

EFFECT OF BRAINSTORMING, JUST-IN-TIME AND DEMONSTRATION TEACHING TECHNIQUES ON STUDENTS' INTEREST IN DIGITAL ELECTRONICS DURING PANDEMIC IN NORTH-WEST, NIGERIA.

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Abstract

The study identified the effects of brainstorming, Just-in-Time and demonstration teaching techniques on students' interest in Digital Electronic during pandemic in North-West Nigeria. One research question was raised and answered as well as one hypothesis was formulated and test at 0.05 level of significant. The study adopted pretest–posttest non-equivalent control group design of quasi-experimental study. The study was conducted in North-West, Nigeria. The population of this study comprised of the whole Nigerian Certificate in Education (NCE) III electrical/electronic students in all the Colleges of Education in the study area offering technical education. Due to the manageable size of the population of the study, there was no sampling of subjects. The instruments used for data collection include: Digital Electronics Interest Inventory (DEII). The instrument was subjected to face and content validation by three experts. The reliability co-efficient of the instrument was determined as 0.83 using Cronbach Alpha statistical technique. The collection of data for the study was achieved through physical administration of the questionnaire. The study employed the use of descriptive using mean and inferential statistics using Analysis of Covariance (ANCOVA) to analyze the data. The study found out that, Just-in-Time Teaching (JiTT) technique had positive effect on the interest of students in digital electronics. The study recommended among others that, digital electronics lecturers should adopt the use of JiTT technique to stimulate students' interest in digital electronics during pandemic.

Keywords: Brainstorming, Just-in-Time Teaching, Demonstration, Interest

Introduction

Digital electronics is a compulsory two credit unit course with code: TEE 328 offered by final year Electrical Electronic Technology Education (EETE) students in colleges of education in Nigeria. The course deals with electronic appliances which function on the principle of logic gate and logic decisions with the use of integrated circuits as their main component. According to Federal Republic of Nigeria (FRN, 2012), the course is aimed at equipping students with the

knowledge of basic computer parts, types and other devices, computer hardware configuration and techniques of computer aided designs, number system, logic gates, flip-flop, counters, decoders and encoders and microprocessors. Halliru and Muhyideen (2018) noted that, the aim of digital electronics is far from being achieved due to the persistently manifested low student's performance attributed to lack of interest. The students' lack of interest in the course could be influenced by instructional techniques used by lecturers such as demonstration method.

Demonstration method refers to the type of teaching method in which the teacher is the principal actor while the learners watch with the intention to act later. Here the teacher does whatever the learners are expected to do at the end of the lesson by showing them how to do it and explaining the step-by-step process to them (Ameh *et al.*, 2017). Mundi (2016), described demonstration method of teaching as a display or an exhibition usually done by the teacher while the students watch with keen interest. The gains of using demonstration method in teaching lies in the fact that it bridges the gap between theory and practice, enables learners to become good observers and generate their interest; students see immediate progress as a result of a correct effort and it enables the lecturer to impart manipulative and operational skills. Despite these benefits, Dorgu (2015) advocated that, improving students' performance especially in digital electronics require students' centered instructional techniques such as brainstorming.

Brainstorming is one of the most important teaching technique in provoking creativity and solving problems in the field of education. As the name suggests, brainstorming is meant to stimulate or excite the brain into thinking about issues in a new way. Filgona *et al.* (2016) described brainstorming teaching technique as a technique that emphasizes the participation, dialogue and two-way communication between teacher and students. According to Akinboye (2019), brainstorming teaching technique involves asking of carefully framed questions aimed at teaching students to find out facts and learn skills for themselves and do critical thinking. It encourages students to arrest conventional, logical thinking and embrace spontaneity, originality, and imagination. Eble (2016) noted that, the interest of students is stimulated when taught using brainstorming teaching technique and other active technique such as Just-in Time Teaching technique.

The Just-in-Time Teaching (JiTT) technique is problem based and student centered learning approaches that allow students to learn and express their idea about yet to be taught topic. According to Simkins and Maier (2016), JiTT technique engage students with reading to answer warm-up questions on new topics outside the class and submit electronically prior to the classroom activity. The students' responses let the teacher tailor his teaching to reinforce the students' understanding as well as stimulates their interest. Pace and Middendorf (2017) confirmed that the pre-class experience that students acquired in the course of doing the assignment stimulates their interest. Moreover, the conspicuous similarity among JiTT, brainstorming and demonstration techniques is their ability to stimulate students' interest.

