

EFFECTS OF COLLABORATIVE LEARNING METHOD ON STUDENTS ACADEMIC ACHIEVEMENT IN ELECTRICAL INSTALLATION IN TECHNICAL COLLEGES

OWODUNNI AYANDA SAMUEL, PhD

C/o Owodunni Mary Atinuke

Nigerian Educational Research and Development Council

Sheda. PMB 91, Garki, Abuja

e-mail Owoscosam@yahoo.com

Tel: 08091021107

Abstract

This study was designed to determine the effect of collaborative learning method on achievement of students in Technical Colleges. The study adopted a pre-test, post-test, non-equivalent control group, quasi-experimental research design which involved groups of students in their intact class assigned to experimental group and control group. The population of the study was 78 Tech II students of Electrical Installation in Technical Colleges in Federal Capital Territory, Abuja. Two research questions and three null hypotheses, tested at 0.05 level of significance, guided the study. The instrument used for data collection was Electrical Installation Achievement Test (EIAT). To ensure content validity of the EIAT, a table of specification was built for the test. The cooperative learning lesson plan and EIAT were subjected to face validation by three experts. The EIAT was trial-tested to determine its psychometric indices and reliability coefficient. The trial test for determining the coefficient of stability of the EIAT was carried out using test re-test reliability technique. Pearson Product Moment Correlation coefficient of the EIAT was found to be 0.83. Mean was used to answer the research questions; while ANCOVA was employed to test the hypotheses. Results from the study found out that cooperative learning approach is more effective in improving students' achievement in Electrical Installation than conventional method. There was an effect of gender on students' achievement in Electrical Installation favouring boys. The study also found out that there are no interaction effects of cooperative learning approach and gender on achievement of Technical College students in Electrical Installation. This simply means that the effectiveness of collaborative learning method on students' achievement in Electrical Installation does not depend on gender. Consequently, it was recommended that The National Board for Technical Education (NBTE) should carry out a review of Electrical Installation curriculum for Technical Colleges with a view to incorporating the collaborative learning approach into the teaching of Electrical Installation.

Introduction

Electrical Installation is one of the courses offered in technical colleges in Nigeria it comprise the following; Basic Electricity, Battery Charging, Domestic Installation, Industrial Installation, Cable Jointing and Winding of Electrical Machines. As contained in the National Board for Technical Education (NBTE) (2001) curriculum. The goal of Domestic Installation is to provide the trainee with the knowledge and skill to enable him carryout Electrical Installation in a building. Domestic Installation concerned with installation of electrical components or equipment in a building, surface wiring, conduit wiring as well as maintenance of electrical fittings; such as illumination lamps used in homes mostly within the range of 0.5V – 415V. Industrial Installation goals according to (NBTE 2001) are to provide the trainee with the knowledge and skills which will enable him carryout all types of industrial/factory installations. Industrial Installation involves voltage ranging from 415V and above is for industrial consumption using high tension conductors. Cable Jointing provides the trainee with knowledge and skills to enable him undertakes with proficiency various methods of cable jointing and terminations. To understand and apply all statutory regulations during electrical winding work, NBTE (2001) specify the goal of module of winding electrical machine as aimed at providing the trainee with the knowledge and skills to enable him wind or rewinding AC and DC

rotating/static machines up to 10kVA and select appropriate tools and equipment used for winding jobs. Winding of electrical machines involve both winding and rewinding of electrical motors and generators.

Electrical installations trade is taught by Electricity/Electronic teachers in Technical Colleges (Okoro, 2006). The technical colleges as one of the institutions in technical education delivery system is currently playing the role of a senior secondary school preparing students for tertiary education and of vocational training institution that offer training in trades whose skills are necessary to practice as a craftsman. In at least two of the colleges, the advanced craft courses are offered in selected trades to produce master craftsmen that are suitable for employment as instructors in the technical colleges, foremen supervisor in industry or be self employed.

