



Effects of Project and Demonstration Teaching Methods on Male and Female Students' Achievement and Retention in Basic Electricity in Technical Colleges

Chibueze Nweke Nwalo^{1*} and Titus Iloduba Eze²

¹Department of Vocational and Technical Education, Alex Ekwueme Federal University, Ndufu-Alike, Ebonyi State, Nigeria.

²Department of Technology and Vocational Education, Nnamdi Azikiwe University, Awka, Nigeria.

Authors' contributions

This work was carried out in collaboration between both authors. Authors CNN and TIE designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Both authors managed the analyses and literature searches of the study. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AIR/2021/v22i230298

Editor(s):

(1) Dr. Ritu Singh, G. B. Pant University of Agriculture and Technology, India.

Reviewers:

(1) Aisha Saleh, Ministry of Defense, Kuwait.

(2) Nikola Kranjčić, University of Zagreb, Croatia.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/68185>

Original Research Article

Received 14 March 2021
Accepted 24 May 2021
Published 02 June 2021

ABSTRACT

The study ascertained the effects of project and demonstration teaching methods on male and female students' achievement and retention in basic electricity in technical colleges. Quasi-experimental design; precisely, pre-test, post-test and delayed post-test for non-randomized and unequal groups were used. Four research questions guided the study and four hypotheses were tested at 0.05 level of significance. Four technical colleges in Ebonyi State, each technical college offering basic electricity, were used. The population of the study comprised of 141 Technical College year II (TC II) students (85 males & 58 females). The project method instructional strategy group had 62 male and 13 female students whereas; the demonstration method instructional strategy group had 20 male and 46 female students. The instruments used in the study were Demonstration Method Instructional Manual (DMIM), Basic Electricity Achievement Test (BEAT) and Project Method Instructional Manual (PMIM), which were validated by three experts. The

*Corresponding author: E-mail: chibex2012@gmail.com;

instrument (BEAT) was administered twice to twenty (20) TC11 students in Enugu State and Pearson's Product Moment Correlation was used to obtain a reliability index of 0.89. Data collected for the study were analyzed using mean with standard deviation for research questions, while hypotheses were tested using Analysis of Covariance (ANCOVA). The study found that both the project and demonstration teaching methods improved male and female students' performances in basic electricity. However, male and female students taught basic electricity using project teaching method had better academic performance and retention in basic electricity, indicating that project teaching method was more effective on male and female students' achievement and retention in basic electricity than demonstration teaching method. The researchers therefore recommended project teaching method as a teaching strategy that could reduce the gender disparity in male and female students' achievement and retention.

Keywords: Technical colleges; basic electricity; project teaching method; demonstration teaching method; gender; achievement, retention.

1. INTRODUCTION

Technical college is an institution of learning geared towards producing craftsmen and master craftsmen with skills, knowledge and attitudes necessary for effective employment, self-reliance or advancement in science and technology. Technical colleges are the integral part of general education system that contributes significantly to the development of the society through developing physical, social, civic, cultural and economic competencies of students. The goals of technical colleges, as stated by Federal Republic of Nigeria, FRN, [1] 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 to give training and impart the requisite skills to individuals who shall be self-reliant economically and in tune with latest technology. Nwachukwu, Bakare and Jika [2] opined that in technical colleges, teachers guide male and female students in acquiring relevant skills, knowledge, and attributes for employment in the occupations.

Basic electricity according to Ogbu [3], deals with the fundamental issues of current-electricity, static-electricity and electronics as studied in schools and colleges. In basic electricity, students develop basic conceptual understanding of basic electrical concepts, including basic electrical measurements, basic electrical theory and understanding of how common electrical components work [4]. The objectives of basic electricity as outlined in the National Business and Technical Examination Board, NABTEB, (2019) syllabus are to equip students with: knowledge and understanding of

the basic concepts and principles of basic electricity. Included in the basic electricity concepts are the ability to use tools and equipment in maintenance as well as repair of electrical/electronic devices; the understanding of the principle of operation and the application of simple electrical/electronic devices; the understanding of safe working procedures and safety precautions in domestic and industrial installation. Basic electricity syllabus also guides candidates' knowledge and understanding of electrical and electronic principles, maintenance and repair of domestic and industrial equipment and safe working procedures. Numgwo, Emmanuel and Joseph (n. d.) stated that basic electricity deals with the basic issues of electrical and electronic engineering/technology by introducing the principles, concepts and practices of electrical and electronic in the lowest and simplest terms. Bela [5] opined that basic electricity provides manipulative and practical skills among students. Therefore, basic electricity equips male and female students with skills and knowledge to care, repair and maintain electrical appliance [6].

