

Effect of Small-Group Discussion Learning Method on Students' Performance in Electrical Installation and Maintenance Works in Edo State Technical Colleges

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Abstract

The study examined the effect of small-group discussion on students' performance in electrical installation and maintenance works in Edo state technical colleges. Two research questions guided the study and two hypotheses were formulated and tested at .05 level of significance. The study adopted a quasi-experimental research design precisely the pretest and posttest non-equivalent control group design. The population of the study comprised all the 189 Vocational II students' offering Electrical Wiring in the six technical colleges of Edo State. Two intact classes were used which was made up of 102 students; purposive simple technique was used to select the students from two technical colleges in the three senatorial district of Edo State. The instrument for data collection was titled: Electrical Installation and Maintenance Works Achievement Test (EIMWAT). The instrument was a standardized NABTEB examination question collated for a period of five years. The data collected were analyzed using mean, standard deviation, t-test and Analysis of Covariance (ANCOVA). Mean and standard deviation were used to answer the research question while the hypotheses were analyzed and tested at .05 level of significance. The result shows that difference existed between the pretest and posttest mean score of students taught Industrial Electrical Wiring using small-group discussion and Conventional Teaching Method. Finally, there was no significant interaction effect of treatments given to students based on gender in technical colleges in Edo State.

Introduction

Education is an important human activity, whose purpose is geared towards equipping the citizenry to reshape their society and eliminate inequality. Education is the best heritage parent can bequeath to their children because it helps any society fashion and model individuals to function well within the environment. Consequently, in the perspective of this research work, the type of education which occupationally prepares the youth for useful living in the society is vocational education.

According to Uwameiye (2017), vocational education prepares youths for employment in industries, commence and other enterprises by revealing them to practices that offer manipulative, cognitive and attitudinal skills that make them qualify for it. Vocational education also provides experiences for adult who are already employed, and whose skills may have become obsolete, and then require to update their skills. The aim of vocational education is to provide training for gainful employment, and re-training for progress within the occupation. Vocational education lays emphasis on exposing clients to experiences of the real world of works and the domains of skills, which are manipulative (psychomotor), informational (cognitive), and attitudinal (affective). These three domains of skill acquisition are important for the success of individuals in any job situation.

Vocational education is offered in technical colleges, leading to the award of National Technical Certificates (NTC) and Advance National Technical Certificate (ANTC). The National Technical Certificate level programme lasts three years after the junior secondary school. It is an equivalent to senior secondary education. The ANTC programme entails two years pre entry industrial work experience and ranks on the lower level of tertiary programmes. All certificates are awarded by the National Business and Technical Examination Board (NABTEB). One of the vocational programme offered in technical colleges in Nigeria is Electrical Installation and Maintenance Works (EIMW).

Electrical Installation and Maintenance Work is the study or acquisition of electrical skills that is performed during the erection or construction of structures of building which entails the installation of electrical materials and maintenance. The objectives that guide the teaching of EIMW in technical college in Nigeria include to:

1. provide technical training to meet the demand of electrical industries and individuals by allowing the students to identify their career objective;
2. prepare an individual with job satisfying skills towards employment and self-reliance; and
3. prepare students to acquire entry level knowledge and manipulative skills for employment in technical industry (National Board for Technical Education (NBTE), 2012).

Though these objectives are commendable but there appears to be an obstruction in the realization of these objectives in technical colleges because EIMW is practically oriented. To adequately realize these objectives, proper instructional techniques must be adopted to actualize these creditable objectives. Generally, the Non-traditional teaching methods help to awake students' curiosity and creativity and motivate them to participate in class activities (Kermanshachi, [2018](#)). These methods are focused mainly on the activity and independent work of students, who gradually

move from the passive method of acquiring knowledge (e.g. interpretation, explanation) to more active methods of acquiring information and become more or less independent implementers of their own education this way.

However, other teaching methods like Small-group discussion method, demonstration method, play-away method, etc. has positive impact on the students' performance. thus, this study we be concern with the effectiveness of Small-group discussion method on students' performance. According to Hooke (2020), small-group discussion is a collaborative learning group which makes work more fun and worthwhile even when doing very challenging problems. Small-group discussion also create the potential for cognitive and psychomotor benefit by arranging students in discussion that requires them to make task related information processing and problem solving skills more relevant. Group influence in project, will go a long way in helping who have social and emotional disorder to increase and develop acceptable and interpersonal relationship to relate with students and fit into the social world of work after graduation. Studies by Faradina and Sari (2016), When students discuss together, they tend to learn more deeply (Powell, Murray, Johal & Elks, 2019).