Interest is described as the attraction which forces or compels a learner to respond to a particular stimulus. According to Mondane (2014), interest is a subjective feeling of concentration or curiosity over something. Interest is an important variable in learning because when a student becomes interested in an activity, he/she is likely to be more deeply involved in that activity. Schraw *et al.* (2011) noted that, lack of interest in a subject such as digital electronics could contribute greatly to students' low academic achievement which is largely influenced by teaching methods. This implies that, the low academic achievement recorded in digital electronics among EETE students is caused by low interest. According to Mondane (2014), active teaching techniques such as brainstorming, JiTT and demonstration techniques can induce student's interest and as well enhance their performance in a particular subject. Martinez (2012) confirmed that, the use of brainstorming, JiTT and demonstration techniques

has shown to stimulate attention and arouse student's interest in sciences and humanities. Thus, it might also enhance students' interest in digital electronics and lead to high cognitive and interest as well as retention of knowledge. Hence, there is need to ascertain the effect of brainstorming, JiTT and demonstration teaching techniques on students' interest in digital electronics in colleges of education in North-West, Nigeria.

Statement of the Problem

Digital electronics is aimed at equipping EETE students with the knowledge and skills in the maintenance of digital electronics appliances. To realize this aim, Governments at both State and federal levels have made provision for several inputs that include, building structures, well designed and developed curriculum as well as teaching staff to ensure effective learning. Unfortunately, despite these efforts by the Governments, it seems as if the aim is defeated as results of the continuous low interest in studying EETE courses such as digital electronics as revealed by Halliru & Muhyideen (2018). The examination records on the performance of student's in digital electronics in North-West, Nigeria from 2015 to 2019 revealed that, in 2014/2015 academic session, 51.06% failed, 48.09% in 2015/2016 and 50% in 2016/2017, 50.86% in 2017/2018 and 48.52% in 2018/2019. Supporting this claim, Azih and Nwosu (2018) reported that, the achievement of students in digital electronics is generally low in examinations due to use of non-effective methods of teaching such as lecture methods that do not take into account the needs of students, their interests, their tendencies and their desires as well as the absence of educational technology. Okon (2018) equally noted that, lecture method of teaching that is mostly used by colleges of education lecturers is not challenging enough to meet the needs of the EETE students.

The continued use of lecture methods in teaching digital electronics to students largely manifests some shortcomings that reflect low academic achievements attributed to lack of interest among students in school subjects such as digital electronics (James, 2015). In a quest to address these shortcomings, there is an urgent need for teaching technique to keep up with the contemporary times in order to improve students' interest in digital electronics. Thus, the study determined the effect of brainstorming, JiTT and demonstration teaching techniques on students' interest to ascertain the most suitable teaching technique in order to enhance students' achievement in digital electronics in colleges of education in North-West, Nigeria.

Objective of the Study

The aim of the study was to determine the effect of brainstorming, JiTT and demonstration teaching techniques on students' interest in digital electronics in colleges of education in North-West, Nigeria. Specifically, the objective of the study is to determine the effect of:

- Brainstorming, JiTT and demonstration teaching techniques on students' interest in digital electronics

Research Question

The following research question was raised and answered:

1. What is the effect of Brainstorming, JiTT and demonstration teaching techniques on students' interest in digital electronics?

Hypothesis

The following null hypothesis was formulated and tested at .05 level of significance:

HO₁: There is no significance difference among the interest scores of students taught digital electronics using Brainstorming, JiTT and demonstration teaching techniques