Gender refers to a state of being male or female, men or women. According to World Development Report [7] gender is a social and cultural construct, which distinguishes differences in attributes of men and women, girls and boys and accordingly refers to the roles and responsibilities of men and women. According to Oludipe [8], certain vocations and professions are traditionally made for men (medicine, engineering and technical education) and others for women (nursing, catering, office management). However, Okwelle, Dighobo and Patrick [9] pointed out that societal belief, parental preferences, teacher's attitude toward female students in technical education,

contributed significantly to low female participation and low achievement and retention of female students. Furthermore, gender has been listed by researchers, for example, Abubakar and Oguguo, [10]; Odagboyi, [11], as one of the factors that affect students' achievement and retention based on teaching methods. Several teaching methods could be more favourable in enhancing achievement and retention of male and female students, whereas, some of the teaching methods could produce significant effect on either males or females. It therefore requires considerable works to find the root causes of the discrepancy in male and female students' achievement and retention in basic electricity. Hence, effects of project and demonstration teaching methods on male and female students' achievement and retention in basic electricity become imperative.

According to Oyibe [12], project teaching method is a systematically planned understanding of a set of activities or tasks by the learners in a given period of time in which the learners are taught with special reference to the topic or project. In this case, the students carry out experiments on their own in form of projects in which they perform several activities that help them develop skills to produce an end product. A student becomes an independent learner who can supplement the formal classroom teaching with other activities that could enhance their understanding of basic electricity concepts. Furthermore, Project teaching method builds students on how to communicate and collaborate as teams, how to develop problem solving skills, how to manage themselves during construction exercises and how to think critically to achieve their goals [13]. Therefore, project teaching method engages the minds, hearts, and abilities of students, and also provides them with real world experiences relevant for learning. It is on that note that Zhang, Hansen and Andersen [14] opined that project teaching method allows students to explore real world problems and challenges. Costa [15] stated that project teaching method is a pedagogy that improves students' achievement and enhances retention. Anand, Singh and Fernandes [16] reported that project teaching method improves students' knowledge and construction practices. Similarly, Borich [17] summited that project-based instructional strategy offers solution to students' low achievement. In general, project teaching method could help to achieve effective instructional delivery in technical colleges [18].

This can be compared with the demonstration teaching method.

Umar [19] stated that demonstration teaching method involves the step- by- step processes teachers use to explain and demonstrate lessons to the understanding of students. According to Cabibihan [20], demonstration teaching method provides a multi-sensory means to describe concepts, ideas or product that may be otherwise difficult to grasp through verbal description alone. Himanshu (n. d.) stated that demonstration teaching method creates an atmosphere where students go into the learning process to develop their skills. Therefore, demonstration teaching method provides students an opportunity to gain background knowledge, observe the steps or procedures, the nomenclatures, and the safety precautions relating to the subject. It implies that demonstration teaching method allows students to learn various scientific methods and techniques, and how to operate various equipment in the laboratory. Giridharan and Raju [21] affirmed that demonstration teaching method promotes students' active participation and is highly effective in enhancing students' achievement and retention in engineering education. It is evident from the above discussion that demonstration teaching method could have significant impact on male and female students' achievement and retention in basic electricity.

Achievement according to Spinath [22], represents performance outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in school, college, and university. Hornby [23] stated that achievement is the ability of somebody to gain or reach a set goal through effort, skill or courage. It implies the art or process of finishing something successfully. Achievement is generally used to determine how well an individual is able to assimilate, retain, recall and communicate knowledge of what has been learnt. Achievement is usually measured using test and/or examinations. It is usually determined by grading or cumulative grade point average (CGPA) assigned by either with letters, range or percentage to determine the level of performances at a particular time. Therefore, achievement can be the examination performance of what the students learnt in basic electricity or skills acquired over a period of time. It also indicates the final results of both male and female students in basic electricity.

Retention ability is a vital component in the educative process, as it tells the worth of a student in subject areas in terms of skills and knowledge acquired overtime ([13]. Poor retention ability is an ever-present problem among higher education all over the world, and high student's retention ability is vital for the survival of educational institutions [24]. Retention has been of central concern to stakeholder especially parents, teachers and education policy makers [25]. However, to solve these problems, teachers should identify students' challenges and employ more effective teaching strategies that could enhance achievement and retention of male and female students in basic electricity. Several studies dealt on the importance of teaching methods on male and female students' achievement and retention. For example, Eze, Obidile and Akamobi [26] revealed that there is no significant difference in mean achievement and retention of male and female students in basic electricity. Meanwhile, Azih and Nwosu [27] affirmed that teaching method is an important factor for improving students' achievement and retention.

