EFFECT OF FLIPPED LEARNING INSTRUCTIONAL STRATEGIES ON STUDENTS' ACHIEVEMENT AND INTEREST IN ELECTRICAL/ELECTRONIC FOR SELF-EMPLOYMENT

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Abstract

The study adopted quasi-experimental design. The study was carried out in technical colleges in Niger State. The population of the study consists of seven technical colleges in Niger State. The sample of study was two hundred and forty seven (247) TC II, Electrical/Electronic students in technical colleges in Niger State. Electrical/Electronic Achievement Test (EAT) and Electrical/Electronic Interest Scale (EIS) were used as the instrument. The two instruments were validated by three experts from the Department of Industrial and Technology Education, Federal University of Technology, Minna. Pearson Product Moment Correlation Coefficient was used to compute results of the trial testing after test re-test instrument administration and the results indicated positive correlation coefficients of 0.85 and 0.88 for EAT and EIS respectively. The researcher administered the instrument with the help of two research assistants. Data for the study were collected through pre-test and posttest using the Electrical/Electronic Achievement Test (EAT) and the Electrical/Electronic Interest Scale (EIS). Data collected were analyzed using Mean and Standard Deviation to answer the two research questions while Analysis of Co-variance (ANCOVA) was used to test the two null hypotheses at 0.05 level of significance. From the findings, the study revealed that flipped learning instructional strategies enhances students' achievement in Electrical/Electronic in technical schools more than the lecture method. The finding also revealed that flipped learning instructional strategies promotes students' interest in Electrical/Electronic in technical schools more than the lecture method among others. The study therefore concluded that students' poor achievement and interest in Electrical/Electronic informed the need for the study on the effect of flipped learning instructional strategies on students' achievement and interest in Electrical/Electronic in Technical Colleges in Niger state.

Keywords: Flipped learning instruction, students, Electrical/Electronic, achievement, interest

INTRODUCTION

Technical colleges are specialized institutions of learning where learners acquire knowledge, skills and attitudes necessary for the world of work. Technical college's according to Umar *et al.* (2020) are integral part of the total educational system in Nigeria that contributes towards the development of good citizenship by developing the physical, social, civic, cultural and economic competencies of the individual. The goals of technical colleges, as stated by Federal Republic of Nigeria, FRN, (2013) are to provide trained manpower in the applied sciences, technology and business, particularly at craft, advanced craft and technician levels; provide the technical knowledge and vocational skills necessary for agricultural, commercial and economic development; and give training and impart the requisite skills to individuals who shall be self-reliant economically. According to Kudu and Beji (2018) graduates of technical colleges are expected to undertake various educational courses that will enable them to be enterprising and self-reliant such as Electrical/Electronic education.

Electrical and electronics is one of the major options or special areas offered in Nigerian polytechnics under the department of technology and vocational education. However, the teaching and learning of electrical/electronic specialized area as a field of study in technology education is vital in the production of workforce with potent understanding and diverse skills in the design, development, production, management and utilization of current electrical and electronics devices and circuits.

According to Caribbean (2021), Electrical and electronic is a field of study that provides both theoretical and hands-on knowledge of current electrical and electronics devices and circuits. Hence, Electrical and Electronics Technology (EET) education syllabus is designed to provide the essential fundamental knowledge and the analytical, practical and experimental skills necessary for a lifelong career in the field of electrical and electronics technology. It also provides students with fundamental knowledge and skills for the workplace and professional teaching skills in electrical and electronics field. For effective teaching and learning of electrical and electronics technology education, instructional materials and facilities are necessary. Instructional materials and facilities on their own help to facilitate teaching and learning and are used to influence concrete and permanent change in technical behaviour. According to Eya (2014) instructional materials are all forms of information carriers which can be used to record, store, preserve, transmit, concretize or retrieve information for the purpose of teaching and learning. Flipped learning is an emerging and instructional learning strategy used to assist students' in obtaining the thinking skills needed for 21st century learning and career development with a strong emphasis on problem solving.

Pusca & Northwood (2018) stated that flipped learning was used as a human-centered, open-ended problem-based approach to transform the way teaching and learning is conducted in education, and to solve the different challenges that instructors and students are facing in the context of digital learning and of outcome-based curriculum. Flipped learning has been proven to be useful in tackling complex problems that are ill-defined or unknown (Fabiano, *et al.* 2021).

