EFFECT OF TPS-SIMULATOR ON STUDENTS' ACADEMIC ACHIEVEMENT IN AUTOMOTIVE LIGHTNING AND SIGNALING SYSTEM IN TERTIARY INSTITUTIONS OF NORTH-EAST NIGERIA

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Abstract

The study examined the effect of TPS-Simulator on students' academic achievement in Automotive Lightning and Signaling System in Tertiary Institutions of North-East, Nigeria. One research question and three null hypotheses guided the study. A quasi-experimental design was adopted for the study. An intact class setting of 9 Automobile Technology Education students at 300 level was taught using TPS-Simulation, while 10 students in the control group were taught using the conventional teaching method. Automotive Lightning and Signaling System Achievement Test (ALASSAT) was used. Data collected were analyzed using mean, standard deviation and t-test. The findings revealed that students taught Automotive Lightning and Signaling System using TPS-Simulation had significantly higher academic achievement than those taught using conventional teaching method. Based on the findings, the study concluded that the TPS-Simulator has a large effect on students' achievement in Automotive Lightning and Signaling System. It was recommended that lecturers should be encouraged to adopt frequent usage of TPS-Simulator. Hence this will enable them improve the academic achievement of Automobile Technology Education students.

Keywords: TPS-Simulator, Automotive Lightning and Signaling System, Automobile Technology Education

Introduction

Technical Vocational Education and Training (TVET) serves as the foundation upon which the development of any nation originates. There has been increasing awareness of the critical role of TVET as one of the most effective human resources strategies that a nation needs to embrace in order to support sustainable economic development (Enemali, 2016). Technical Vocational Education and Training could be termed as that aspect of education which provides the recipients with the basic knowledge and practical skills necessary for entry into the world of work as employees or as self-employed (Audu, Kamin, Musta'amal, & Saud, 2014). This is also indicating that, with the current situation of rampant unemployment among our youth TVET may be the solution. Nigerian government in its effort to improve the quality of teaching and learning in TVET tertiary institutions of the country provides series of simulators, demonstrators and workshop equipment that were distributed to over three hundred and fifty tertiary institutions across the country of which Toyota Product System (TPS) simulator was among (Federal Government of Nigeria, 2015).This equipment is meant for improving teaching and learning and to keep the students abreast with the contemporary challenges in the area.

Automobile Technology Education (ATE) is one of the TVET courses that enable the students to test, diagnose, service and repair any fault relating to conventional motor vehicle main assembly units and systems to the manufacturers specification (Inti, Abdul Latib, & Audu, 2014). Auto-electrical and engine management system is an aspect of automobile technology that deals with electrical components of a car while Automotive Lightning and Signaling System (ALASS) is a unit of a course (Auto-electrical and Engine Management System). ALASS exposes the students to the basics of auto-electricity, test, diagnose and repair electrical components.

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ATE is studied by TVET students at Nigeria Certificate in Education (NCE) and at bachelor of technology (B. Tech.) levels in Tertiary Institutions (TIs) across the country (F.G.N., 2012).

Ademola (2014) emphasized that the teaching methods employed by automobile technology education teachers are teacher centered in nature and with little emphasis on practical skills even when teaching topics that need other teaching methods. Hence, for effective teaching and learning to take place teachers need to adopt various teaching methods that ensemble the content to be taught (Ezeudu & Ezenwanne, 2013). More so, according to Ugwu (2016) teacher must be able to deliver skills which match new technologies and practices, and deliver skills to the current and future work force at consistent level of quality needed in the potential workplace. Conventional method of teaching does not help students develop important skills, creativity, problem solving and all other skills that will make them knowledgeable and self-employed (Ahmad, Nordin, Ali, & Nabil, 2015; Shehu, Inti, Ibrahim, Adamu, Salihu & Adamu, 2016). In the same vein, Cyril (2016); Arolowo, Abdulmalik, and Hosea (2016) emphasized that conventional method of teaching may not yield what is expected in terms of achievement and or performance from the learners when used in teaching some aspects of Automobile Technology Education like auto-electricity.

In the words of Glover (2014) simulation refers to the imitation of real-world activities and processes in a safe environment. Simulations aim to provide an experience as close to the 'real thing' as possible; however, a simulated activity has the advantage of allowing learners to 'reset' the scenario and try alternative strategies and approaches. According to Farooq (2013) the word simulation means to emulate closely, and he emphasized that simulated teaching is a teaching method which develops the ability in individual regarding problem solving behavior or a role playing strongly in which learner performs the role in an artificially created environment.