Nevertheless, similarities and disparities between gender, achievement and retention of students taught basic electricity using project and demonstration teaching methods have been of interest to the researchers. Several research findings showed the apparent discrepancies in achievement and retention of male and female students in science and technology. For example, Saka-Alikinla et al. [4] reported that mean score of male students taught basic electricity using guided inquiry instructional technique was higher than the female students. They went further to say that male students excelled in science and technology reasoning than female students. Fred [28] and Borich [17] found that female students performed better than male students in science and technology subjects when taught using demonstration teaching method. Other group of researchers submitted that sex has no noticeable impact on students' achievement in basic electricity. For instance, Robinson (2017) reported that gender had no influence on the performance of students in basic electricity when taught using Computer Aided Instruction (CAI). Astumbe, Owodunna, Raymond and Uduafemhe [29] affirmed that there was no significant effect of gender on students' achievement in basic electricity using scaffolding and collaborative instructional approaches. Sex factor as an area of educational research has generated conflict and inconclusive

findings; and its' disparities in male and female students' achievement and retention in science and technology subjects have not been settled. Despite the frequently reported positive findings on the effects of project and demonstration teaching methods on students' achievement and retention, its comparative effects on male and female students has not been ascertain. Hence, the present study.

1.1 Purpose of the Study

The study tends to determine the effects of project and demonstration teaching methods on male and female students' achievement and retention in basic electricity in technical colleges. Specifically, the study compared:

1. the mean achievement scores of male students taught basic electricity using project teaching method and those taught using demonstration teaching method.
2. the mean achievement scores of female students taught basic electricity using project teaching method and those taught using demonstration teaching method.
3. the mean retention scores of male students taught basic electricity using project teaching method and those taught using demonstration teaching method.
4. the mean retention scores of female students taught basic electricity using project teaching method and those taught using demonstration teaching method.

1.2 Research Questions

The study was guided by the following research questions:

1. What are the mean achievement scores of male students taught basic electricity using project teaching method and those taught using demonstration teaching method?
2. What are the mean achievement scores of female students taught basic electricity using project teaching method and those taught using demonstration teaching method?
3. What are the mean retention scores of male students taught basic electricity using project teaching method and those taught using demonstration teaching method?
4. What are the mean retention scores of female students taught basic electricity using project teaching method and those taught using demonstration teaching method?

1.3 Hypotheses

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

1. There is no statistically significant difference in mean achievement scores of male students taught basic electricity using project teaching method and those taught using demonstration teaching method.
2. There is no statistically significant difference in mean achievement scores of female students taught basic electricity using project teaching method and those taught using demonstration teaching method.
3. There is no statistically significant difference in mean retention scores of male students taught basic electricity using project teaching method and those taught using demonstration teaching method.
4. There is no statistically significant difference in mean retention scores of female students taught basic electricity using project teaching method and those taught using demonstration teaching method.

2. MATERIALS AND METHODS

Quasi-experimental research design, precisely, pre-test, posttest and delayed posttest for non-randomized and unequal groups were used in the study. Four research questions guided the study and four hypotheses were tested at 0.05 level of significance. Four technical colleges in Ebonyi State, each technical college offering basic electricity, were used. The population of the study comprised of 141 Technical College year II (TC II) students (85 males & 58 females). The entire population was used for the study, since the population was small and manageable. Simple random sampling (balloting) was used to assign two intact classes to demonstration method group and the other two intact classes to Project Method Group. The demonstration method instructional strategy group had 20 male and 46 female students whereas; the project method instructional strategy group had 62 male and 13 female students.

Demonstration Method Instructional Manual (DMIM), Basic Electricity Achievement Test (BEAT) and Project Method Instructional Manual (PMIM) were the instruments used for study. The researchers developed the instruments based on the content areas in basic electricity, such as:

electric current and potential difference, conductors and insulators, resistance, capacitors and capacitance. The table of specifications was used to allocate questions to content areas. BEAT consisted of two sections A and B. Section A elicited the background information of the students, while section B was a multiple-choice test comprising of 50-items with four options (A – D) per item adapted from NABTEB and WAEC past questions from 2005-2018.

Three experts were used to ascertain the validity of the instruments; two of the experts are from Technology Education programme, and one from Measurement and Evaluation unit, all from Nnamdi Azikiwe University, Awka. The recommendations, suggestions and corrections made were used to modify the final copies of the instruments. The reliability of the BEAT was established using a test-retest method and Pearson's Product Moment Correlation was used to obtain a reliability coefficient of 0.89. The Demonstration Method Instructional Manual (DMIM) was a set of lesson plans based on demonstration teaching method, whereas, Project Method Instructional Manual (PMIM) was a set of lesson plans based on project teaching method.

The researchers took permission from the school authority before the commencement of the experiments to involve staff and students in the study. The researchers therefore, organized a 2-day training conference for the teachers on the use of demonstration method instructional manual and project method instructional manual. The teachers were also exposed to detailed explanations on the use of project and demonstration teaching methods and other research expectations. The training programme was based on the aims and objectives of the research, the topics to be taught, use of lesson plans/manuals, the method of administration of Basic Electricity Achievement Test (BEAT) and general conduct of the study.