Bergman and Sams (2012) view flipped learning as a teaching strategy whereby students work on assigned activities outside the classroom and the class time is devoted to building their knowledge base. In this type of instruction, students are empowered to take charge of their own learning, at their own pace. Educators who use flipped classroom instruction no longer bear the sole responsibility of imparting knowledge, rather students' active participation in the learning process and the classroom session becomes centre for effective interaction between teachers and students. The flipped learning instruction is one of the approaches through which teachers introduce technology to students in a learning environment thereby encouraging self-directed learning. The Federal Republic of Nigeria (FRN) 2013 in the National Policy on Education (NPE) agreed that teaching has to be practical, activity-based, experimental and ICT supportive. Students may be instructed to study some new materials in the internet for the next class instruction, review teacher-created video content outside the classroom or read a section of a textbook. The class time is used for more engaging, interactive activities facilitated by the teacher. In this instance, students are encouraged to take charge of their own learning. The flipped classroom instruction changes the environment of initial introduction of new topic to an interactive class where every student is capable of contributing to the topic. It incorporates formative and diagnostic evaluations, as well as promotes meaningful face-to-face learning activities (Cereja, *et al.*, 2018).The FRN also emphasized that teaching has to be participatory, exploratory, and child centred. In relation to this view Ausubel (2018) pointed out that learning occurs best when students interact in the classroom. This promotes interest, retention and participation in the subject studied.

Furthermore, a study conducted by Shé *et al.*, (2021) on the application of flipped learning flexible methodology, emphasized the importance of students' empathy. The findings of the study suggested that instructional designers can use the flipped learning process to achieve empathy with their students, ensuring that they are fully engaged and achieve the course's learning objectives. Cereja, *et al.*, (2018), stated that flipped learning is popular with a 5-step process that is very similar to Simon's 8-step process. (1). Empathize, the ability to

understand the needs of others. (2). Define- In a person-centered manner, adjust and define the issue. (3). Ideate - During the imagination session, come up with a lot of different ideas. (4). Prototype - Using a functional prototyping approach to the prototyping method. (5). Test: Create a unique prototype / solution to the problem. Another study carried out by Pande and Bharathi, (2020), explains how to recognize the tenets of constructivist learning theory (constructivist principles) within the teaching-learning of the flipped learning process. With the implementation of flipped learning learning might improve student academic achievement.

Student Academic achievement has to do with the successful accomplishment of goals, measured by the extent to which instructional objectives are achieved. According to Eze and Osuyi, (2018), academic achievement is a measure of the degree of success in performing specific tasks in a subject area or area of study by students after a learning experience. Whereas Ahmad and Ombuguhim, (2020) defined achievement as the scholastic standing of a student at a given moment in learning both theoretical and practical skills in Electrical/Electronic therefore, is essential to students' progress in the changing world of technology. In this regard, effective instructional approach must be developed to improve skills achievement and to maintain acquired skills at a functional level over a period of time. With adoption of flipped learning learning strategies, students' interest might increase. When students' interests are piqued, their performance improves.

Student interest according to Duru *et al.* (2021) is defined as a content-specific, person-object relationship that emerges from an individual's interaction with the environment. According to the authors, interest is an important variable in the school context, as it can influence students' level of participation in learning, Self-efficacy of their learning experience as well as their level of performance. The study therefore poised to find out the effect of flipped learning instructional strategies on students' achievement and interest in Electrical/Electronic for self-employment.

Statement of the Problem

The National Business and Technical Examination Board (NABTEB) reports show the persistent records of the students' low performance in Electrical/Electronic and this has been attributed to teachers' inappropriate pedagogical approaches. Study Mbonyiryivuze, *et al.* (2019) had shown that students' poor academic achievement is as a result of teaching methods employed by teachers. Similarly, Researchers such as Duhu and Ibanga, (2020) and Lawal *et al.,* (2020) also identified several factors responsible for students' poor performance in subjects such as Electrical/Electronic to be specific, and they classified these factors as

students-related factors, teacher related factors, society-related factors and government–related factors. Among other things that form the teacher-related factors is the teaching methods adopted by teacher like conventional teaching method. These learning methods adopted by teacher`s' in the technical colleges according Ayonmike, (2020) results to students' abseentism during lesson thereby paving way for students poor learning outcome. Various methods of improving the poor performance of students have been neglected, hence there is the need to look for more proactive methods that will incorporate individual differences of learners and make them learn in a more profitable way. To search for more efficient methods that will improve students' academic performance call for the trial of another individualized approach such as flipped learning teaching methods. Therefore, the study, seeks to investigate effect of flipped learning instructional strategies on students' achievement and interest in Electrical/Electronic for self-employment in Niger State.

Research Questions

The following research questions guided the study:

1. What are the mean achievement scores of students taught electrical/electronic using flipped learning instructional strategies and those taught using lecture method for self-employment?
2. What are the mean interest scores of students taught electrical/electronic using flipped learning instructional strategies and those taught using lecture method for self-employment?

Hypotheses

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

H_{o1}: There is no significant difference in the mean achievement scores of students taught electrical/electronic using flipped learning instructional strategies and those taught using lecture method for self-employment.