Statement of the Problem

Students' performance in electrical installation and maintenance works subject has not been encouraging. Judging from the recent results obtained from students of EIMW NABTEB examination for the past five years. Out of the 817 candidates that sat for the examination, 27 (3.3%) candidates passed at A and B level, 99 (12.1%) candidates passed at credit level, 236 (28.9%) passed with passed grade and 455 (55.7%) failed the examinations (see table on appendix xviii). This analysis shows poor performance in Electrical Installation and Maintenance Work in Edo State technical colleges.

A number of instructional methods have been used since EIMW have been introduced to technical colleges. It is good to provide technical college students with the best skills an attitude for acquiring knowledge so that they would be adequately prepared to deal with future technological challenges. Poor students' performance in Electrical Installation and Maintenance work seems to be attributed to mainly expository with little or no involvement in practical projects. Again, the methods that have been adopted in teaching Electrical Installation and Maintenance Work all along may not be very effective. To this end, one may say that the quality of instruction provided to the students is intricately linked to the strategies the teacher adopted in passing knowledge to students in college. Study on students' performance in schools subject reported inefficient teaching methods by school

teachers as a major factor (Pepple, 2010).

All of the above-mentioned factors may lead to students' performance in EIMW. The problem of the study therefore is poor students' performance of EIMW. It is against this background, that the researcher sought to inspect the effect of small-group discussion method on students' performance in Electrical Installation and Maintenance Works in technical colleges in Edo State.

Purpose of the Study

The purpose of the study is to determine the effect of small-group discussion learning technique on the students' performance in Electrical Installation and Maintenance Works in technical colleges in Edo State. Specifically, the purpose of the study is to:

- a. determine differences between the pretest and post-test mean scores of students taught EIMW using small-group discussion learning techniques and conventional teaching method in technical colleges in Edo State;
- b. investigate whether differences exist between the post-test scores of students taught EIMW using small-group discussion learning techniques and conventional teaching method on students' performance in EIMW in technical colleges in Edo State?

Research Questions

The following research questions were raised to guide the study:

- a. is there any difference between the pretest and posttest mean scores of students taught EIMW using small-group discussion learning techniques and conventional teaching method in technical colleges in Edo state.
- b. what is the significant difference between the posttest scores of students taught EIMW using small-group discussion learning teaching method and conventional teaching method on students' performance in EIMW in technical colleges in Edo State?

Hypotheses

The following hypotheses were formulated and tested at .05 level of significance:

- a. there is no significant difference between the pretest and posttest mean scores of students taught EIMW using small-group discussion learning and conventional teaching method in technical colleges in Edo State;

- b. there is no significant difference between the posttest scores of students taught EIMW using small-group discussion learning techniques and post test scores of students using conventional approach in technical colleges in Edo State;

Method of Study

The study adopted a quasi-experimental research design, specifically, the pretest and posttest, non-equivalent group design. According to Nworgu (2006) quasi-experimental design involved the use of intact class or pre-existing groups which are not equal in size. A quasi-experimental design means that experimental designs are applied to real situation. This is because the aim is to maintain the reality of the classroom and the conditions proper to it. Group I and II were the experimental group which received a pre-test followed by a treatment condition (small-group discussion learning technique), thereafter, a post-test. Group II was the control group, which received a pre-test followed by the control condition (lecture method) and then the post-test. The population of the study comprised all the 189 Voc. II Electrical Installation and Maintenance Works students in the six technical colleges in Edo State, Nigeria. and Sampling Technique 102 Electrical Installation and Maintenance Works students were Sample in Edo State technical colleges were used for the study. Purposive simple technique was used to select the two technical colleges in the three senatorial districts of Edo State, Nigeria. Each technical college constituted a treatment group. The selection of the schools to either of experimental or control group was done using the two intact classes. The sample distribution as shown in Table 1 below:

Table 1: Sample Distribution

Names of Colleges	Treatment Group	No of students
62 Government Sci. and Tech College Uromi. Edo State	small-group discussion	
40 Government Sci. and Tech College Benin. Edo State	Control Group	
Total		102

Source: Edo State Ministry Higher and Technical Education, (2019)

The instrument for the study was titled “Electrical Installation and Maintenance Works Achievement Test (EIMWAT)” developed by the researcher. The EIMWAT contained 60 multiple choice items with five options divided into two Parts. Part A and Part B. The version tagged Part A was used as pre-test while Part B was used as posttest. The lesson note was used by the Electrical Installation and Maintenance Works teachers who were the research assistants. Items in the EIMWAT

were drawn from the topics in Electrical Installation and Maintenance Works as specified in the NABTEB curriculum for Voc. II in technical colleges. The topics included; industrial electrical wiring tools, industrial electrical wiring accessories, industrial electrical wiring material, industrial electrical wiring symbols and fitting, industrial safety regulation in electrical wiring and simple industrial electrical wiring. The items specification for the EIMWAT measured knowledge, comprehension and application the instrument was a standardized NABTEB examination questions collated for a period of five years. In the experimental group E_{G1} small-group learning (PBL) was used in College A. The research assistants helped to provide assistance to the students. In experimental group I, the teacher selected the lessons topic in which small-group discussion learning was used to teach as indicated in the lesson plan. In experimental group II, the teacher used balloting technique to group the students into group of five students, making a total of eight groups. Groups were made up of mixed age, ability level, spatial ability and gender for the lesson. In experimental group E_{G1} , project-based technique was adopted in College A, students carried out simple industrial wiring project using electrical wiring tools, accessories, material, symbols and how to observe safety regulations in electrical wiring as small-group discussion learning in classroom.

