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Effect of cooperative learning on practical performance among technical college students learning domestic electrical installation: A mixed-method study

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Abstract: A search for an alternative instructional method to enhance students' practical performance in domestic electrical installation informed this sequential explanatory mixed method study which investigated the effect of cooperative learning on practical performance in electrical installation among technical college students in Bayelsa State, Nigeria. The study participants comprised 55 students of electrical installation and maintenance works trade in technical colleges in Bayelsa State, Nigeria. During the first phase of the study, a validated Domestic Installation Performance Test, pilot tested for reliability, was used for data collection at the pretest and posttest stages. After the pretest, a total of 22 students in the experimental group were exposed to instruction through cooperative learning while 33 students in the control group were exposed to instruction through the conventional teaching method. The second phase of the study used open ended questions to explore the experiences of 13 students from the cooperative learning group. Descriptive and inferential statistics were for analysisng quantitative data and thematic analysis for qualitative data. Cooperative learning enhanced students' practical performance than the conventional teaching method. This was explained by knowledge sharing, teamwork and interdependence among others. Cooperative learning was effective in enhancing practical performance in domestic electrical installation among student.

Keywords: Cooperative learning, practical performance, electrical installation, group learning, technical colleges

1. Introduction

Technical and Vocational Education and Training (TVET) provides education and training to equip individuals with competencies for smooth transition to paid or self-employment. Technical colleges in Nigeria are among the access points to TVET. They offer programmes in various trades designed to equip students with relevant knowledge and practical skills. One of these trades is Electrical Installation and Maintenance Works. Domestic electrical installation is one of the modules in Electrical Installation and maintenance Works. The goal of domestic electrical installation is to equip students with the competencies required to install and maintain electrical systems in residential buildings. Specific areas of competences include: understanding of working diagram, knowledge of different types of domestic surface and conduit wiring, understanding of the principles underpinning protection of electrical devices and their installation, understanding of the procedure for inspection and testing of domestic installation and understanding of different types of lamps used in domestic installation (National Board for Technical Education, NBTE, 2001; 2007; 2010).

As a practical based programme, practical performance is vital for students to successfully gain entrance into a career in electrical installation and maintenance work. Practical performance involves an individual's ability to utilise knowledge in real life situations. It also encompasses the demonstration of skills in doing something (Yusof & Fauzi, 2013). Students of electrical installation and maintenance work require skills in diagnosing and resolving problems related to: identification and fixing of faults in wire and cable connection, circuit overload, grounding problems, voltage fluctuations, environmental issues such as moisture and corrosion on equipment and devices or corrosive substances, loss of power supply, electric shocks and safety hazards among others (Linsley, 2008; Scaddan, 2008; Onoh & Onyebuenyi, 2015; Olojuolawe, et al., 2019; Obadiah, et al., 2021). Students' ability to demonstrate these skills contributes to their

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practical performance in Electrical Installation and Maintenance Works. Practical performance in domestic installation is vital for students of electrical installation and maintenance work from technical schools. This is because they are expected to occupy job positions as craftsmen or technicians in industries where they will carry out installation and maintenance services in residential, commercial and industrial buildings.

Although, practical performance is very important to the students of electrical installation and maintenance works, literature shows that it is minimally possessed by students of electrical installation and maintenance works in technical colleges in Nigeria. For example, Eze and Ekuma (2016) lamented that graduates from technical colleges have limited skills in installing and diagnosing faults in electrical installation. Furthermore, Olusola (2020) found that problem-solving skills were lacking among graduates of technical colleges. One key factor that plays a very important role in the improvement of students' learning performance and achievement is the instructional method employed by the teacher (Olowa, 2009; Umaru, et al., 2022).

Technical colleges in Nigeria provide training to equip students with skills to transit smoothly to the world of work. Consequently, the curriculum emphasizes utilisation of demonstration instructional method (NBTE, 2001; NBTE, 2007; NBTE, 2010). To this end, the teachers rely heavily on demonstration during instructional delivery. After demonstration, the teacher gives activities to students in form of individual project to be accomplished in the workshop or at home. Although demonstration teaching method is perceived to promote knowledge retention and acquisition of psychomotor skills (Auwal; Daluba in Ogweno, et al. 2021), literature shows that despite utilization of this teaching method, students of electrical installation and maintenance works in technical colleges in Nigeria, still perform poorly in external examination set by National Business and Technical Education Board (NABTEB) (Osuyi, et al., 2021; Imam, et al., 2023).