H_{o2}: There is no significant difference in the mean interest scores of students taught electrical/electronic using flipped learning instructional strategies and those taught using lecture method for self-employment.

METHODOLOGY

The study adopted quasi-experimental design. The study was carried out in technical colleges in Niger State. The population of the study consists of seven technical colleges in Niger State. The sample of study was two hundred and forty seven (247) TC II, Electrical/Electronic students in technical colleges in Niger State. ELECTRICAL/Electronic Achievement Test (EAT) and Electrical/Electronic Interest Scale (EIS) were used as the instrument. The two instruments were validated by three experts from the Department of Industrial and Technology Education, Federal University of Technology, Minna. Pearson Product Moment Correlation Coefficient was used to compute results of the trial testing after test re-test instrument administration and the results indicated positive correlation coefficients of 0.85 and 0.88 for EAT and EIS respectively. The researcher administered the instrument with the help of two research assistants. Data for the study were collected through pre-test and posttest using the Electrical/Electronic Achievement Test (EAT) and the Electrical/Electronic Interest Scale (EIS). After the pre-test, items of the EAT were reshuffled before re-administration for posttest. The essence of reshuffling the items was to ensure that students do not memorise all the contents of the EAT. Data collected from the two tests (pre-test and post-test) were used

for data analysis. Data collected were analyzed using Mean and Standard Deviation to answer the two research questions while Analysis of Co-variance (ANCOVA) was used to test the two null hypotheses at 0.05 level of significance. The ANCOVA was preferred because of its power to take care of the initial lack of equivalence (differences) in the experimental and control groups since intact classes were used for the study. The pretest served as covariate to the post-test and this justifies more the use of ANCOVA for testing the null hypotheses.

Results

Research Question 1: What are the mean achievement scores of students taught electrical/electronic using flipped learning instructional strategies and those taught using lecture method?

Table 1: Mean Achievement Scores of Students taught Electrical/Electronic using Flipped learning instructional strategies and those taught using Lecture Method

Teaching Methods	N	Pre-test		Post-test		Mean Gain Score
		Mean	SD	Mean	SD	
Flipped learning instructional strategies	126	33.28	10.32	79.08	8.80	42.80
Lecture Method	121	33.62	6.20	37.77	7.25	4.15
Total	**247**	**33.45**	**8.26**	**58.43**	**8.03**	**23.48**

Table 1 showed that students taught electrical/electronic in technical schools using flipped learning instructional strategies had a mean and standard deviation achievement score of 33.28 (10.32) in pre-test while students taught with lecture method had pretest mean and standard deviation achievement score of 33.62 (6.20) respectively. This suggests that at pretest level students in both flipped learning based and lecture methods almost had the same achievement. The post-test mean and standard deviation achievement of students taught electrical/electronic in technical schools using the flipped learning based and lecture methods are 79.08 (8.80) and 37.77 (7.25) respectively. This implies that students taught electrical/electronic in technical schools with flipped learning based had better achievement than their counterparts taught using the lecture method. Thus, the flipped learning instructional strategies enhances students' achievement in electrical/electronic in technical schools more than the lecture method.

Research Question 2: What are the mean interest scores of students taught electrical/electronic using flipped learning instructional strategies and those taught using lecture method?

Table 2: Mean Interest Scores of students taught Electrical/Electronic using Flipped learning instructional strategies and those taught using lecture method

Teaching Methods	N	Pre-test		Post-test		Mean Gain Score
		Mean	SD	Mean	SD	
Flipped learning instructional strategies	126	1.69	0.80	3.39	0.68	1.70
Lecture Method	121	1.55	0.62	1.76	0.75	0.21
Total	**247**	**1.62**	**0.71**	**2.58**	**0.72**	**0.95**

Table 2 revealed that students taught electrical/electronic in technical schools using flipped learning instructional strategies had a mean and standard deviation interest score of 1.69 (0.80) in pre-test while students taught with lecture method had pretest mean and standard deviation interest score of 1.55 (0.62) respectively. This suggests that at pretest level students in both flipped learning instructional strategies and lecture method almost had the same interest level. The post-test mean and standard deviation interest of students taught electrical/electronic in technical schools using the flipped learning based and lecture methods are 3.39 (0.68) and 1.76 (0.75) respectively. This implies that students taught electrical/electronic in technical schools with flipped learning based had higher interest in electrical/electronic than their counterparts taught using the lecture method. Thus, the flipped learning instructional strategies promotes students' interest in electrical/electronic in technical schools more than the lecture method.

H_{O1}: There is no significant difference in the mean achievement scores of students taught electrical/electronic using flipped learning instructional strategies and those taught using lecture method.