Moreover, the study took place during the normal school lesson periods. The normal time table of the school was strictly followed during the study. The regular school basic electricity teachers were used as research assistants. The students involved in the study were within the same age bracket and academic ability and were also the prospective candidates for NABTAB and WAEC examinations.

On the first week, before the lessons commenced, the instrument (BEAT) was administered as pre-test to the two groups after which the proper teaching commenced using the prepared instructional manuals/lesson plans. The two groups were taught the selected topics by the research assistants who were the regular class teachers, using project and demonstration teaching techniques. The teaching lasted for four weeks, after which the post-test was administered, their scores recorded and after two weeks of no activity, delayed posttest was administered in order to determine the retention. The content of BEAT was reshuffled and the colour of the paper changed each time the BEAT was used for data collection. The achievement and retention of male and female students were determined in terms of mean scores and mean gain. Differences in post-test mean scores and pre-test mean scores indicate achievement mean gain, whereas, differences in delayed post-test mean scores and post-test mean scores indicate retention mean gain. Furthermore, the research questions were answered using mean with standard deviation while the hypotheses were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA). The scores obtained from both groups were compared to determine if there was any significant difference in the two methods on male and female students' achievement and retention in basic electricity.

3. RESULTS

Research question 1: What are the mean achievement scores of male students taught basic electricity using project teaching method and those taught using demonstration teaching method?

The results of data analysis presented in Table 1 reveals that male students taught basic electricity using project teaching method had pre-test mean score of 32.83 with a standard deviation of 4.57, and post-test mean score of 73.10 with a standard deviation of 9.02, while their

counterparts taught using demonstration teaching method had pre-test mean score of 33.10 with a standard deviation of 5.96, and post-test mean score of 66.10 with a standard deviation of 6.82. Project teaching method had mean gain score of 40.27 which is relatively higher than 33.00 mean gain score of demonstration teaching method. However, the table did not show whether the observed difference is statistically significant or can be attributed to error variance. Therefore, the result was subjected to inferential testing as shown in hypothesis 1.

Hypothesis 1: There is no statistically significant difference in mean achievement scores of male students taught basic electricity using project method and those taught using demonstration teaching method.

Table 2 shows that at .05 level of significance, the value of F-calculated is 10.675 with p-value of 0.002 which is less than 0.05. The hypothesis is therefore rejected. This means that there was statistically significant difference in mean achievement scores of male students taught basic electricity using project method and those taught using demonstration teaching method. This implies that the observed difference in mean achievement scores of male students taught basic electricity using both project teaching method and demonstration teaching method was significant which cannot be attributed to error variance. With this result and the one shown in Table 1, it could be deduced that although project and demonstration teaching methods improved male students' achievement as shown in their mean achievement scores, however, male students taught basic electricity using project teaching method had higher mean achievement scores than their counterparts taught using demonstration teaching method. This suggests that project teaching method was more effective on male students' achievement in basic electricity than demonstration teaching method.

Table 1. Mean and standard deviation of male students' achievement in basic electricity

Teaching Method	No. of Subjects (N)	Test Type	Mean (X)	Standard Deviation (SD)	Gain Score
Project	62	Pre-test	32.83	4.57	40.27
		Post-test	73.10	9.02	
Demonstration	20	Pre-test	33.10	5.96	33.00
		Post-test	66.10	6.82	

Table 2. ANCOVA of Male Students' Achievement Scores in Basic Electricity

Dependent Variable: POSTTEST						
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	
Corrected Model	972.144 ^a	2	486.072	6.836	.002	
Intercept	5915.378	1	5915.378	83.191	.000	
PRETEST	231.851	1	231.851	3.261	.075	
METHOD	759.069	1	759.069	10.675	.002	
Error	5617.368	79	71.106			
Total	424508.000	82				
Corrected Total	6589.512	81				

Table 3. Mean and standard deviation of female students' achievement in basic electricity

Teaching Method	No. Of Subjects (N)	Test Type	Mean (X)	Standard Deviation (SD)	Gain Score
Project	13	Pre-test	32.61	4.86	42.62
		Post-test	75.23	9.88	
Demonstration	46	Pre-test	32.78	4.70	30.17
		Post-test	65.95	7.52	

Research question 2: What are the mean achievement scores of female students taught basic electricity using project teaching method and those taught using demonstration teaching method?

In Table 3, female students taught basic electricity using project teaching method had pre-test mean score of 32.61 with a standard deviation of 4.86, and post-test mean score of 75.23 with a standard deviation of 9.88, while their counterparts taught using demonstration teaching method had pre-test mean score of 32.78 with a standard deviation of 4.70, and post-test mean score of 65.95 with a standard deviation of 7.52. The female students taught basic electricity using project teaching method had mean gain score of 42.62 which is relatively higher than 30.17 mean gain score of their counterparts taught using demonstration teaching method. However, the table did not show whether the observed difference is statistically significant or can be attributed to error variance. Therefore, the result was subjected to inferential testing as shown in hypothesis 2.