Students in the treatment condition (PBL) participated in an average of two sessions per week until they reached the session requirement of 12 session total; however, all participants completed the interaction in an average of 6 weeks. In project-based technique, each tutoring session lasted for about 45 minutes in duration.

In the control group, students were taught the same electrical wiring concept by their teacher using the conventional teaching method with the prepared lesson plans. Each lesson lasted for 45 minutes. At the end of the six weeks teaching exercise; a posttest was then administered on the three groups using EIMWAT. The scores obtained from the two groups were compared to determine if there are significant differences in students' performance of the three groups. The data for the study was analyzed using mean, standard deviation, t-test and Analysis of covariance (ANCOVA). Mean and standard deviation were used to analyze the research questions raised for the study while t-test and Analysis of covariance (ANCOVA) were used to analyze data on the hypotheses and tested at .05 level of significance. t-test and ANCOVA were used to determine whether differences were significant.

Results

Research Question 1: Is there any difference between the pretest and posttest mean scores of students taught EIMW using project-based learning and conventional teaching method in technical colleges in Edo State?

Data for answering research question 1 are presented in Table 1

Table 1: Descriptive statistics of pretest and posttest students' performance mean scores taught EIMW using small-group technique and conventional teaching method

Group		N		Pretest		Posttest		$\bar{X}$ Diff	
$\bar{X}$	SD	$\bar{X}$	SD						
Experimental Group									
(small-group)		60	27.65	7.74	55.15	10.83			
Control Group									
(Lecture method)			4031.259.8140.438.68						

Table 1 shows the descriptive statistics with respect to the students' performance $\bar{X}$ scores for two groups (One control group and one experimental group). Table 1 shows that the pretest scores of these experimental and control groups had low $\bar{X}$ scores of 27.65 and 31.25 respectively. This indicates that the two groups exhibited low levels of performance $\bar{X}$ scores before treatment was administered. Table 1 also shows post-test scores with project-based and control as 68.13 and 40.43 respectively. Hence, results of the post-test mean scores shows that there is an increase in students' performance mean scores of the experimental group from 29.92 to 68.13 after the treatment with project-based approach. However, the post-test mean scores of the control group and the treatment group were 31.25 and 40.43 respectively. Thus, in comparison, this indicates that the students in the treatment group had higher scores than the students in the control group at post-test. This increase in posttest scores seen among the treatment group may be due to the project-based approach that was administered to the treatment group

Research Question 2: What is difference between the posttest scores of students taught EIMW using small-group Techniques and Conventional Teaching Methods on academic performance of students in EIMW in technical colleges in Edo State?

Data for answering research question 2 are presented in Table 2

Table 2: Mean Scores of Students Taught EIMW Using small-group and Conventional Teaching Method

Posttest	$\bar{X}$	Diff		
	X	$\bar{X}$	SD	
Small-group discussion	62	68.13	27.50	
Control Group	40	40.43		21.18
Mean			6.32	
Gain		27.7		

Table 2 shows a post-test mean scores of 62 students taught EIMW using small-group and 40 students taught EIMW using conventional teaching method in Edo state technical colleges. Posttest mean scores of the students' taught EIMW using small-group discussion was 68.13 with a standard deviation of 27.50. While students taught EIMW using conventional teaching method had 40.43 with a standard deviation of 21.18, indicating a mean gain of 27.7 with a standard deviation difference of 6.32. This analysis revealed that a mean gain between students taught EIMW using small-group and conventional teaching method in Edo state technical colleges was in favour of small-group.

Hypothesis 1

Hypothesis 1 There is no significant difference between the pretest and posttest mean scores of students taught EIMW using small-group discussion and conventional teaching method in technical colleges in Edo State.

