THE COLLOQUIUM -A Multi disciplinary Thematic Policy Journal
www.ccsonlinejournals.com
Volume 7 , Number 1 , 2019 Pages 27-36
CC-BY-NC-SA 4.0 International Print ISSN : 2971-6624 eISSN: 2971-6632

EFFECT OF GUIDED – DISCOVERY PEDAGOGY ON STUDENTS' ACHIEVEMENT IN INSPECTION AND TESTING OF DOMESTIC ELECTRICAL INSTALLATIONS IN TECHNICAL COLLEGES IN SOUTH-SOUTH GEO-POLITICAL ZONE OF NIGERIA

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Abstract

The study determined effect of guided – discovery pedagogy on students' achievement in Inspection and Testing of Domestic Electrical Installations (ITDI) in technical colleges in South-South Geo-Political Zone of Nigeria. The study adopted quasi experimental pre-test, post-test, non-equivalent control group design which involve six experimental and six control groups was adopted for the study. Three research questions and three hypotheses guided the study. Sample size consisted of 291 Vocational Class 2 students in six intact classes randomly drawn from six purposively selected technical colleges in three South-South States of Nigeria and were stratified into urban/rural. Samples was taken from each stratum. A 43- item Inspection and Testing of Domestic Installations Achievement Test (ITDIAT) of a reliability coefficient of 0.87 was used for data collection. Intact classes were randomly assigned to experimental and control groups. Research questions were answered using mean and standard deviation while the hypotheses were tested at 0.05 level using ANCOVA. Findings among others showed that guided-discovery pedagogy significantly enhanced students' academic achievements in EIMW when taught ITDI more than the lecture method, there was also significant difference in the mean achievement score of urban and rural students with students in the experimental group exhibiting higher achievement. Among the recommendations was that seminars and workshops should be regularly organized for teachers on the use of guided - discovery teaching method.

Key words: *Students achievement , domestic electrical installations, guided-discovery, Technical Colleges*

Introduction

Education is a dynamic instrument for change. It emphasizes the development of intellectual capabilities, moralities, behavioral modifications and other qualities acceptable at home, workplaces and in the society (Iloma & Amadike, 2017). Alumode (2010) defined education as the process by which the child, the youth and the adults are adequately prepared to enhance their productivity and contribution towards the development of the society. The development of any nation therefore depends to a high extent on the quality of its educational system. According to the

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National Policy on Education (NPE) of Federal Republic of Nigeria (FRN, 2013), education is an instrument for national development and social change. Human capacity building and sustainable manpower resources are pertinent in this policy. The vital role of education for human development makes it necessary for people to embark on it irrespective of their status. Education therefore exists in various organized forms such as Business Education, Medicine, Agricultural Education, Law and Technical Education (TE). According to FRN (2013), TE refers to those aspects of educational processes which in addition to general education, involve the study of technologies and related sciences as well as the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of the economy and social life.

The goals of technical education include provision of trained manpower in the applied sciences, technology and business particularly at craft, advanced craft and technical levels; provision of technical knowledge and vocational skills necessary for agricultural, commercial and economic development; giving training and imparting the necessary skills to individual who shall be self-reliant economically (FRN, 2013). In Nigeria, technical education programmes are offered in different institutions of learning of which technical college is inclusive. A technical college is an educational institution that prepares students for a career in specific technical fields (Johnson, 2012). It is a college that provides courses in a range of practical subjects such as engineering, information technology, applied sciences, agriculture, and secretarial skills (Collins, 2015). Okoro (2006) opined that technical colleges provides full vocational training which is intended to prepare students for entry into various occupations as artisans, craftsmen and technicians. Technical colleges therefore provide opportunity for acquisition of practical skills, basic scientific knowledge and behavioural attitude that will conform to the standard expected of craftsmen and technicians at sub-professional level (Akpan, 2003). Technical colleges in Nigeria train students to acquire occupational skills in the level of craftsmen and technicians. Training prepares graduates of technical colleges for jobs in various sectors of the economy. All sectors of the economy requires trained and competent craftsmen and technicians capable of operating and maintaining the available technical equipment (Ndomi, 2005).