Hypothesis 2: There is no statistically significant difference in mean achievement scores of female students taught basic electricity using project teaching method and those taught using demonstration teaching method.

Table 4 shows that at 0.05 level of significance, the value of F-calculated is 17.956 with p-value of 0.000 which is less than 0.05. The hypothesis

is therefore rejected. This means that there was statistically significant difference in mean achievement scores of female students taught basic electricity using project teaching method and those taught using demonstration teaching method. This implies that the observed differences in female students' achievement taught basic electricity using both project teaching method and demonstration teaching method was statistically significant which cannot be attributed to error variance. With this result and the one shown in Table 3 above, it could be deduced that although project and demonstration teaching methods improved female students' achievement as shown in their mean achievement scores, however, female students taught basic electricity using project teaching method had higher mean achievement scores than their counterparts taught using demonstration teaching method. This suggests that project teaching method was more effective on female students' achievement in basic electricity than demonstration teaching method.

Research question 3: What are the mean retention scores of male students taught basic electricity using project teaching method and those taught using demonstration teaching method?

The focus is on the post-test scores (b) obtained after the treatment and the delayed post-test score (c) obtained after an interval of two weeks of no activity. In Table 5 above, students taught basic electricity using project teaching method had post-test mean score of 73.10 with a

standard deviation of 9.02, and a delayed posttest mean score of 77.16 with a standard deviation of 8.38, whereas, students taught using demonstration teaching method had post-test mean score of 66.10 with a standard deviation of 6.82, and a delayed posttest mean score of 69.10 with a standard deviation of 7.00. The table therefore shows that project teaching method had retention mean gain score of 4.06 which is greater than 3.00 retention mean gain score obtained from demonstration teaching method. However, the table did not show whether the observed difference in mean retention scores of

students taught basic electricity using project teaching method and those taught using demonstration teaching method was statistically significant or can be attributed to error variance. Therefore, the result was subjected to inferential testing as shown in hypothesis 3.

Hypothesis 3: There is no statistically significant difference in mean retention scores of male students taught basic electricity using project teaching method and those taught using demonstration teaching method.

Table 4. ANCOVA of female students' achievement scores in basic electricity

Dependent Variable: Posttest						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	
Corrected Model	1790.103 ^a	2	895.052	17.889	.000	
Intercept	2136.754	1	2136.754	42.706	.000	
PRETEST	918.324	1	918.324	18.354	.000	
METHOD	898.424	1	898.424	17.956	.000	
Error	2801.897	56	50.034			
Total	277408.000	59				
Corrected Total	4592.000	58				

Table 5. Mean and Standard Deviation of Male Students' Retention in Basic Electricity

Method	Pre-test (a)		Post-test (b)		Delayed Post-test ©		Mean difference c - b
	Mean	Std	Mean	Std	Mean	Std	
Project method	32.83	4.57	73.10	9.02	77.16	8.38	4.06
Demonstration method	33.10	5.96	66.10	6.82	69.10	7.00	3.00

Table 6. ANCOVA of male students' retention scores in basic electricity

Dependent Variable: delayed posttest						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	
Corrected Model	5469.343 ^a	2	2734.671	292.920	.000	
Intercept	175.500	1	175.500	18.798	.000	
posttest	4486.652	1	4486.652	480.581	.000	
method	50.177	1	50.177	5.375	.023	
Error	737.535	79	9.336			
Total	469860.000	82				
Corrected Total	6206.878	81				

Table 7. Mean and standard deviation of female students' retention in basic electricity

Method	Pre-test (a)		Post-test (b)		Delayed Post-test ©		Mean difference c - b
	Mean	Std	Mean	Std	Mean	Std	
Project method	32.61	4.86	75.23	9.88	78.61	8.53	3.38
Demonstration method	33.78	4.70	65.95	7.52	67.69	7.78	1.74

Table 6 shows that at 0.05 level of significance, the value of F-calculated is 5.375 with p-value of 0.023 which is less than 0.05. The hypothesis is therefore rejected. This means that there was statistically significant difference in mean retention scores of male students taught basic electricity using project teaching method and those taught using demonstration teaching method. This implies that the observed difference in mean retention scores of male students taught basic electricity using project and demonstration teaching methods was significant which cannot be attributed to error variance. With this result and the one shown in Table 5 above, it could be deduced that although project and demonstration teaching methods improved male students' retention as shown in their mean retention scores, however, the male students taught basic electricity using project teaching method performed significantly higher in the mean retention score than their counterparts taught using demonstration teaching method. This indicates that project teaching method was relatively more effective on male students' retention in basic electricity than demonstration teaching method.