The present study on cooperative learning was motivated by the search for an alternative instructional method capable of enhancing students' competence in domestic electrical installation. More so, usage of cooperative instruction has been advocated by a number of researchers. Awofala et al. (2012) recommended the usage of student team achievement division, a variant of cooperative instruction by teachers to complement the teaching of mathematics. Similarly, Saleh (2011) recommended the adoption of cooperative learning strategy as an effective instructional strategy to improve students' performance. Furthermore, Iyer (2013) advocated for cooperative learning approach as it leads to higher academic performance, self-esteem and greater comprehension of content among students.

Conducting this study is very crucial as it could provide insights into how cooperative learning can enhance practical performance in domestic electrical installation among students. When students' practical skills are enhanced, they become better prepared for work after graduation. The study is also important as its findings could inform policy makers in the educational system, school administrators as well as teachers and instructors of electrical installation and maintenance works in Technical Colleges on the efficacy of cooperative learning as an alternative to demonstration teaching method. This information could guide curriculum review and instructional delivery towards integrating student-centred instructional methods like cooperating learning that places emphasis on collaboration. Furthermore, the present study is needed as it will extend research findings of cooperative learning to the specific area of practical performance in domestic electrical installation in the context of technical colleges in Bayelsa State, Nigeria. Consequently, the result of the study will add to the body of knowledge on the effectiveness of cooperative learning.

1.1 Purpose of the Study

The aim of the present study was to investigate the effect of cooperative learning on practical performance in domestic electrical installation among students of technical colleges in Bayelsa State, Nigeria. To achieve this purpose, two research questions and one hypothesis guided the study.

1.2 Research Questions

1. What is the difference in practical performance in domestic installation between students taught using cooperative learning and conventional demonstration methods?
2. What are the experiences of students exposed to instruction in domestic installation through cooperative learning?

1.3 Hypothesis

There is no significant difference between practical performance in domestic installation of students taught using cooperative learning and conventional demonstration method.

2 Literature Review

Cooperative learning is an instructional strategy where students are organised into interactive groups of four, five or six members with different levels of abilities with the aim of sharing knowledge (Slavin, 2006; Aluko & Olorundare, 2007; Santrock, 2011; Seifert and Sutton, 2009). Cooperative instruction is characterised by positive interdependence; individual accountability; face-to-face interaction; social skill and group processing. It promotes knowledge retention,

learning satisfaction, critical thinking, teamwork, problem-solving, entrepreneurship, managerial and communication skills (Chikodili et al., 2020; Moreno, 2010; Escobar Moreno et al., 2025). Cooperative learning strategies such as think-pair-share, Students Teams-Achievement Division (STAD) and group projects promotes participation, creativity and motivation among students which enhance performance in practical tasks and technical and vocational education and training (Ismail et al., 2023; Khalid & Pg Hj Metersad, 2016; Kamal et al., 2023; Lucas et al., 2012). These skills are highly relevant in preparing students of technical and vocational education and training for work (Halik Bassah & Mohd Asri, 2023). Furthermore, Antón, et al. (2011), in their project-based learning approach to the teaching of electrical installation, noted the importance of cooperative learning as a major complementary component of project-based learning approach.

Cooperative learning is rooted in the theory of constructivism. This is a cognitive view of learning which holds that learners are actively involved in constructing knowledge during learning (Slavin, 2006). There are two perspectives on constructivism. These are social and cognitive constructivism. Social constructivism which is based on Lev Vygotsky's work in 1978, states that learners learn by sharing individual perspectives with each other to construct knowledge that may not have been possible if done individually (Vygotsky, 1978; Moreno, 2010; Omodan, 2022). On the other hand, cognitive constructivism is based on the work of Jean Piaget in 1971 (Rahim, et al., 2021). It states that learners learn by actively constructing knowledge in their minds, individually as they encounter information or situations in the environment that conflict with existing knowledge (Moreno, 2010; Misman, et al., 2021; Futurelearn, 2022). Cooperative learning provides a learning environment where students can actively construct knowledge in domestic electrical installation on their own (cognitive constructivism) as well as learn from peers (social constructivism).