Electrical/Electronic Trade curriculum provides training in the area of electrical/electronic appliances, maintenance and repairs; Electrical Installations and Maintenance Works; instrument mechanics, radio, television and electronics work (NBTE, 2012). The trade deals with all fundamental issues in electrical and electronic technology. The present Electrical Installations and Maintenance Works (EIMW) scheme consist of contents which are designed to cover a period of three years which is further divided into basic sections. The contents are divided into three sections for the three classes in the Vocational Class (i.e. Voc 1, Voc 2 and Voc 3). The units for each class are further divided into three to cover the three terms that make up each academic session in Nigeria. Inspection and Testing of Domestic Installation (ITDI) is one of the topics learnt in Voc 2 (NABTEB, 2007) and it is the focus of this study. This is because students' academic achievement in the trade area is pertinent in providing skilled manpower needed in sustaining domestic installations since modernization has made it necessary for homes to depend much on electricity and its appliances.

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Academic achievement is performance outcome indicating the extent to which a person has accomplished specific intended goals in instruction (Steinmayr et al., 2014). Students' academic achievement in ITDI in Electrical Installations and Maintenance Works is the measure of the extent to which instructional objectives of the topic taught in EIMW has been achieved by the students. Academic achievement is always indicated by scores or grades. Achievement scores represents the degree instructional objectives have been achieved by the learner (Asuru, 2006). Hence, students' academic achievement scores in EIMW is a measure of the level to which the students have performed when engaged in academic test after teaching. Teaching becomes effective and sustained when teacher and students' interests are aroused.

Several studies including that of Iloma and Osaji (2015) and Amadike (2014) have attributed differences in academic achievement of students to the teacher's method of presenting instructional experience instruction. Nwoji (2000) observed that whenever a learner is determined to succeed and is properly guided using facilitative strategy, the learner mostly performs excellently. Iloma et al., (2015) identified appropriate teaching and learning strategies as essential ingredient for achievement of educational objectives. Several pedagogies such as demonstration, discovery, lecture, discussion and field trip can be used in the instructional processes in the trade. The predominant pedagogy used in teaching ITDI in technical colleges has been the lecture method. The lecture method is a process whereby the teacher verbally delivers a pre-planned body of knowledge to the students while the students listen and jot down with very low contribution coming from the students. The students depend entirely on the knowledge given by the teacher. Some instructors prefer this method of instruction because of its easiness to administer and evaluate.The persistence agitation for improved capacity building through manpower development in Inspection and Testing of Domestic Installations to meet the increasing demand presented by modernization suggests that probably, the predominant instructional lecture pedagogy might not be effective and appropriate enough to enhance students' achievement in ITDI in EIMW. It is based on this that the need to consider the effect of other innovative pedagogy such as guided-discovery becomes important.

Guided – discovery pedagogy is an instructional strategy which has its root in the theory of constructivism. It is based on the concept that learning (cognition) is the result of mental construction. Constructivism attaches premium to students' active role in the learning process. Constructivist-based methods of instruction accept the child ownership of ideas (Nworgu, 2006). It is anchored on the belief that learners actively construct their own knowledge and meaning from their experiences (Fosnot, 1996). The main benefits of guided-discovery teaching method are that students develop greater interest in the learning process when they are actively involved than when they are just observers. Moreover, guided-discovery teaching method focuses more on understanding and learning to think, unlike the lecture method which focuses on memorization. The strategy engages students' initiatives and gives them ownership of what they learn. Guided-discovery teaching method develops students' ability to express and use their knowledge in several ways in real life situations irrespective of gender difference and prevailing challenges. Furthermore, guided-discovery teaching method is fashioned to promote students' active involvement and to necessitate a crossbreed approach to instruction, hence, the strategy consists of subsets of alternative teaching styles such as modeling, discovery, interaction pattern,

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experimentation and discussion methods. In guided-discovery classroom, more than one of these subsets of teaching methods can be used intermittently in a smooth and organized form because the method incorporates tenets of all other teaching methods that require students' active involvement in the instructional process. Kato and Kamoi (2001) opined that the implication of this strategy is that the learner becomes actively self-supporting in learning. The child's own activities as he interacts with his social and physical environment is the basic proposal of Piaget's theory of cognitive learning.