As one of the teaching methods that facilitate in teaching skills oriented courses like automobile technology, simulation played overriding important roles as found by so many researchers. The use of simulation is a good technique that replicates complex real life situations which facilitate teaching. Also, simulation provides active participation and manipulation of materials which make the lesson more meaningful and lively to the students (Ezeudu & Ezenwanne, 2013). More so, Ajai (2013) stressed that teachers should engage in using simulation where necessary and where the resources are available. In the same vein, Akinsola and Animasahun (2007) mentioned that students' poor performance in some courses is connected to the use of improper method of teaching which make some of the concepts difficult for the students to understand and comprehend. Furthermore, Poripo (2008) and Elangovan and Ismail (2013) posited that teaching with simulations may bring positive impact on learners' knowledge and understanding of a given topic.

Regardless of the advantages of using simulation in teaching practical oriented courses and their availability in some of the Nigerian tertiary institutions the researcher has not lay his hands on any empirical study conducted in order to determine the effects of these simulators on students' achievement. In view of this, the researcher proposes to determine the effect of TPS-simulator on students' academic achievement on automotive lightning and signaling system in tertiary institutions in north-east Nigeria.

Statement of the Problem

Conventional method of teaching being predominantly used in teaching Automobile Technology Education is based on the behavioral learning theories. The method placed emphasis on knowledge transmission from the teacher to passive students and promotes rote memorization of facts (Cyril, 2016). The consequence of this is that the students are unable to retain their learning and apply it to new situations. This is in line with the opinion of Inti, Abdul latif and Audu (2014) who stated that Automobile Technology Education graduates could not display required skills after graduation. According to Shehu, Birniwa, Audu, Eric, Jibrin, & Abubakar,

(2016) there is need to deliberately domesticate the technological skills in Automobile Technology Education through the utilization of modern tools and equipment and by using appropriate teaching methods when teaching the course. These challenges necessitate a shift from conventional method of teaching to those rooted in constructivism approach to teaching, of which teaching with TPS-Simulor is among.

Purpose of the Study

The purpose of the study is to determine the effect of TPS-simulator on students' academic achievement in automotive lightning and signaling system in tertiary institutions of north-east Nigeria.

Research Question

What is the effect of TPS-simulator on students' academic achievement in automotive lightning and signaling system in tertiary institutions of North-East Nigeria?

Research Hypotheses

Ho$_1$: There is no significant difference between the pretest mean scores of students taught Automotive Lightning and Signaling System using TPS-Simulator and those taught using conventional teaching method in Tertiary Institutions of North-East, Nigeria.

Ho$_2$: There is no significant difference between the pretest and the posttest mean scores of students taught Automotive Lightning and Signaling System using TPS-Simulator in Tertiary Institutions of North-East, Nigeria.

Ho$_3$: There is no significant difference between the posttest mean scores of students taught Automotive Lightning and Signaling System using TPS-Simulator and those taught using conventional teaching method in Tertiary institutions of North-East, Nigeria.

Methodology

Quasi experimental design was employed for the study; specifically pretest-posttest. The area of the study was North-East Nigeria, comprising of: Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe States. The population of the study consists of 209 Automobile Technology Education students in degree awarding tertiary institutions. A simple random sampling technique was used in selecting the two tertiary institutions; that is the experimental and control. Two intact classes of which nineteen (19) 300 level students were used as samples. Automotive Lightning and Signaling System Achievement Test (ALASSAT) adapted from training manual of Autotronic Demonstrator System was used as instrument for data collection. The instrument was subjected to face and content validation by two experts in the field of Automobile Technology Education. ALASSAT was administered to the students during pretest to both groups in order to determine the entry behavior of the students, and posttest was later administered for both experimental and control groups to determine the effect of the treatment.