Results from empirical literature show that utilization of cooperative learning has positive effect on students' learning outcomes across various subject areas and context (Aluko & Olorundare, 2007; Olatoye, et al., 2011; Saleh, 2011; Awofala, et al., 2012; Oloyede, et al., 2012; Saba, et al., 2014; Tumba & Andeyarka 2014; Huang, et al., 2017; Appiah-Twumasi, et al., 2020; Trujillo-León, et al., 2022; Wang & Wu, 2022). However, majority of these studies investigated the effect of cooperative learning generally on cognitive performance among students and had little or no focus on practical performance or development of skill (Olatoye, et al., 2011; Saleh, 2011; Awofala, et al., 2012; Oloyede, et al., 2012; Saba, et al., 2014; Tumba & Andeyarka, 2014; Appiah-Twumasi, et al., 2020). Although some empirical studies have focused on the effect of cooperative learning on specific skills such as problem-solving skills (Aluko & Olorundare, 2007; Trujillo-León, et al., 2022; Wang & Wu, 2022), critical thinking and skill development (Huang, et al., 2017), there exists a gap in the literature on the effect of cooperative learning on practical skills especially in the context of technical colleges in Nigeria. Among the studies which focused on the link between cooperative learning and practical performance or skills, only the study by Sata, et al. (2014) was conducted in technical colleges, focusing on students of electrical installation and maintenance works in Nigeria. This paucity of empirical studies on cooperative learning and its effect on practical skill and or performance in electrical installation in the context of technical colleges in Nigeria, informed the need for this study.

3 Methodology

The study adopted a mixed method research approach. Specifically, the study utilised sequential explanatory mixed method design. This is a research design employed when the researcher intends to use qualitative approach in the second phase of a research to explain quantitative result of the first phase of a study (Gay, Mills & Airasian, 2012; Onwuegbuzie, & Leech, 2006). This study aimed to use qualitative findings from open-ended responses in the second phase to explain the quantitative results obtained in the first phase. Consequently, a sequential explanatory mixed-method design was considered appropriate. The first phase of the study adopted a non-randomised control group, pretest-posttest quasi-experimental design. This design is used in situations where it is practically impossible to randomly assign research subjects into experimental and/or control groups. In such cases, intact groups are randomly assigned to experimental and control groups. (Lodico, et al., 2006; Ary, et al., 2010; Creswell 2012). The present study was conducted in technical colleges in Bayelsa state, Nigeria. As such, it was not feasible to start selecting students from some of the schools and randomly assigning them to either control or experimental group. Consequently, intact classes were randomly assigned to control and experimental groups. For this reason, quasi-experimental design was considered appropriate. Usually, in this design, after the intact assignment, a pretest is administered to the experimental and control groups. Then the experimental group is treated with the intervention programme while the control group is treated with the conventional programme for same length of time. After the treatment, a posttest (same as the pretest) is administered to both groups. The design is shown in Table 1.

Table 1: *Nonrandomized control group, pretest–posttest design*

Group	Assignment	n	Pretest	Independent Variable	Posttest
Experimental	No random assignment	22	*DIPT	Instruction using Cooperative learning	*DIPT
Control	No random assignment	33	*DIPT	Instruction using conventional teaching method	*DIPT

*DIPT (Domestic Installation Performance Test) (Source: Adapted from Ary, et al., 2010).

The study sample comprised 55 Technical II students specializing in Electrical Installation and Maintenance Works from two technical colleges in Bayelsa State, Nigeria. The sample was obtained through cluster sampling technique. Two schools were randomly selected from the five technical colleges of the state. These two schools were randomly assigned into control and experimental groups. In technical colleges in Nigeria, "Domestic Installation" or "Domestic Electrical Installation" is a module taken by Technical II (Year 2 of 3 years programme) students of electrical installation and maintenance works trade. This informed the choice of Technical II students as sample for the study. The school selected as control group had a total of 33 students while the school selected as experimental group had a total of 22. The two teachers in charge of electrical installation and maintenance works from the two selected schools were also involved in the study. They served as research assistants.