This study therefore sought to determine effect of guided – discovery pedagogy on students' achievement in Inspection and Testing of Domestic Installations (ITDI) in Technical Colleges in South-South Geo-Political Zone of Nigeria. Specifically, this study:

1. determined the difference between the effect of guided-discovery and lecture pedagogies on students' achievement in ITDI in EIMW
2. determined the difference between the effect of guided-discovery and lecture pedagogies on male and female students' achievement in ITDI in EIMW
3. determined the difference between the effect of guided-discovery and lecture pedagogies on urban and rural students' achievement in ITDI in EIMW

Research Questions

The following research questions guided the study:

1. What are the mean achievement scores of Voc 2 students who were taught ITDI using guided-discovery teaching method and those taught using lecture method?
2. What are the mean achievement scores of male and female Voc 2 students who were taught ITDI using guided-discovery teaching method?
3. What are the mean achievement scores of urban and rural Voc 2 students who were taught ITDI using guided-discovery teaching method?

Null Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

Ho_1: There is no significant difference between the mean achievement scores of EIMW students taught ITDI using guided-discovery teaching method with those taught using lecture method.

Ho_2: There is no significant difference between the mean achievement scores of Voc 2 male and female students when taught ITDI using guided-discovery teaching method.

Ho_3: There is no significant difference between the mean achievement scores of urban and rural Voc 2 students when taught ITDI using guided-discovery teaching method.

Methodology

The research adopted a quasi-experimental pre-test, post-test, non-equivalent control group design involving six experimental and six control groups. The study was carried out in South-South Geopolitical Zone of Nigeria which comprises of six states. There are twenty-nine (29) Technical colleges in the Zone. Sample size consisted of 291 Vocational Class 2 students offering Electrical Installations and Maintenance Works in six (6) intact classes randomly drawn from six purposively

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selected Government Technical Colleges (GTCs) in three South-South States of Nigeria. This was stratified into urban/rural and samples taken from each stratum.
The purposively selected technical colleges from Rivers State were GTC Ahoada (urban) and GTC Ele – Ogu (rural). From Akwa – Ibom State were GTC Ewet (urban) and GTC Abak (rural) while GTC Utagbe-Ogbe (urban) and GTC Ofagbe (rural) were purposively selected from Delta State. The instrument for data collection was a 43- item Inspection and Testing of Domestic Installations Achievement Test (ITDIAT). The instrument was validated by three research experts from Enugu State University of Science and Technology, Enugu, Nigeria. Test-retest method was used to generate data for determining the reliability status of the instruments. Pearson product moment correlation coefficient was used to correlate the two sets of data and reliability coefficient of 0.87 was obtained. The intact classes were assigned randomly to experimental and control groups. Experimental groups were taught (ITDI) in (EIMW) using guided-discovery pedagogy while control groups were taught the same topic using lecture method. Pre-test was administered to both groups before the commencement of the treatment. Treatment was administered for a period of 6 weeks after which a post-test was administered. Mean and standard deviation were used to answer the research questions while the hypotheses were tested at 0.05 level of significance using one-way analysis of covariance (ANCOVA).

Results

Research Question 1

What are the mean achievement scores of Voc 2 students in EIMW taught Inspection and Testing of Domestic Installation using guided-discovery pedagogy and those taught using lecture method?

Table 1: ***Mean Achievement Scores of Students in Experimental Group and Control Group***

Method	Type of Test	Mean	Gain Score	N
	Pre – ITDIAT	27.78	5.72	138
Experimental group	Post – ITDIAT	33.50		
Control group	Pre – ITDIAT	27.43	2.29	153
	post – ITDIAT	29.72		
Grand Mean		29.61		291

Table 1 showed that students taught in the experimental group achieved had higher than those students taught in control group with a mean gain score of 5.72 and 2.29 respectively.

Hypothesis 1: There is no significant difference between the mean achievement scores of EIMW students taught Inspection and Testing of Domestic Installations using guided-discovery pedagogy with that of those taught using lecture method.

