and technical colleges in Gombe state, and encourage teachers to use such facilities in teaching and learning.
4. Curriculum planners such as Nigeria Educational research and development Council and National Board for Technical Education should consider review of curriculum for EIMWT with view of incorporating Computer aided instruction as a teaching method in curriculum implementation and also develop CAI packages for technical subjects.

## REFERENCES

- Abdullahi, A. Y. 2014. *Effect of computer assisted instruction on performance of secondary school students in Basic technology in Sokoto state, Nigeria*.unpublished M.ed Thesis: Depatment of Educational foundation and curriculum, Ahmadu Bello university Zaria, Nigeria.
- Ahiatrogoh, P. D., Madjoub, M. B. and Bervell, B. 2013. Effect of computer assisted instruction on the achievement of basic school students in pre-technical skills. *Academic journal of interdisciplinary studies.*, 2(1), 77-86. doi:10.5901/ajis/2013.v2n.p77
- Asilokun, B. A. 2006. Effect of computer AutoCAD software assisted instruction on the performance of secondary school students in Technical drawing. *Technology education Journal*, 6(1), 175-183.
- Atadogo, M. M., Mari, J. S. and Danjuma, A. B. 2016. Effects of computer assisted instruction on academic achievement of NCE

- physics students in Niger state, Nigeria. *science publication*, 8(6). doi:10.7537/marsoj08011606
- Bakare, A. 2009. *Effect of two teaching methods on academic achievement and attitude of students in technology*. Unpublished ph.D thesis: Department of science education UNN.
- Bell, M. J. 2012. *Definition of academic achievement*. Retrieved from <http://www.ehow.com/fact7468202.html>
- Chado, M. I. and Okwori, O. R. 2015. Effects of computer assisted instructional package for teaching Metal work Technology at Nigeria certificate in education (technical) level. *International journal of academic research in progressive education and developmnet*, 4(1). Retrieved from <http://dx-doi.org/10.6007/IJRPED/v4-i1/1454>
- Creswell, J. W. 2012. *Educational research: planning, conducting and evaluating qualitative and quantitative research* (4th ed.. Boston: Pearson education Inc.
- Cyril, M. U. 2016. Effects of computer assisted instruction and demonstration method of teaching Automobile technology in Federal colleges of education (technical) in North-Eastern Nigeria. *International journal of science and research*, 5(3), 1325-1329. Retrieved from [www.ijer.net](http://www.ijer.net)
- Federal Republic of Nigeria.(2004. *Natioanalplicity on education*. Lagos: NERDC press.
- Fletcher, I. 1990. *Instructional technology and material development*. London: Nobe publication and distribution.
- Igbo, C. A. 1997. Development and evaluating task instructional sheet for teaching clothi  
ng construction skills in senior secondary schools. *Nigeria Vocational journal*, 6(1), 6-7
- Igweh, A. U. 2012. *Combined effect of computer tutorial and drill on senior secondary school students' achievement, interest, and retention in basic electronics in Lagos state*. Unpublished Ph.D Thesis University of Nigeria Nsukka.
- Imhanlahimi, O. E. and Imhanlahimi, R. E. 2008. An evaluation of effectiveness of computer assisted learning and expository method of teaching Biology: A case study of Lumen Christi international high school, Uromi Nigeria. *Journal of social science*, 16(3), 215-220.
- Ismail, K., Muhsin, T. G. and Murat, K. 2012. The computer assisted instruction and its effects on academic success of students in lightning technique and indoor installation project course. *international journal of advance engineering and technology*, 2(1). Retrieved from [www.e-ijaet.org/media/716-IJEAT0612653.pdf](http://www.e-ijaet.org/media/716-IJEAT0612653.pdf)
- Kanter, H. 2012. *What is measurement of academic performance*. Retrieved from <http://www.ehow.com/fact7468202.html>
- Kulik, J. A., Kulik, C. C. and Banger-drowns, R. L. 1985. Effectiveness of computer based education in elementary schools. *Computer in human behaviour*, 1(1), 57-74.
- National Board for Technical Education. 2003. *Electrical installation and maintenance work curriculum and course specifications*. Kaduna: NBTE publication.
- Nnorom, N. R. 2015. Effect of cooperative learning instructional strategy on senior secondary school students' achivement in Biology in Anambara state. *International journal for cross-disciplinary subjects in education special issue*, 5(1), 2424-2438. Retrieved from [informatic-society.org/.../Effectof-](http://informatic-society.org/.../Effectof-)
- Odu, O. K. 2001). *Developing and validation of an instrument for assessing students' psychomotor performance in Blocklaying and concreting*. Unpublished Ph.D Thesis University of Nigeria Nsukka.
- Ogwo, B. A. and Oranu, R. N. 2006). *Methodology in informal and nonformal technical/vocational education*. Nsukka: University of Nigeria press Ltd.
- Onweh, V. E. and Akpan, U. T. 2014. Instructional strategy and students' academic performance in electrical installation in technical colleges in Akwa Ibom state: instructional skills for structuring appropriate learning experiences for students. *International journal of educational administration and policy studies*, 6(5), 80-86. doi:10.5897/IJEAPS2014.0347
- Robinson, R. N. 2017. Effectiveness of computer aided instructions (CAI) on students' performance in basic electricity in technical colleges in rivers state of nigeria. *International Journal of Research-Grenthaalayah*, 5(11), 14-21. Retrieved from <http://doi.org/10.5281/zenodo.1065704>
- Samiala, Y., Makinde, A. A. and Zambwa, J. 2016. Development of computer assisted instruction for effective teaching of electrical/electronics devices at Nigeria certificate in education (Technical) in Norht-Eastern Nigeria. *International journal of vocational and technology education research.*, 12(1). Retrieved from [www.eajournals.org](http://www.eajournals.org)
- United Nations Education Scientific and Cultural Organization.(2002. *Information and communication technology in teacher education*. R. matco 2006. Retrieved from <http://www.unesco.org/images/0012/001295/12955333epdf>

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