To commence the first phase of the study, a Domestic Installation Performance Test (DIPT) was first administered to the experimental and control groups. The DIPT comprises 36 questions used to assess performance knowledge and skills in areas of domestic electrical installation. These include: interpretation of working diagram (four questions), surface wiring (eight questions), conduit wiring (eight questions), inspection and testing (six questions), and protective devices (10 questions) (See Appendix). This first test served as pretest. The test instrument was constructed by the researchers and crossed checked for validity by the teachers of electrical installation in technical colleges in Bayelsa State, Nigeria. To enhance reliability of the test instrument, a pilot test was conducted by administering it to a small group of electrical installation and maintenance works students. After the administration, potential issues with the instrument were identified and resolved.

After the pretest, the experimental group comprising of 22 students was exposed to instruction in domestic electrical installation using cooperative learning. They were divided into five groups with four groups having four members and one group having six members. The teacher taught the students using the traditional demonstration teaching method (NBTE, 2001). After the instruction, students were provided with materials for hands-on exercise. At this stage, the students worked together in cooperative groups to accomplish tasks. At intervals the teacher went round the groups to observe what they were doing and provided assistance were necessary. The groups had group leaders who were responsible for coordinating the activities of the group. Furthermore, the groups were made up of members of mixed abilities. The students solved problems together, sharing ideas and interacting with each other in their groups to proffer solution to problems. The instruction took a full term consisting of about three months. At the end of each module (interpretation of working diagram; surface wiring; conduit wiring; inspection and testing; installation of protective devices) of instruction, there was time for general discussion during which, representatives of each group came out and shared ideas with everybody in the class. At the end of instruction, the Domestic Installation Performance Test (DIPT) was administered the second time. This second test served as the post-test.

After the pretest, the control group comprising the 33 students was also exposed to instruction in domestic installation using demonstration teaching method by the teacher. At the end of demonstration, students were provided with materials for hands-on exercise. However, students worked on tasks and projects individually. The instruction took a full term consisting of about three months of learning. At the end of each module (interpretation of working diagram; surface wiring; conduit wiring; inspection and testing; installation of protective devices) of instruction, there was time for presentation of completed work with everybody in the class. At the end of instruction, the Domestic Installation Performance Test (DIPT) was also administered the second time. This second test served as the post-test.

One of the potential problems with quasi-experimental research designs is absence of randomization of sample. This could easily introduce selection bias which may threaten the internal validity of the study (Ary, et al., 2010). The pretest administered before the commencement of treatments was used to deal with this threat. The aim was to check for equivalence of the two groups on the dependent variable (practical performance in domestic installation). The result showed there was no significant difference in the means of the two groups ($t(53) = 1.825$; $p > .05$) on the pretest scores as shown in Table 2.

Table 2: Test for equivalence of groups on pretest

	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	p-value	t	df	p-value
Equal variances assumed	0.007	0.934	1.825	53	0.074
Equal variances not assumed			1.813	44.10	0.077

To further deal with threat to internal validity, the two groups took the same pretest and posttest. They also underwent treatment for the same length of time (three months, full term). The treatments took place within the usual school calendar as the instruction took place within the term that domestic electrical installation is specified in the curriculum. In addition, the schools selected for the study were all government owned technical colleges within the same geographical area with similar characteristics in terms of resource provision. To deal with threat to external validity in the study, random sampling was employed in selecting two schools out of the five technical colleges.

Analysis of data for the study was carried out using both descriptive and inferential statistics. Specifically, mean and standard deviation were used as descriptive statistics to answer the research questions while t-test was used as inferential statistics to test the hypotheses at .05 alpha level of significance. Specifically, paired t-test was used to test hypotheses one and two. This is because these hypotheses focused on testing statistical significance between two means (pretest and posttest scores) from one group (control or experimental group). Welch's t-test was used to test hypothesis three.