Table 3: ANCOVA Summary Table of the difference in the mean (x) achievement scores of students taught Electrical/Electronic using Flipped learning instructional strategies and those taught using lecture method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	109046.255[a]	2	54523.128	1081.545	.000
Intercept	28358.581	1	28358.581	562.534	.000
Pretest	3708.140	1	3708.140	73.556	.000
Method	**106104.674**	**1**	**106104.674**	**2104.740**	**.000**
Error	12300.587	244	50.412		
Total	976558.000	247			
Corrected Total	121346.842	246			

Table 3 shows the F value as 2104.74 and the probability value as .000. The probability value of .000 of this finding is less than the alpha value of 0.05. Therefore, the null hypothesis is rejected and thus, there is significant difference in the mean achievement scores of students taught electrical/electronic using flipped learning instructional strategies and those taught using lecture method in favour of the flipped learning instructional strategies. This implies that students taught electrical/electronic with Flipped learning instructional strategies had better achievement compared with their counterparts taught with the lecture strategy.

H_{O2}: There is no significant difference in the mean interest scores of students taught electrical/electronic using flipped learning instructional strategies and those taught using lecture method.

Table 4: ANCOVA Summary Table of the difference in the mean (x) interest scores of students taught Electrical/Electronic using Flipped learning instructional strategies and those taught using lecture method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	165.925[a]	2	82.963	163.546	.000
Intercept	313.734	1	313.734	618.469	.000
Pre-Interest	2.219	1	2.219	4.374	.038
Method	**165.854**	**1**	**165.854**	**326.950**	**.000**

Error	123.775	244	.507
Total	1948.000	247	
Corrected Total	289.700	246	

Table 4 showed the F value as 326.95 and the probability value as .000. Since the probability value of .000 of this finding is less than the alpha value of 0.05. Therefore, the null hypothesis is rejected and thus, there is a significant difference in the mean interest scores of students taught electrical/electronic using flipped learning instructional strategies and those taught using lecture method in favour of the flipped learning instructional strategies. This suggests that students taught electrical/electronic with the Flipped learning instructional strategies had higher interest in the subject compared to their counterparts taught with the lecture method.

Discussion of Results

The data presented in Table 1 and Table 3 revealed that students taught electrical/electronic in technical schools with flipped learning based learning had better achievement than their counterparts taught using the lecture method. There is significant difference in the mean achievement scores of students taught electrical/electronic using flipped learning instructional strategies and those taught using lecture method. This implies that students taught electrical/electronic with flipped learning instructional strategies had better achievement compared with their counterparts taught with the lecture method. This finding is expected as students' direct involvement in the teaching and learning processes enhances students' achievement more than teacher-dominated instruction. The finding of this study is coherent with that of Fabiano *et al.* (2021) who found that flipped learning instructional strategies was very effective in promoting students' academic performance and retention in children.

The data presented in Table 2 answered research question 2 while the data presented in Table 4 answered hypothesis 2. The result of the analysis revealed that students taught electrical/electronic in technical schools with flipped learning instructional strategies had higher interest in electrical/electronic than their counterparts taught using the lecture method. There is a significant difference in the mean interest scores of students taught electrical/electronic using flipped learning instructional strategies and those taught using lecture method in favour of the flipped learning instructional strategies. This suggests that students taught electrical/electronic with the flipped learning instructional strategies had higher interest in the subject compared to their counterparts taught with the lecture method. This finding is expected as students' active participation in teaching and learning process rekindles their interests and deactivates boredom and day dreaming. In line with the findings of this study Cereja *et al.* (2018) found out that students taught using flipped learning exhibited higher interest in the subject Technical Drawing, than those taught by their teachers using the lecture method.

Conclusions

Students' poor achievement and interest in electrical/electronic informed the need for the study on the effect of flipped learning instructional strategies on students' achievement and interest in electrical/electronic in Technical Colleges in Niger state. The study indicated that flipped learning instructional strategies enhances students' achievement and interest in electrical/electronic more than the lecture method. Basically, there was significant difference in the mean achievement and interest scores of students taught electrical/electronic using flipped learning instructional strategies and those taught using lecture method in favour of the flipped learning instructional strategies. It was concluded that appropriate use of flipped learning instructional strategies in teaching electrical/electronic would facilitate students' achievement and interest in electrical/electronic.

Recommendations

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

1. Electrical/electronic teachers should be encouraged by the government through its relevant ministries to adopt flipped learning instructional strategies in teaching and learning Electrical/Electronic for better academic achievement of the students in the subject.
2. The Government through its relevant ministries of education should organize seminars, workshops and symposia for the in-service teachers on the use of flipped learning instructional strategies for effective teaching and learning of electrical/electronic in technical schools.

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