Table 2: ANCOVA analysis of Students achievement Score in ITDIAT N= 291

Source of Variation	Degree of freedom	Sum of square	Mean square	F value	F significant	Decision
Between group	1	909.4	909.3			
Within group	290	1809.8	6.28	144.7	0.001	Rejected

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Grand Total	291

Table 2 shows that the F- value of 144.7 is greater than the F - significant of 0.001 at $p \leq 0.05$. This therefore implies that there is a significant difference between the mean achievement scores of students in EIMW taught ITDI using guided-discovery pedagogy and that of those taught using lecture method in favour of the former group. The experimental group therefore achieved significantly higher than those in the control group, hence, it implies that the use of guided-discovery method enhanced students' achievement in EIMW when taught Inspection and Testing of Domestic Installation more than the lecture method.

Research Question 2

What are the mean achievement scores of male and female Voc 2 students who were taught Inspection and Testing of Domestic Installations using guided-discovery teaching method?

Table 3: Mean Achievement Scores of Male and Female Students

Method	Type of Test	Mean	Gain Score	N
Male				
	Pre – ITDIAT	17.41		
Experimental group	Post – ITDIAT	33.49	16.08	180
Control group	Pre – ITDIAT	17.10		
	Post – ITDIAT	28.61	11.51	
Female				
	Pre – ITDIAT	19.91	12.51	
Experimental group	Post – ITDIAT	32.42		
				111
Control group	Pre - ITDIAT	18.01	9.10	
	Post – ITDIAT	27.11		
Grand Total		24.26		291

Table 3 showed that a mean achievement score of 33.49 was obtained by male students in experimental group while a mean achievement score of 28.61 was obtained by male students in control group both in the Post – ITDIAT. The Table also showed that a mean achievement score of 17.41 was obtained by male students in experimental group while a mean achievement score of 17.10 was obtained by male students in control group lecture class both in the Pre – ITDIAT. Further, the Table shows that female students in experimental group obtained a mean achievement score of 32.42 while female students in the control group obtained a mean achievement score of 27.11 in the Post – ITDIAT. Further, female students in experimental group obtained a mean score of 19.91 while female students in the control group obtained a mean achievement score of 18.01 in the Pre – ITDIAT. The result therefore showed that in the experimental group male students achieved higher than the female students with a gain score of 16.08 and 12.51 respectively. Male students therefore achieved significantly higher than their female counterparts. It implies that the use of guided-discovery teaching method enhances students' achievement in EIMW in favour of male students.

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Hypothesis 2 There is no significant difference between the mean achievement scores of Voc 2 male and female students when taught Inspection and Testing of Domestic Installations using guided-discovery teaching method.

Table 4: ANCOVA analysis of Male and Female Students Score in ITDIAT

Source of Variation	Degree of freedom	Sum of square	Mean square	F-value	F significant	Decision
Between group	1	4821.1	4821.13			
Within group	288	9556031	33180.7	0.145	0.703	Not rejected
Grand Total	289					

The Table shows that the F- value of 0.145 is less than the F - significant of 0.703 at $p \leq 0.05$. The hypothesis is therefore not rejected. Hence, there was no significant difference in the mean achievement scores of male and female students in EIMW using guided-discovery teaching method.

Research Question 3

What are the mean achievement scores of urban and rural Voc 2 students who were taught Inspection and Testing of Domestic Installation using guided-discovery teaching method?

Table 5: ***Mean Achievement Score of Urban and Rural Students in EIMW***

Method	Type of Test	Mean	Gain Score	N
Urban				
	Pre – ITDIAT	27.50		
Experimental group	Post – ITDIAT	33.61	6.11	
				138
Control group	Pre – ITDIAT	26.90	3.23	
	post – ITDIAT	30.13		
Rural				
Experimental group	Pre – ITDIAT	26.12	3.6	
	post – ITDIAT	29.72		153
Control group				
	Pre – ITDIAT	25.99	2.39	
	post – ITDIAT	28.38		
Grand Total		28.53		291