Research Methods

The study adopted pretest–posttest non-equivalent control group design of quasi-experimental study. The design is most suitable for the study since pre-selection and randomization of groups is often difficult in a school setting, intact classes will be used to avoid disruption of normal classes. The study was conducted in North-West, Nigeria. The North-West, Nigeria comprises of Kaduna, Kano, Katsina, Sokoto and Zamfara States. The population of this study comprised of the entire 142 Nigerian Certificate in Education (NCE) III electrical/electronic students in all the Colleges of Education in the study area offering technical education. The sample of the study was the whole population. Due to the manageable size of the population of the study, there was no sampling of subjects. Moreover, purposive sampling technique was used to assigned Federal College of Education (Technical), Gusau and Federal College of Education, Bichi to the experimental group II. This is simply because; the two colleges of education possessed the necessary learning facilities that support the use of JiTT. Furthermore, Simple Random Sampling Technique was used to assign Isah Kaita College of Education, Katsina and Shehu Shagari College of Education, Sokoto to control group and Kaduna State College of Education, Gidan Waya to experimental group I. The instrument used to collect data for this study was Digital Electronics Interest Inventory (DEII). The DEII was subjected to face and content validation by three experts. The reliability coefficient value of DEII was determined as 0.83 using Cronbach Alpha statistical technique. The collection of data for the study was achieved through physical administration of the DEII to all NCE III digital electronics students to determine their interest in digital electronics. The study employed the use of descriptive and inferential statistics to analyze the data. Descriptive statistics using mean was used to answer the research question and inferential statistics using Analysis of Covariance (ANCOVA) to test the null hypothesis at significant level of 0.05.

Experimental Procedures

The study was conducted in 12 weeks' period during which, 8 topics in digital electronics will be covered. The study involved four stages which include: administration of pre-test, treatment, posttest and retention test. The pre-test was administered to all the students involved in the study in the first week of the research exercise before both groups are subjected to treatment. After the administration of the pre-test, the students in the experimental group I and II were taught using brainstorming and Just-in Time Teaching techniques and the students in the control group were taught using demonstration method.

Results:

What is the effect of Brainstorming, Just-in-time and Demonstration teaching techniques on students' interest in digital electronics? The data answering the research question is contained in table 1.

Table 1: Mean of Pre-test and Post-test Interest Scores of Students Taught Digital Electronics Using Brainstorming, Just-in-time and Demonstration Teaching Techniques

Groups	Pretest			Posttest		Mean Gain
	N	Mean	SD	Mean	SD	
Control Group (Demonstration Method)	62	34.21	0.95	59.76	0.43	25.55
Experimental Group I (Brainstorming Technique)	42	34.23	1.04	60.42	1.17	26.19
Experimental Group II (Just-in-time Technique)	38	34.61	2.51	84.79	0.41	50.18

Table 1 shows that, the control group taught with demonstration method had pre-test mean interest score of 34.21 with standard deviation of 0.95 and post-test score of 59.76 with standard deviation of 0.43. The mean gained between the pre-test and post-test of the control group was 25.55. The experimental group I taught with Brainstorming technique had pre-test mean interest score of 34.23 with standard deviation of 1.04 and post-test score of 60.42 with standard deviation of 1.17. The mean gained between the pre-test and post-test of the experimental group I was 26.19. The experimental group II taught with JiTT had pre-test mean interest score of 34.61 with standard deviation of 2.51 and post-test score of 84.79 with standard deviation of 0.41. The mean gained between the pre-test and post-test of the experimental group II was 50.18. The experimental group II had higher mean gained than experimental group I and control group. This indicated that, students taught digital electronics using JiTT technique had higher mean interest scores than students taught using brainstorming and demonstration techniques.

Hypothesis One

There is no significance difference among the interest scores of students taught digital electronics using Brainstorming, Just-in-time and demonstration teaching techniques. The data for testing the hypothesis is contained in table 2.

Table 2: Analysis of Covariance for the test of Significance difference among the Interest Scores of Students Taught Digital Electronics Using Brainstorming, Just-in-time and Demonstration Teaching Techniques

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	169.11 ^a	3	563.23	808.53	.000
Intercept	12.74	1	126.47	181.17	.000
Pretest	.869	1	.86	1.24	.266
Group	166.77	2	833.88	119.59	.000*
Error	96.16	138	.69		
Total	6496.00	142			
Corrected Total	169.87	141			

a. R Squared = .994 (Adjusted R Squared = .994)

Table 2 shows the F-calculated value for testing the significance difference among the interest scores of students taught digital electronics using Brainstorming, Just-in-time and

demonstration teaching techniques. The F-calculated value of 119.59 was obtained with associated exact probability value of 0.00. Since the associated probability of 0.00 was less than 0.05 set as level of significance, the null hypothesis which stated that there is no significance difference among the interest scores of students taught digital electronics using Brainstorming, Just-in-time and demonstration teaching techniques is rejected. Hence, there is significance difference among the interest scores of students taught digital electronics using Brainstorming, Just-in-time and demonstration teaching techniques. In order to determine the group responsible for the significance difference, post hoc test was carried out as shown in Table 3.