During the treatment, experimental group was taught Automotive Lightning and Signaling System using TPS-Simulator (as the treatment) for five weeks, while the control group was taught using conventional teaching method by the research assistant for the same period of time. Paired sample and independent sample t-test were used to test the hypotheses. These hypotheses were run using SPSS software package version 21 analysis tool at 0.05 level of significance. The effect size of the final result from the posttest means comparison was determined using **η^2 (eta squared)** based on Cohen (1992) effect size index bench mark. The effect size index has a range value of .20 as small, .50 as medium and .80 as large. The effect sizes are vital because they allow researchers to compare the magnitude of experimental mean treatments from one experiment to another (Thalheimer & Cook, 2002).

Results

Table 1: The Effect of TPS-Simulator on Students' Academic Achievement in Automotive Lightning and Signaling in Tertiary Institutions of North-Eastern Nigeria

Group	N	Mean	S.D.	t	η^2 (eta squared)	Effect Size	Decision
Experimental	9	24.44	2.698		0.94		Large
				6.44	(94%)	Large	Effect
Control	10	18.00	2.00				

Table 1 shows the effect of TPS-simulator on students' academic achievement in automotive lightning and signaling system. The result from the table shows Experimental Group having a mean of 24.44 and an S.D. = 2.698) while the Control Group having a mean of 18.00 and a S.D of 2.00. The result shows a large effect size of 0.94 obtained using η^2 (eta squared) which is equivalent to 94%. Hence, the effect of TPS-simulator on students' academic achievement in Automotive Lightning and Signaling System in tertiary institutions of North-East, Nigeria is large.

Table 2: Test of Difference Between the Pretest Mean Scores of Students taught Automotive Lightning and Signaling System Using TPS-Simulator and Those Taught Using Conventional Teaching Method

Group	N	Mean	S.D.	t	df	α	*P*	Decision
Experimental	9	16.89	2.261					
				.493	17	0.05	.629	Ho_1 Accepted
Control	10	16.40	2.066					

Table 2 shows the independent samples t-test that was conducted to compare the pre-test mean scores of students taught Automotive Lightning and Signaling System using TPS-Simulator and those taught using conventional teaching method. The result from the table shows that there was no significant difference between the mean scores of the Experimental Group (mean = 16.89 and S.D. = 2.261) and the Control Group (mean = 16.40 and S.D. = 2.066) and *P*= 0.629. The *P* value is greater than the alpha value of 0.05 that is *P* > 0.05. The null hypothesis which states that there is no significant difference between the pretest mean scores of students taught Automotive Lightning and Signaling System using TPS-Simulator and those taught using conventional teaching method in Tertiary Institutions of North-East, Nigeria was accepted.

Table 3: Test of difference between the pretest and the posttest mean scores of students taught Automotive Lightning and Signaling System using TPS-Simulator in Tertiary Institutions of North-East, Nigeria.

Group	Test	N	Mean	S.D.	t	df	α	*P*	Decision
	Pretest	9	16.89	2.261					
Experimental					12.068	8	0.05	.000	Ho_2 Rejected
	Posttest	9	24.44	2.698					

Table 3 shows the paired samples t-test that was conducted to compare the pretest and the posttest mean scores of students of the experimental group. The result from the table shows that there was a significant difference between the mean scores of students in the posttest (mean = 24.44 and S.D. = 2.698) and the pretest (mean = 16.89 and S.D = 2.261) and *P*= 0.000. The *P*-value is far less than the alpha value of 0.05 that is *P* < 0.05. Therefore, the null hypothesis which states that there is no significant difference between the pretest and

the posttest mean scores of students taught Automotive Lightning and Signaling System

using TPS-Simulator in Tertiary Institutions of North-East, Nigeria was rejected.

Table 4: Test of difference between the posttest mean scores of students taught Automotive Lightning and Signaling System using TPS-Simulator and those taught using conventional teaching method in Tertiary institutions of North-East, Nigeria.

Group	Test	N	Mean	S.D.	t	Df	α	P	Decision
Experimental	Posttest	9	24.44	2.698					
					5.958	17	0.05	.000	Ho_3Rejected
Control	Posttest	10	18.00	2.000					

Table 4 shows the independent samples t-test that was conducted to compare the posttest mean scores of students taught Automotive Lightning and Signaling System using TPS-Simulator and those taught using conventional teaching method. The result from the table shows that there was a significant difference between the mean scores of the Experimental Group (mean = 24.44 and S.D. = 2.698) and the Control Group (mean = 18.00 and S.D = 2.000) and P= 0.000. The P-value is far less than the alpha value of 0.05 that is $P < 0.05$. The null hypothesis which states that there is no significant difference between the posttest mean scores of students taught Automotive Lightning and Signaling System using TPS-Simulator and those taught using conventional teaching method in Tertiary Institutions of North-East, Nigeria was rejected.