In Vocational and Technical Institutions, Szczurkwa (1997) suggested that greater stress should be placed on providing students with broad learning and problem solving skills in order to prepare them for a wide range of challenges posed by technological advancement. Therefore, the development of work place thinking and problem solving skills in the students for 21st century workplace as suggested by UNESCO and ILO (2002) emphasized that there should be adjustment in the programmes of educational institutions. In the same vein, Ogwo & Oranu (2006) explained that the adjustment will affect the curricular implementation processes which are executed through learning experiences and content. They stressed further that these adjustments by the educational institutions would largely be pivoted on the instructional activities employed.

Despite the needs for adjustment, lecture method and demonstration method which are based on behavioural learning theories are still the main teaching/learning strategies employed for implementing the curriculum in the technical colleges. According to Oranu (2003) lecture and demonstration methods are content driven and certainly not learner-centered. Students are not given enough opportunities to participate in the class activities. These methods which are predominantly used in teaching Electrical Installation in the technical colleges are based on behavioural learning theories which according to Boyle, Duffy and Dunleavy (2003) emphasize knowledge transmission from the teacher to passive students and encourage rote memorization of facts. The consequence of the use of these strategies in teaching vocational subjects such as Electrical Installation in the technical colleges is that students are unable to retain their learning and apply it to new situation (Doolittle, and Camp, 2000). This method of teaching may also account for poor performance of vocational education students at public examinations (Aina 2000) and at the work place when employed on graduation (Fawcet and Howden, 1998)

It has therefore become apparent that the lecture method, which is currently the predominant teaching approach in Nigerian Technical Colleges, is inappropriate and ineffective for achieving the high objectives of the electrical/electronic programme. There is therefore, a need to search for more effective strategies which are suitable and efficient for promoting the level of electrical/electronic achievement beyond contemporary limits and to the satisfaction of the current electrical/electronic curriculum requirements for which collaborative learning instructional method is one (Adeyemi, 2008).

Collaborative learning is an instructional method in which students work in group toward achieving common goal. It suggests a way of dealing with students which respect and highlights individual group's members' abilities and contribution (Pernitz, 1996). According to Song, Koszaika and Grabowski (2005) students working together are engaged in the learning process instead of passively listening to the teacher. Pairs of students working together represent the most effective form of interaction (Schwart, Black, and Strange, 1991). When students work in group, valuable problem solving skills are developed by formulating ideas, discussing the ideas, receiving immediate feedback and responding to questions and comments by their bee during the classroom teaching and learning.

According to Adeyemi (2008), a number of research works have been carried out on the efficacy of cooperative and collaborative learning in Nigeria. Such studies include those of Esan (1999) and Adeyemi (2002). More recently, Terty (2010) investigated the effect of collaborative learning method on students' achievement and interest in English language tenses. It was the conclusion of all these studies that collaborative learning strategies seem more useful than other instructional strategies. Therefore, this study sought to determine the effect of collaborative learning method on students' academic achievement in Electrical Installation.

Statement of the Problem

Despite all effort by the government to ensure qualitative education at the technical colleges and bring about high competent products both in academic and employability, there have been persistent reports of high failure rate among graduates of the colleges (FME, 2001). One probable cause of the high failure of students in recent years according to NABTEB (2002) chief examiners' report is partly due to teaching methods employed by instructors to teach the students. It has also been observed that the lecture method and project method which are teacher-centered are the main teaching methods employed by technical teachers for implementing the curriculum. The shortcoming in this teacher-centered method of teaching could be responsible for poor performance of Electrical Installation students in public examinations (NABTEB, 2002)

Purpose of the Study

The study sought to determine:

1. The influence of collaborative learning method on students' academic achievement in Electrical Installation.
2. The influence of gender on academic achievement when taught Electrical Installation using collaborative learning approach.