To utilize t-test, test of normality was conducted. The test of normality showed a skewness of -.790 (SE = .491) and kurtosis of .523 (SE = .953) for the cooperative learning group and a skewness of -.780 (SE = .409) and kurtosis of .182 (SE = .798) for the conventional method group (See Table 3). Although these values show that the data for the posttest scores were a little skewed (z = -1.61 and -1.91 for the experimental and control groups respectively) and kurtotic (z = -.55 and -.23 for the experimental and control groups respectively), it did not differ significantly from normality as the z values fell within the range of -1.96 and 1.96 (Doane & Seward, 2011).

Table 3: ***Normality test***

Descriptives

Method				Statistic	Std. Error	z-value
Score	Cooperative Learning method	Mean		82.50	1.425	
		95% Confidence Interval for Mean	Lower Bound	79.54		
			Upper Bound	85.46		
		5% Trimmed Mean		83.01		
		Median		85.00		
		Variance		44.643		
		Std. Deviation		6.682		
		Minimum		65		
		Maximum		90		
		Range		25		
		Interquartile Range		11		
		Skewness		-0.790	0.491	-1.60957
		Kurtosis		0.523	0.953	0.548653
	Conventional teaching method	Mean		76.67	2.002	
		95% Confidence Interval for Mean	Lower Bound	72.59		
			Upper Bound	80.75		
		5% Trimmed Mean		77.24		
		Median		80.00		
		Variance		132.292		
		Std. Deviation		11.502		
		Minimum		50		
		Maximum		95		
		Range		45		
		Interquartile Range		15		
		Skewness		-0.780	0.409	-1.90971
		Kurtosis		0.182	0.798	0.22778

However, the Levene's test for homogeneity of variance was violated as indicated by a p-value of .021 which is less than .05 as shown in Table 4. This is an indication that test of homogeneity of variance was violated, which informed the choice of Welch's t-test for testing of hypothesis. Welch's t-test is a version of independent t-test for which variances are heterogeneous (Clark-Carter, 2019).

Table 4: Levene's homogeneity test

Variance	Levene's Test for Equality of Variances	
	F	p-value.
Equal variances assumed	5.655	0.021
Equal variances not assumed		

In the second phase, qualitative approach was adopted to address research question two. Specifically, phenomenological design was adopted. This is because, the second research question investigated experiences of students exposed to instruction in domestic installation through cooperative learning. open ended questionnaire was employed to follow up result obtained from the first phase. After the quantitative first phase of the study, an open-ended questionnaire was distributed to 13 students from the experimental group who were willing to participate in the second phase of the study. Qualitative data gathered were analysed using thematic analysis.

4. Results

The results of the study are presented under two sections. The first section presents the quantitative result while the second section presents the qualitative findings.

4.1 Quantitative Result

The quantitative phase of the study was used to answer the first research question and the hypothesis of the study which aimed to ascertain the difference in practical performance in domestic installation between students taught using cooperative learning and conventional demonstration method in technical colleges in Bayelsa State, Nigeria. Results are presented in Tables 4 and 5. Each table is followed with an interpretation of results.

4.1.1. Research question 1

What is the difference in practical performance in domestic installation between students taught using cooperative learning and conventional demonstration method?

Table 5: Mean scores for cooperative learning and conventional teaching methods

Groups	Pretest			Posttest			Mean Gain
	N	$\bar{x}$	S.D.	N	$\bar{x}$	S.D.	
Experimental	22	37.73	9.85	22	82.50	6.68	44.77
Control	33	32.88	9.52	33	76.67	11.50	43.79
Mean Difference		4.85			5.83		

Result in Table 5 shows that for the experimental group, the posttest mean score ((Result in Table 5 shows that for the experimental group, the posttest mean score ($\bar{x}$ = 82.50) is higher than the pretest mean score ($\bar{x}$ = 37.73) by a difference of 44.77. Similarly, for the control group, the posttest mean score ($\bar{x}$ = 76.67) is higher than the pretest mean score ($\bar{x}$ = 32.88) by a difference of 43.79. These results suggests that both cooperative learning and conventional teaching methods had positive effect on practical performance in domestic installation among students of technical colleges in Bayelsa State, Nigeria.