Table 3: Post hoc test for the Significance difference among the Interest Scores of Students Taught Digital Electronics Using Brainstorming, Just-in-time and Demonstration Teaching Techniques

(I) GROUP	(J) GROUP	Mean Difference (I- J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
CON	EI	-.65 [*]	.166	.001	-1.07	-.24
	EII	-25.02 [*]	.187	.000 [*]	-25.49	-24.56
EI	CON	.65 [*]	.166	.001	.24	1.07
	EII	-24.37 [*]	.172	.000 [*]	-24.79	-23.94
EII	CON	25.02 [*]	.187	.000	24.56	25.49
	EI	24.37 [*]	.172	.000	23.94	24.79

Table 3 reveals $p = 0.00$ for experimental group II when compared with control group and experimental group I. This indicated that, experimental group II (students taught digital electronics using Jut-in-Time Teaching technique) is responsible for the significant difference between the interest scores of students taught digital electronics using Brainstorming, Just-in-time and demonstration teaching techniques.

Findings

1. Students taught digital electronics using JiTT technique had higher mean interest scores than students taught using brainstorming and demonstration techniques.
2. There was significance difference among the interest scores of students taught digital electronics using brainstorming, Just-in-time and demonstration teaching techniques.

Discussion of Findings

Findings on the effects of brainstorming, JiTT and demonstration teaching techniques on students' interest in digital electronics in colleges of education in North-West, Nigeria revealed that, JiTT technique had positive effects than brainstorming and demonstration techniques. The findings entails that, JiTT technique enhanced the interest of students in digital electronics. The finding is related to the findings of Gavrin (2013) on the effects of JiTT technique on students' cognitive gains, retention, and interest in Physics that revealed that, students' interest was improved with 40 percent. The positive effects of JiTT technique on students' interest in digital electronics could be due to the feature of the technique that allows pre-class activities on learning contents to be studied through the use of multimedia. The finding supports the assertion of [Marrs](#) and [Novak](#) (2014) that revealed JiTT improved student interest, increased classroom interactivity, increased student academic success and retention rates. The

implication of this finding is that, using JiTT technique to teach practical oriented courses as digital electronics can enhance students' interest.

Furthermore, findings on the test for significance difference among the interest scores of students taught digital electronics using brainstorming, Just-in-time and demonstration teaching techniques revealed statistical significant. The statistical significant difference was traced to the group taught digital electronics using JiTT technique. The finding entails that, the group taught using JiTT technique was responsible for significance difference among the interest scores of students taught digital electronics using brainstorming, Just-in-time and demonstration teaching techniques. The finding is similar to the finding of Claude *et al.* (2006) that revealed significant difference between students taught history of photography course using JiTT technique and lecture method. This implied that, the JiTT technique is capable of causing vast dissimilarity in students' interest.

Conclusion

Based on the findings of the study, insights on the effects of brainstorming, JiTT and demonstration teaching techniques on students' interest was provided. The study found out that, students taught digital electronics using JiTT technique had significant positive effect on the interest of students in digital electronics than brainstorming and demonstration teaching techniques. The implication of the findings is that, the adoption of JiTT technique hold the potential to enhance students' interest in digital electronics. Nevertheless, the findings are limited to the contents of digital electronics at college of education level in North-northwest, Nigeria. Therefore, it is concluded that, JiTT technique had significant positive effects on students' interest in digital electronics during pandemic. This could be due to the fact that, students submit their responses electronically which reduces time and frequency of interaction.

Recommendations

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

2. Digital electronics lecturers should adopt the use of Just-in Time Teaching technique in order to stimulate students' interest in digital electronics.
3. Digital electronics students should also embrace learning through the use of Just-in Time Teaching technique in order to stimulate their interest in learning in learning digital electronics.

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