Significance of the Study

The findings of the study will be of great importance to students, teachers, researchers, administrators, parents, textbooks writers and curriculum planners. Its applications will expose students of Electrical installation to various learning opportunities through acquisition of skills by way of collaborative learning. It will improve academic performance of students and this will in turn lead to more students offering Electrical Installation, thereby creating an opportunity for students to acquire the necessary skills needed for gainful employment and further studies. It is hoped that the findings of this study will also assist vocational and technical teachers to appreciate the need to adopt suitable instructional methods in teaching vocational and technical subjects in technical colleges. It will provide more insight on how to use collaborative learning method in teaching Electrical Installation in order to encourage more female participation in the trade.

Finally, the findings will provide empirical evidence which could serve as a guide to professional technical teachers, administrators, curriculum planners in their effort to help improve academic achievement of students. For administrators, the result of the study will be of immense importance for organizing conferences, workshops and seminars on new innovations in teaching and learning. The study may help curriculum planners to develop curriculum that will incorporate new teaching/learning innovations such as collaborative learning approach that will facilitate the training of Electrical Installation students in technical colleges.

Research Questions

The following are the research questions guided the study;

1. What is the influence of Collaborative learning method on students' mean achievement scores in Electrical Installation?
2. What is the influence of gender on students mean achievement scores when taught Electrical Installation using collaborative learning method?

Hypotheses

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

- HO₁: There is no significant difference between the mean achievement scores of students taught Electrical Installation with collaborative method and those taught with conventional method.
- HO₂: There is no significant difference between the effect of gender (male and female) on students achievement in Electrical Installation.
- HO₃: There is no significant interaction effect of treatments given to students and their gender with respect to their mean scores on the Electrical Installation Achievement test.

Methodology

Population of the Study

The population of this study comprised 78 (57 males and 21 females) year II students of Electrical Installation in all the technical colleges that offer Electrical Installation in Federal Capital Territory, Abuja. The entire population was used for the study.

Instrument for Data Collection

The instrument used for data collection for this study consists of Electrical Installation achievement test (EIAT). The EIAT which was used to test the achievement of students in Electrical Installation was developed based on the test blue print table. The pretest and posttest items were developed based on Electrical Installation modules. It consists of 25 – multiple choice items with five options. The construction of the test blue print was based on NBTE Electrical Installation trade curriculum and course specifications 2008. The EIAT was subjected to face and content validation by two experts in Electrical Installation and one measurement and evaluation expert. The reliability coefficient of the EIAT was found to be .83 using Pearson Product Moment after administering the instrument twice at two weeks interval on equivalent sample group in Government Technical College Minna, Niger State .

Lesson Plan

The researcher prepared two (2) sets of lesson plans for the teaching of the module set out for the study. These lesson plans were prepared from the units in the test blue print. Each set contains (6) lesson plans that lasted for a period of 3 weeks. One set of the lesson plan was written based on collaborative learning strategies. The subject teacher in the experimental group applied the collaborative learning lesson plan at different stages of instructional process, while the second set was prepared based on conventional approach in teaching Electrical Installation and the control groups were taught with conventional lesson plans.

Method of Data Collection

The Electrical Installation teachers administered the pretest and posttest EIAT to the treatment groups and control groups in their respective schools. The researcher marked the answer sheets of the EIAT to obtain the students' scores on the cognitive achievement before and after the treatment. The exercise provided baseline data on the dependent variable (Achievement of each treatment and control group).

Method of Data Analysis

Data collected for this study were analyzed using mean to answer all the research questions. The pre-test, - post-test mean gain of each group (control and experimental groups, boys and girls) were compared to determine the group that performed better. The null hypotheses were tested using Analysis of Covariance (ANCOVA) at 0.05 level of significance.

Results

The results of the data analysis are presented below in accordance with the research questions and hypotheses.

Research Question 1

What is the effect of collaborative learning method on student's academic achievement in Electrical Installation?