Table 5 showed that the mean achievement score of 33.61 was obtained by students in urban experimental group while a mean achievement score of 30.13 was obtained by students in urban control group both in the Post – ITDIAT. The Table also shows that a mean achievement score of 27.50 was obtained by students in urban experimental group while a mean achievement score of 26.90 was obtained by students in urban control group both in the Pre – ITDIAT. Further, the Table shows that students in rural experimental group obtained a mean achievement score of 29.72 in the Post – ITDIAT while students in rural control group obtained a mean achievement score of 28.38. Further, students in rural experimental group obtained a mean achievement score of 26.12 while students in rural control group obtained a mean achievement score of 25.99 in the Pre – ITDIAT. Also, the Table shows that the mean achievement gain score obtained by students in urban experimental group was 6.11 which is higher than the 3.6 achievement gain score obtained

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by students in rural experimental group. This implies that students in urban colleges achieved significantly higher than their counterparts in rural colleges as indicated by their gain scores.

Hypothesis 3

There is no significant difference between the mean achievement scores of urban and rural Voc 2 students when taught Inspection and Testing of Domestic Installations using guided-discovery teaching method.

Table 6: ANCOVA analysis of Urban and Rural Students Achievement Score in ITDIAT N= 291

Source of Variation	Deg of freedom	Sum of square	Mean square	F-value	F- sign	Decision
Between group	1	1057.49	1057.49			
Within group	288	1792.81	6.23	169.88	0.001	Rejected
Grand Total	289					

Table 6 above shows that the F- value of 169.88 is greater than the F - significant of 0.001 at $p \leq 0.05$. The null hypothesis is therefore rejected. Hence, there is significant difference in the mean achievement scores of students in urban and rural technical colleges when taught Inspection and Testing of Domestic Installations in EIMW using guided-discovery teaching method in favour of the former. Students in urban colleges therefore achieved significantly higher than those in rural colleges.

Discussion of Findings

The result of the study showed that the mean achievement score of Voc 2 students in the experimental group was higher in comparison to that of their counterpart in the control group in ITDIAT. Similarly, the result indicated that students in experimental group achieved significantly higher than students in control group after teaching them the same topic. This finding shows that instructional strategy is imperative in enhancing students' achievement in some topics in EIMW. Mbaba (2006) finding which noted that teachers' method of teaching technical subjects has direct bearing on technical students' level of achievement is in line with this study. The finding is also in line with that of Iloma and Osaji (2015), Amadike (2014) and Ciwar (2005) in their separate studies which revealed that the use of appropriate instructional strategy enhances students' academic achievement in technical subjects. The study further showed that gender has significant relationship on students' academic achievement in technical subjects in favour of the male. This result corroborates that of Jimoh (2004) that male students achieve higher than their female counterpart in science and technical subjects. The finding also agreed with that of Negedu and Noah (2013) which pointed out that male students demonstrate higher academic achievement in technical subjects. The study further showed that Voc 2 students in urban colleges have higher achievement and interest in the ITDI than their counterparts in the rural colleges as shown by their mean achievement gain scores. The study further indicated that there was a significant difference in the mean achievement scores of students in urban and rural colleges in the EIMW. These findings corroborate that of Ugonabo (2009) that there was a significant difference in the mean achievement score of rural and urban students in Basic Technology.

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CC-BY-NC-SA 4.0 International Print ISSN : 2971-6624 eISSN: 2971-6632

Conclusion

The study sought to determine the difference between the effect of guided-discovery and lecture pedagogies on students' achievement in ITDI in EIMW. Subjects were stratified into male/female and urban/rural strata and assigned to experimental and control groups. Treatment was given for a period of six weeks. Three research questions and three hypotheses guided the study. Result as analyzed showed that the mean scores of students in experimental group is higher than that of those in control group in ITDIAT. It was therefore concluded that guided-discovery pedagogy enhances students' achievement in ITDI than the lecture method.

Recommendations

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

- Regular seminar on the use of guided-discovery teaching method should be organized for teachers teaching EIMW and other technical subjects.
- adequate human and material resources that will facilitate the use of guided-discovery teaching method in technical colleges should be provided by government and non-governmental organizations in both urban and rural schools

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