Findings
1. There was a large effect of TPS-Simulator on Students' academic Achievement in Automotive Lightning and Signaling in Tertiary Institutions of North-East, Nigeria.
2. There was no significant difference between the pretest mean scores of students taught Automotive Lightning and Signaling using TPS-Simulator and those taught using conventional teaching method in Tertiary Institutions of North-East, Nigeria.
3. There was a significant difference between the pretest and the posttest mean scores of students taught Automotive Lightning and Signaling using TPS-Simulator in Tertiary Institutions of North-East, Nigeria.
4. There was a significant difference between the posttest mean scores of students taught

Automotive Lightning and Signaling using TPS-Simulator and those taught using conventional teaching method in Tertiary Institutions of North-East, Nigeria.

Discussion of Findings
The finding of this study reveals that the academic achievement of students taught Automotive Lightning and Signaling System using TPS-Simulator and those taught using conventional teaching method during pretest was almost the same. This indicated that both the groups have equal entry behavior before the application of the treatment. This finding agreed with the position of Akinsola and Animasahun (2007); Bayrak (2008); Ezeudu and Ezenwanne (2013); Tyav (2014) in their separate studies found no difference between the achievement of students in the experimental and control groups in the pretest which implies that both groups were at the same entry behavior before the treatment was applied.

The finding also shows that there was a significant difference between the pretest and the posttest mean scores of students taught Automotive Lightning and Signaling System using TPS-Simulator in Tertiary Institutions of North-East, Nigeria. That is, the posttest mean score of students taught Automotive Lightning and Signaling System using TPS-Simulator was significantly higher than the pretest mean score of students after the treatment. This noticeably implies that the difference was as a result of the treatment. This finding confirms with that of Akinsola and Animasahun (2007); Poripo (2008); Bayrak (2008); Elangovan and Ismail (2013); Ezeudu and Ezenwanne (2013); Cyril (2013) and Cyril (2016) who stated that students in the experimental group had higher

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academic achievement in posttest. This is an indication that using an appropriate teaching aid/method could enhance meaningful learning in Automotive Lightning and Signaling System. This implies that teaching using simulators can be adopted as a method for effective teaching of Automobile Technology Education courses.

The finding also reveals that there was a significant difference between the posttest mean scores of students taught Automotive Lightning and Signaling System using TPS-Simulator and those taught using conventional teaching method in Tertiary Institutions of North-Eastern Nigeria. That is, the posttest mean score of students taught Automotive Lightning and Signaling System using TPS-Simulator was significantly higher than the mean score of students taught Automotive Lightning and Signaling System using conventional teaching method. This implies that the achievement scores of students in the experimental group outweigh that of the control group after the application of the treatment. This finding is in agreement with that of Bayrak (2008); Adebayo and Jimoh (2015); Taher and Khan (2015); Ezeudu and Ezenwanne (2013); and Constance (2013) who all found that there was a significance between the posttest mean academic achievement scores in the experimental and the control group. This signifies that using TPS-Simulator greatly help in improving the academic achievement scores of students in Automotive Lightning and Signaling System far more than the conventional teaching method.

Conclusion

The findings of the study reveal that TPS-Simulator has an effect on students' academic achievement in Automotive Lightning and Signaling System in Tertiary Institutions. The TPS-simulation provides active participation and manipulation of materials which make the lesson more meaningful and lively to the students. Therefore, TPS-Simulator serve as alternative to conventional method of teaching in Automotive Lightning and Signaling System in Tertiary Institutions.

Recommendations

Based on the findings of this study, the following recommendations have been proffered:
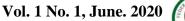
1. TPS-Simulators should be made available in other to give room for their utilization in teaching Automotive Lightning and Signaling System.
2. Lecturers of Automobile Technology Education in tertiary institutions should adopt TPS-Simulators in teaching Automotive Lightning and Signaling System.
3. Necessary facilities for teaching Automobile Technology Education should be put in place for effective utilization of TPS-Simulators in teaching Automotive Lightning and Signaling System.
4. Regular training in form of workshop and seminars should be organized to enhance lecturers' skills in using the simulators.

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