Table 1: Mean of Pretest and Posttest Scores of Experimental and Control Groups in the Academic Achievement Test

Group	N	Pretest	Posttest	Mean Gain
		\bar{X}	\bar{X}	
Experimental	33	4.22	22.64	18.42
Control	45	3.15	17.35	14.20

The data presented in Table 1 show that the experimental group had a mean score of 4.22 in the pretest and a mean score of 22.64 in the posttest making a pretest, posttest mean gain in experimental group to be 18.42. The control group had a mean score of 3.15 in the pretest and a posttest mean of 17.35 with a pretest, posttest mean gain of 14.20. With this result, the students in the experimental group performed better in the achievement test than the students in the control group. Hence, collaborative learning method is effective than the conventional teaching method on students achievement in Electrical Installation

Research Question 2

What is the effect of gender on academic achievement of students studying Electrical Installation?

Table 2 Mean of Pretest and Posttest of Male and Female Students Taught Electrical Installation in the Achievement Test

Gender	Collaborative Learning				Conventional Method			
	N	Pretest	Posttest	Mean Gain \bar{X}	N	Pretest	Posttest	Mean Gain \bar{X}
Male	24	3.30	24.08	20.78	33	3.11	15.75	12.64
Female	9	3.54	23.25	19.71	12	3.32	14.44	11.14

The data presented in Table 2 show that male students taught Electrical Installation with collaborative learning method had a mean score of 3.30 in the pretest and a mean score of 24.08 in the posttest making a pretest, posttest mean gain in the male students taught with collaborative learning method to be 20.78. Meanwhile, female students taught Electrical Installation with collaborative learning method had a mean score of 3.54 in the pretest and a posttest mean of 23.25 with a pretest, posttest mean gain of 19.71. Also, male students taught with conventional method had a mean score of 3.11 in the pretest and a mean score of 15.75 in the posttest making a pretest, posttest mean gain in the male students taught with conventional method to be 12.64. Meanwhile, female students taught Electrical Installation with conventional method had a mean score of 3.32 in the pretest and a posttest mean of 14.44 with a pretest, posttest mean gain of 11.14. With these results male students taught Electrical Installation had higher mean scores than female students in the Achievement Test. Thus, there is an effect attributable to gender on the achievement of students taught Electrical Installation.

Hypotheses

- HO₁: There is no significant difference in the mean achievement scores of students taught Electrical Installation with collaborative learning method and those taught with conventional method
- HO₂: There is no significant mean difference between the effect of gender (male and female) on students' achievement in Electrical Installation
- HO₃: There is no significant interaction effect of treatments given to students and their gender with respect to their mean scores on the Electrical Installation Achievement Test

Table 3 Summary of Analysis of Covariance (ANCOVA) for Test of Significance between the Mean Scores of Experimental and Control groups in the Achievement Test, Effects of Gender and Interaction Effect of Treatments given to Students and their gender with respect to their mean scores on the Electrical Installation Achievement Test

Source	Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	891.422 ^a	4	236.055	45.900	.000
Intercept	1614.003	1	1614.003	316.167	.000
Pretest	3.462	1	3.462	.666	.421
Group	768.660	1	768.660	142.314*	.008
Gender	23.069	1	23.069	3.423*	.025
Group * Gender	5.123	1	5.123	1.002	.428
Error	518.223	99	5.182		
Total	48978.000	104			
Corrected Total	1515.526	103			

*Significant at sig of F < .05

The data presented in Table 3 shows F-calculated values for mean scores of experimental and control groups in the achievement test, gender and interaction effect of treatments and gender on students' achievement in Electrical Installation. The F-calculated value for Group is 142.314 with a significance of F at .008 which is less than .05. The null-hypothesis is therefore rejected at .05 level of significance. With this result, there is a significant difference between the mean achievement scores of students taught Electrical Installation with collaborative learning method and those taught with conventional method. The F-calculated value for gender is 3.423 with a significance of F at .025 which is less than .05. This means that there is significant difference between the effects of Gender on students' achievement in Electrical Installation. Therefore, the null hypothesis of no significant difference between the effect of gender (male and female) on students' achievement in Electrical Installation is rejected at .05 level of significance. The interaction of treatments and gender has F-calculated value of 1.004 with significance of F of .319. Since .319 is higher than .05, the null hypothesis for interaction effect of treatment and gender is accepted. Hence, there is no significant interaction effect of treatments given to students and their gender with respect to their mean scores on the Electrical Installation Achievement Test.