Research Question 4: What are the mean retention scores of female students taught basic electricity using project teaching method and those taught using demonstration teaching method?

In Table 7 above, female students taught basic electricity using project teaching method had post-test mean score of 75.23 with a standard deviation of 9.88, and delayed posttest mean score of 78.61 with a standard deviation of 8.53, whereas, female students taught basic electricity using demonstration teaching method had post-test mean score of 65.95 with a standard deviation of 7.52, and delayed posttest mean score of 67.69 with a standard deviation of 7.78. In Table 7, project teaching method had retention

mean gain score of 3.38 which is greater than 1.74 retention mean gain score obtained from demonstration teaching method. However, the table did not show whether the observed difference in the mean retention of female students taught basic electricity using project teaching method and those taught using demonstration teaching method was statistically significant or can be attributed to error variance. Therefore, the result was subjected to inferential testing as shown in hypothesis 4.

Hypothesis 4: There is no statistically significant difference in mean retention scores of female students taught basic electricity using project teaching method and those taught using demonstration teaching method.

Table 8 shows that at 0.05 level of significance, the value of F-calculated is 4.74 with p-value of 0.034 which is less than 0.05. The hypothesis is therefore rejected. This means that there was statistically significant difference in mean retention scores of female students taught basic electricity using project teaching method and those taught using demonstration teaching method. This implies that the observed difference in mean retention scores of female students taught basic electricity using project and demonstration teaching methods was significant which cannot be attributed to error variance. With this result and the one shown in Table 7 above, it therefore shows that although project and demonstration teaching methods improved female students' retention as shown in their mean retention scores, however, female students taught basic electricity using project teaching method performed better in the mean retention scores than their counterparts taught using demonstration teaching method. This further shows that project teaching method was relatively more effective on female students' retention in basic electricity than demonstration teaching method.

Table 8. ANCOVA of female students' retention scores in basic electricity

Dependent Variable: delayed posttest					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4012.161 ^a	2	2006.080	140.561	.000
Intercept	103.328	1	103.328	7.240	.009
posttest	2803.587	1	2803.587	196.440	.000
method	67.575	1	67.575	4.735	.034
Error	799.229	56	14.272		
Total	294752.000	59			
Corrected Total	4811.390	58			

4. DISCUSSION OF FINDINGS

The finding of this study revealed that project teaching method is more effective than demonstration teaching method on male students' achievement in basic electricity. This was further confirmed by the fact that there was a statistically significant difference in mean achievement scores of male students taught basic electricity using project teaching method and those taught using demonstration teaching method. The finding agrees with Olatoye and Adekoye [30] who posited that project teaching method was effective in enhancing achievement of male students in sciences than their counterparts taught using demonstration teaching method. Edmond and Ayodele [31] stated that project instructional approach was better in enhancing male students' achievement in building construction than demonstration teaching method. These previous studies have validated the findings of the present study that project teaching method is more effective than demonstration teaching method on male students' achievement in basic electricity. In contrast to the finding of the present study, Igboegwu [32] found that demonstration teaching method was more effective on male students' achievement in chemistry than project teaching method. Nevertheless, Sola and Ojo [33] affirmed that project teaching method brings more significant difference in male students' achievement when compared with those exposed to demonstration teaching method in separation of mixtures, as a model of experimental aspect of chemistry. This might be due to the interaction and friendliness that the project teaching method provides for students. Students in project group were better motivated to learn and develop new ideas and concepts. Furthermore, project teaching method provides avenue for learners' participation as it engages male students in an investigation in order to produce products, hence, more effective than demonstration teaching method on male students' achievement in basic electricity.

Furthermore, the study also found that project teaching method enhances female students' achievement scores in basic electricity more than demonstration teaching method. This was confirmed by the fact that there was statistically significant difference in mean achievement scores of female students taught basic electricity using project teaching method and those taught using demonstration teaching method. The finding of the study was supported by the report

of Zhang, et al. [14] who stated that project teaching method was more effective in improving female students' achievement in power electronics than demonstration teaching method. Borich [17] reported that project teaching method has the capacity to offer solution to the problem of female students' low achievement. However, in contrast to the present study, Ernest [34] found that female students produced better results in learning science subjects with demonstration teaching method. Fred [28] reported that female students performed significantly higher in learning chemistry with demonstration teaching method than project teaching method. Nevertheless, the present study found that project teaching method was relatively more effective than demonstration teaching method on female students' achievement in basic electricity. The finding was further supported by Anand, et al. [16] who stated that project teaching method was highly effective on female students' achievement. Project teaching method allows students to explore the real-world problems and challenges, hence, more effective than demonstration teaching method on female students' achievement in basic electricity.