ANCOVA Results for the Effect of Small-group Technique and Conventional Teaching Method on the Students' Performance Mean Scores

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1665.313 ^a	1	1665.313	20.449	.000	.208
Intercept	3933.845	1	3933.845	48.305	.000	.382
CONTROL GROUP	1665.313	1	1665.313	20.449	.000	.208

Error	6352.175	78	81.438			
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Tests of Between-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1665.313 ^a	1	1665.313	20.449	.000	.208
Intercept	3933.845	1	3933.845	48.305	.000	.382
CONTROL GROUP	1665.313	1	1665.313	20.449	.000	.208
Error	6352.175	8	81.438			
Total	110907.000	80				
Corrected Total	8017.487	79				

Corrected Model	23443.750 ^a	1	23443.750	264.732	.000	.685
Intercept	.261	1	.261	.003	.957	.000
SMALL-GROUP	23443.750	1	23443.750	264.732	.000	.685

DISCUSSION

Error	10803.887	122	88.556			
Total	246729.000	124				
Corrected Total	34247.637	123				

Total	110907.000	80				
Corrected Total	8017.487	79				
Corrected Model	23443.750 ^a	1	23443.750	264.732	.000	.685
Intercept	.261	1	.261	.003	.957	.000
SMALL-GROUP	23443.750	1	23443.750	264.732	.000	.685
DISCUSSION						
Error	10803.887	122	88.556			
Total	246729.000	124				
Corrected Total	34247.637	123				

Data for testing hypothesis 2 are presented in Table 3

Table 2:
ANCO
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Using

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1665.313 ^a	1	1665.313	20.449	.000	.208
Intercept	3933.	1	3933.845		.000	.382
CONTROL	1665.3	1	1665.313	20.449	.000	.208
Error	6352.15	8	81.438			
Total	110907.000	0				
Corrected Total	8017.487	79				
Corrected Model	23443.750 ^a	1	23443.750	264.732	.000	.685
Intercept	.261	1	.261	.003	.957	.000
SMALL-GROUP DISCUSSION	23443.750	1	23443.750	264.732	.000	.685
Error	10803.887	122	88.556			
Total	246729.000	124				
Corrected Total	34247.637	123				

a. R Squared = .208 (Adjusted R Squared = .198)

b. R Squared = .693 (Adjusted R Squared = .686)

Small-Group Discussion Technique and Conventional Teaching

Control group: $F(1, 79) = 20.449, p=.000$

Small-group discussion Approach: $F(1, 123) = 264.732, p=.000$

Analysis of covariance statistics (ANCOVA) was carried out to test if significant difference exists between the pretest and posttest students' performance mean scores - taught EIMW using small-group discussion technique and conventional teaching method. Results of the ANCOVA statistics was significant at $F(1, 79) = 20.449, p=.000$ for the control group and also significant at $F(1, 123) = 264.732, p=.000$ for the treatment group. The null hypothesis is therefore rejected and we conclude that there is a significant difference between the pretest and posttest students' performance mean scores - taught EIMW using small-group instructional technique and conventional teaching method in technical colleges in Edo State. The experimental group which received treatment of small-group approach had significantly higher scores than the control group which received conventional teaching method. Hence, treatment of small-group discussion technique is responsible for the

significant difference in mean scores.

Discussion

Results of hypothesis two reveals that there is a significant difference ($p < .05$) between the pretest and posttest students' performance mean scores taught EIMW using small-group instructional technique and conventional teaching method in technical colleges in Edo State. The results in this study clearly indicates that, small group discussions help the students' performance better, when compared with the conventional methods. When we compare small-group discussion approach to the conventional approach, this study shows small-group discussion is better probably because more attention is given and this helps the students develop good communication skills and problem solving skills and (Pal et al., 2015; Schmidt et al., 2011). Small-group discussions offer active participation of students, increases the teamwork ability, help in retention of knowledge and there by a helps in giving a better performance. It helps to increase the student- teacher relationship, which is proved to enhance the cognitive growth of the student (Padugupati et al., 2017). Similarly, Akinnuoye (2011) revealed that students taught with small-group teaching technique performed better in home economics than those taught with expository method. In line with this, study by Faradina and Sari (2016) showed a positive effect of small-group discussion in reading class on students' in reading comprehension. Although, the study carried out by Agapi and Evangelia (2016) revealed that students in the experimental group that studied literary texts in small-groups demonstrated higher individual competence in the development of interpretive strategies than those in the conventional method, the study further went ahead to show that the improvement between both groups was not statistically significant.

Conclusion

Building on the findings of this study, it was concluded that the use of small group discussion method enhances students' performance scores in Electrical Installation and Maintenance Works than the conventional teaching method. It was also found that there was no significant difference in students' performance scores based engender using the small-group discussion method

Recommendations

This paper recommends as follows:

1. In view of the effectiveness of project-based technique on the students' performance it is recommended that project-based approach should frequently be used in technical colleges by educators in Electrical Installation and Maintenance Works (EIMW).
2. Educators in technical education should understand that the quality of learning depends on the nature of interactions.
3. Administrators of Technical Colleges are recommended to provide the necessary support and conducive learning environment for educators to fully utilize project-based approach and small-group discussion technique.

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