Discussion

The data presented in Table 1 provided answer to research question one, results revealed that the main effect of collaborative learning method on students' achievement in Electrical Installation is higher than the main effect of conventional technique. At the same time, Analysis of covariance was used to test the first hypothesis, Table 3, at the calculated F-value (142.314), Significance of F (.008) and confidence level of .05 there was a statistically significant difference between the main effect of (collaborative and conventional method) on students achievement in Electrical Installation confirming that the difference between the main effect of collaborative learning and conventional method was statistically significant. The implication of this finding is that collaborative learning method is more effective than conventional method in enhancing students' achievement in Electrical Installation. The findings that collaborative learning has positive effect on students achievement is similar to the finding of Adeyemi (2008) who in their study found out that the adoption of cooperative/collaborative learning approach in the teaching of Social studies improved the students achievement in Social studies than the students taught with traditional instructional method. A possible explanation for the effectiveness of the collaborative learning method is the students' active involvement in learning process using cooperative learning and, 'knee-to-knee' communication posturing as the students interacts in groups with the learning materials.

The data presented in Table 2 provided answer to research question 2. Finding revealed that male students had a higher mean score in the Electrical Installation achievement test than female students. At

the same time, Analysis of covariance was employed to test the second hypothesis, Table 3, at the calculated F- value (3.423), significance of F (.025) and confidence level of .05, there was a significant difference between the main effects of gender (male and female) on students' achievement in Electrical Installation which confirmed that the difference between the achievement of male and female students in Electrical Installation was statistically significant favouring boys. The obvious implication of this finding is that there was an effect attributable to gender on achievement of students in Electrical Installation. This finding is similar to findings of several other studies that had been conducted on gender effects on achievement of male and female students in vocational and technical education. For instances, one of the important discoveries emerging from studies involving the effect of the constructivist instructional approach on achievement and retention of auto-mechanics students in technical colleges carried out by Owoso (2010) revealed that male students performed better than their female counterparts in auto-mechanics. This also affirms by Owodunni, (2009) that it has been documented that disparity exists between male and female students' performance in vocational and technical fields, and in some cases boys had an edge over girls in academic achievement (Mbah, 2002). Generally, boys were consistently found to perform better than girls on vocational and technical achievement tests suggesting that boys generally possess greater vocational and technical skills than girls. Male advantages in vocational and technical skills have been established in studies by Mbah (2002), where the trends of gender differences were found to be stable and consistent. The identified gender effect on achievement in Electrical Installation was responsible for the significant gender effect found on students' achievement in Electrical Installation. However, Analysis of covariance was used to test hypothesis three, Table 3. At the calculated F-value (1.002), significance of F (.428) and confidence level of .05, there was no interaction effect of treatment given to students and their gender with respect to their mean scores on Electrical Installation Achievement test.

Conclusions

The need to find the best method to assist students in learning Electrical Installation Trade is essential for achievement in engineering profession as a whole. The study therefore, set out to determine the influence of collaborative learning approach on academic achievement of Electrical Installation students in Technical Colleges. It is hoped therefore, that if collaborative learning approach is taken into consideration in the teaching of Electrical Installation in Technical Colleges, the craftsmen trained will graduate with Electrical Installation skills in strong problem solving, creative thinking, cooperative work, and independent decision making skills which will make them adaptable to the present and envisaged changes in the electrical industries occasioned by technological advancement. Consequently, the craftsmen will be able to improve on their learning and pass their NABTEB examinations with better grades, contribute their own quota to industrial development of this nation, and become employers of labour instead of hoping solely on paid employment. Based on the findings, it was recommended that technical college teachers should adopt the use of collaborative learning approach to teach Electrical Installation.