The finding of this study revealed that project teaching method is more effective than demonstration teaching method in enhancing male students' retention in basic electricity. This was further confirmed by the fact that there was a statistically significant difference in mean retention scores of male students taught basic electricity using project teaching method and those taught using demonstration teaching method. The finding agrees with Okoro (2013) who stated that project teaching method enhances male students' academic retention in home economics more than other teaching methods. In the views of Tumba and Shuaibu (2016); Ogbuanya et al. [18], project teaching method is highly effective for teaching practical skills as it enhances male students' retentive abilities and understanding of concepts being taught. Project teaching method allows male students to experiment and discover facts on their own which promotes their retentive abilities. Project teaching method allows hand-on practice that improves retentive abilities of male students in basic electricity. These conform to the present study that project teaching method is more effective than demonstration teaching method in enhancing male students' retention in basic electricity.

The finding of this study revealed that project teaching method is more effective than demonstration teaching method in enhancing female students' retention in basic electricity. This was further confirmed by the fact that there was a statistically significant difference in mean retention scores of female students taught basic electricity using project teaching method and those taught using demonstration teaching method. The finding agrees with Freeba (2013) who posited that project teaching method helps learners to retain more knowledge than those who observed teacher's demonstration. Project teaching method helps female students to make connection between new and previous knowledge, ideas and facts in order to clear impressions and doubts. Project teaching method helps female students to confirm prepositions and apply it in real situations in order to solve problems.

5. CONCLUSION

Appropriate and effective teaching methods promote creative and critical reasoning that could reduce gender disparity in achievement and retention among basic electricity students. Male and female students taught basic electricity using project teaching method performed significantly higher in their achievement and retention in basic electricity than those taught using demonstration teaching method. This signifies that project teaching method could reduce gender disparity in the male and female students' achievement and retention.

6. RECOMMENDATIONS

Based on the findings of this study, the researchers made the following recommendations:

1. The researchers recommended project teaching method as a teaching strategy that could reduce the gender disparity in the male and female achievement and retention.
2. Government through its educational agencies should lay more emphasis on project teaching method as a strategy that enhances male and female students' achievement and retention in basic electricity considering the changes in industrial methods.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Federal Republic of Nigeria, F.R.N. National Policy on Education. Lagos. Government Printing Press; 2014.
2. Nwachukwu CE, Bakare JA, Jika FO. Effective laboratory safety practices skills required by electrical and electronic students of technical colleges in Ekiti State. Nigerian Vocational Association Journal. 2011;16(1):141-147.
3. Ogbu JE. Benchmark on the teaching effectiveness of basic electricity teacher in south Eastern Nigeria. European Scientific Journal. 2010;8(22):299-326.
4. Saka-Alikinla I, Owodunni AS, Babatunde HW. Comparative effects of structured and guided inquiry instructional techniques on students' academic achievement in basic electricity in Kwara State technical colleges. British Journal of Applied Science and Technology. 2016;14(6):1-10. Available:www.sciencedomain.org
5. Bela MJ. Academic performance; 2012. Available:http://www.education.ehowcom on June 20th, 2019
6. Ogbu JE. Effect of integrative application of interaction patterns on students' cognitive achievement in basic electricity. Journal of Science Teachers' Association of Nigeria. 2011;(46):71-81. Available:http://iis-db.stanford.edu
7. World Development Report. Gender Equality and development. Washington, D. C; 2012.
8. Oludipe DI. Gender difference in Nigerian Junior secondary students' academic achievement in basic science. Journal of Education and Social Research. 2012;2(1):93-99.
9. Okwelle PC, Dighobo H, Patrick S. Gender participation in technical and vocational education and training in technical colleges in Rivers State, Nigeria. International Journal of Innovative Social & Science Education Research. 2018;6(3):118—127. Available:www.seahipaj.org
10. Abubakar RB, Oguguo DO. Age and gender as predictors of college mathematics and science students. Proceeding of the 2011 International Conference on Teaching, Learning and Change; 2011.
11. Odagboyi IA. The effect of gender on the achievement of students in biology using the jigsaw method. Journal of Education and Practice. 2015;6(17):176 -179.