References

- Adeyemi, B. A. (2008). Effects of cooperative learning and problem-solving strategies on junior secondary school students achievement in social studies. *Electronic Journal of Research in Educational Psychology*. No 16, Vol. 5 (3) pp. 691-708
- Aina,, O. (2000). Nigeria technical and vocational education in the near future. In Federal Ministry of Education (2001), *The National Master-plan for Technical and Vocational Development in Nigeria in the 21st Century with the Blue Print for the Decade 2010*. Abuja, FME.
- Adeyemi, S. B. (2002). Relative effects of cooperative and individualistic learning strategies on students declarative and procedural knowledge in map work. Unpublished Ph.D Thesis, University of Ibadan
- Boyle, E. A. Duffy, T & Donleavy, K (2003), Learning Styles and Academic Outcome: The Validity and Utility of Vermants Inventory of Learning Style in a British Higher Education setting. *British Journal of Educational Psychology*. 73(2), 267 – 290.
- Doolitte, H. & Camp, V. (2000) *Constructivism: The Career and Technical education*. Un-published doctoral thesis, V.A. Virginia polytechnic institute and state university.

- Esan A.D (1999). Effects of cooperative and individualistic problem-solving strategies on Students learning outcomes in secondary Mathematics. Unpublished Ph.D Theses..University of Ibadan.
- Fawcet, F., & Howden, C. (1998). Gender issue in technical and vocational education. In Dyankov, A. Current Trends and Issues in Vocational and Technical Education. Retrieved May 12 2005, from <http://www.unesco.org>
- Federal Ministry of Education (2001). *National master plan for technical and vocational education, Development in Nigeria in the 21st Decade*. Abuja: Publishers.
- Mbah, P.E. (2002). Effects of two instructional methods and some moderator variables on Junior secondary school Home Economics students Academic Achievement. Unpublished Ph.D thesis. University of Benin.
- National Business and Technical Examination Board (2000). Condition for Award of National Technical Certificate (NTC) and National Business Certificate (NBC). NABTEB Newsletter, July, 2 (7): 14. NRDC Press.
- National Board for Technical Education (NBTE), (2001). *National technical certificate examination (craft level) syllabus for engineering trades based on the NBTE modular curricular*. Kaduna: NBTE
- National Business and Technical Examination Board (2006). Chief Examiners Report of National Technical Certificate (NTC) and National Business Certificate (NBC). NABTEB Newsletter, Nov, 4 (6): 21. NRDC Press.
- Ogwo, B. A., & Oranu, R. N. (2006). *Methodology in informal and nonformal technical/vocational education*. Nsukka: University of Nigeria press.
- Okoro, O.M. (2006). Principles and Methods in Vocational Technical Education, Education Nsukka: University Trust Publishers.
- Oranu R. N. (2003) Vocational and Technical education in Nigeria. Retrieved on July 18, 2005 from <http://www.lbec.unesco.org>.
- Owoso, J. O (2009). Effects of the Constructivist Instructional Approach on Achievement and Retention of Automechanics Students in Technical Colleges. Unpublished PhD, University of Nigeria, Nsukka.
- Owodunni, A. S. (2009). Gender Inequality in Vocational and Technical Education: Implication for female education in Nigeria. ASO Journal of Education (1)2
- Paul, R. W. (1986). *Programme for the international conference on critical thinking and education*. Rohert park, C.C. Sonoma state University centre for critical thinking and moral critique.
- Pernitz,, T. (1996). A definition of collaborative vs cooperative learning. Retrieved May 10, 2004, from <http://www.tiger.coemissauri.edu.-vlib/Pernitz.htm>
- Szczurkowska, S. D. (1997). Training of teachers/trainers in technical and vocational education. Retrieved march 20, 2006 from <http://www.unevoc.unesco.org/publications/studies/studies-11e>
- Torty, O. A. (2010). Effects of collaborative learning method on students achievement and interest in English language tenses. Unpublished PhD Thesis, University of Nigeria, Nsukka.
- UNESCO (1996), *Development of Technical and Vocation Education A Comparative Study* Paris. UNESCO.
- UNESCO & ILO (2002). *Technical and vocational education and training for the twenty-first century*. Paris: UNESCO.