12. Oyibe OA. Effects of self-directed instructional method on secondary school students' achievement in social studies in Onueke Educational Zone of Ebonyi State. Unpublished doctoral thesis, Department of Arts and Social Science Education, Ebonyi State University; 2015.
13. Nwalo CN, Eze TI. Comparative effectiveness of project and demonstration teaching methods in improving students' retention ability in basic electricity in technical colleges. *Int. J. Educ. Pol. Res. Rev.* 2021;8(1):1-7.
DOI: <https://doi.org/10.15739/IJEPRR.21.001>
14. Zhang Z, Hansen CT, Andersen MAE. (nd). Teaching power electronics with a design-oriented and project-based learning method at the Technical University of Denmark Kgs. Lyngby 2800, ENMARK; 2015.
Available: <https://www.researchgate.net/publication/276428967>
15. Costa SR. Effective teaching methods in the master's degree: Learning strategies, teaching learning processes, teacher training, *European Scientific Journal.* 2014;1:106-120.
16. Anand S, Singh R, Fernandes FBG. Unique power electronics and drives experimental bench (PEDEB) to facilitate learning and research. *IEEE Trans. Educ.* 2012;55(4):573-579.
17. Borich GD. *Effective Teaching Methods, Research-Based practice* (7th ed.). New York: Pearson Education, Inc; 2011.
18. Ogbuanya TC, Akintonde AA, Bakare J. Assessment of practical skill training of technical college students in Electrical and Electronics Trade in Osun State, Nigeria. *International Journal of Applied Engineering Research.* 2017;12(18):7501-7514.
Available: <http://www.ripublication.com>
19. Umar F. Demonstration method of teaching meaning, advantages and disadvantages; 2013.
Available: <http://www.studylecturenotes.com/curriculum-instructions/demonstration-method-of-teaching-meaning-advantages-disadvantages26/06/2019>
20. Cabibihan JJ. Effectiveness of student engagement pedagogies in a mechatronics module: A 4- year multi-cohort study. *Journal of the NUS Teaching Academy.* 2013;3(4):125-149.
21. Giridharan K, Raju R. Impact of teaching strategies: demonstration and lecture strategies and impact of teacher effect on academic achievement in engineering education. *International Journal of Educational Sciences.* 2016;14(3):174-186.
22. Spinath B. Achievement. In *encyclopedia of human behaviour* (2nd ed.) San Diego, CA: Academic Press; 2012.
23. Hornby AS. *Oxford Advanced Learners Dictionary of current English* New York: oxford university Press; 2010.
Available: <https://www.pinterest.com/happy/teacher/classroom-managements>
24. Cotter B. Student retention - An issue, a discussion and a way forward For Higher Education Professionals; 2013.
Available: <https://cobek.com/pdf/Student-Retention-White-Paper.pdf>
25. Eze TI, Olumoko BO, Obi MN, Akingbemisilu AA. Effect of multimedia instructional strategy in enhancing students' academic retention ability: A Case Study of Ondo State Technical Colleges in Nigeria. *Advances in Social Sciences Research Journal.* 2020;7(8):451-460.
DOI: 10.14738/assrj.77.8658
26. Eze TI, Obidile JI, Akamobi OG. Relative effectiveness of constructivism and meta-Learning teaching methods on male and female students' academic achievement and retention in basic electricity in technical colleges. *Journal of Education and Practice.* 2019;10(33):58-64.
DOI: 10.7176/JEP/10-33-10
27. Azih, U & Nwosu, B. O. (2011). *Research Methods in Education: An Introduction.* Philadelphia: J.B Lippincott. Co
28. Fred GA. A comparative effectiveness of the lecture- demonstration and individual laboratory methods. *The Journal of Educational Research,* 1. 2010;3(5):355-365.
Available: [http://localhost/f:/JSTOR%20journal%20ofEducational%20research%](http://localhost/f:/JSTOR%20journal%20ofEducational%20research%20)
29. Astumbe B, Owodunni S, Raymond E, Uduafemhe M. Students' achievement in basic electronics: Effects of scaffolding and collaborative instructional approaches. *EURASIA. Journal of Mathematics, Science and Technology Education.* 2018;14(8):1-17.
DOI: 10.29333/ejmste/91898
30. Olatoye RA, Adekoye YM. Effect of project based, demonstration and lecture teaching

- strategies on senior secondary students' achievement in an aspect of Agricultural science. International Journal of Educational Research and Technology. 2010;1(1):19-29.
Available:<http://www.soeagra.com/ijert/vol1/ijert4.pdf>
31. Edmond AO, Ayodele O. Effect of project instructional approach on the achievement of building construction students in technical colleges in Ogun State, Nigeria. Global Journal for Research Analysis. 2014;3(5):35-38.
32. Igboegwu EN. Effect of guided discovery and demonstration teaching methods on achievement of chemistry students of different levels of scientific literacy Journal of Research in Curriculum and Teaching. Benue State University, Makurdi. 2012;6(1):445-458.
33. Sola OA, Ojo OE. Effects of project, inquiry and lecture-demonstration teaching methods on senior secondary students' achievement in separation of mixtures practical test. Educational Research and Review. 2007;2(6):124-132.
Available:<http://www.academicjournals.org/ERR>
34. Ernest FO. Relative effects of programmed instruction and demonstration method of students' academic performance in science. College study Journal; 2010.
Available:<http://www.adlog/c/r>

© 2021 Nwalo and Eze; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
<http://www.sdiarticle4.com/review-history/68185>