Again, the result in Table 5 shows that for the experimental group, the standard deviation for posttest scores (*SD* = 6.68) is less than the standard deviation for the pretest scores (*SD* = 9.85). This is an indication that scores on the posttest had a closer spread around the mean than the pretest scores. However, for the control group, standard deviation for posttest scores (*SD* = 11.50) is higher than the standard deviation for the pretest scores (*SD* = 9.52). This is an indication that scores on the posttest had a wider spread from the mean than those of the pretest scores.

Now, comparing the experimental group and the control group shows that mean score of the experimental group ($\bar{x}$ = 82.50) is higher than the mean score of the control group ($\bar{x}$ = 76.67) by a difference of 5.83 on the posttest. This suggests that students exposed to instruction in domestic installation through cooperative learning had a higher practical performance than their counterpart exposed to instruction in domestic installation through the conventional teaching method. At the pretest, mean score of the experimental group ($\bar{x}$ = 37.73) is higher than the mean score of the control group ($\bar{x}$ = 32.88) by a difference of 4.85. With this result, it may be argued that the higher practical performance recorded by the experimental group on the posttest scores is due to the fact that they performed higher on the pretest scores and this has transferred to the posttest score as well. However, the mean gain of 44.77 for the experimental group being slightly higher than the mean gain of 43.79 for the control group buttresses the fact that students exposed to instruction in domestic installation through cooperative learning had a higher practical performance than their counterparts exposed to instruction in domestic installation through the conventional teaching method.

Again, the result in Table 5 shows that the standard deviation for the experimental group (*SD* = 6.68) is less than the standard deviation for the control group (*SD* = 11.50). This is an indication that scores of students in the cooperative learning were clustered more around their mean score than those of the scores of the conventional teaching method.

4.1.2 Hypothesis

There is no significant difference between practical performance in domestic installation of students taught using cooperative learning and conventional demonstration method.

Table 6: ***Welch's t-test for cooperative learning and conventional teaching methods***

	t	df	p-value	Mean Difference	Std. Error Difference
Equal variances assumed	2.146	53	0.036	5.833	2.719
Equal variances not assumed	2.374	52.21	0.021	5.833	2.457

The result in Table 6 shows that t (53) = 2.37; p < .05 (Welch's t-test: equal variances not assumed). Consequently, the hypothesis was rejected. This suggests that there was a significant statistical difference between the practical performance in domestic installation of students taught using cooperative learning and those taught using conventional teaching method.

4.2 Qualitative Findings

The qualitative phase of the study which was used to answer the second research question. The findings are presented in this section.

4.2.1. Research question 2

What are the experiences of students exposed to instruction in domestic installation through cooperative learning?

Three open ended questions were used to gather data to answer this research question. These are:
1. State the benefits derived from working in groups to learn domestic installation.
2. Would you prefer that group learning be used frequently and why?
3. State the things you like about learning domestic installation in groups.

1. Benefits derived from working in groups while learning domestic installation

A typical benefit derived from working in groups to learn domestic installation as reported by the students is knowledge sharing. This is evident by the report from PARTICIPANT 1. According to the participant,

> I learn from others. My mates' ideas, add to my own ideas.

In support of this, PARTICIPANT 3 reported:

> When I work in group, I learn from others and it gave me more experience and exposure to different work styles and approaches in a project because of the opinions and ideas shared…

Similarly, PARTICIPANT 4 also reported:

> When we work in group, contributions will be made and, in that process, you will know something you don't know or understand. And if there is error in your opinion you will be corrected.

Another benefit derived from working in group as reported by the participants is confidence, easiness and fastness in work as well as enhancement in comprehension. This is evident by reports from two participants.

> I benefited that when working in group it's easier, faster and more understandable and it also deals with co-operation (PARTICIPANT 2).

And PARTICIPANT 5 reported:

> The things I benefited while working in group, I gained confidence. It (working in group) made me work easy and fast and it will not require too much time to work.

Working in group also promoted reasoning, teamwork, communication and leadership skills among students. Excerpts from three participants are evident to these benefits.

> It (working in group) opens my sense of reasoning… (PARTICIPANT 6)
>
> …working in a group enables us to improve in communication and teamwork skills in domestic installation (PARTICIPANT 7).
>
> …Development of leadership and delegation skills (PARTICIPANT 8).

Furthermore, from the report of PARTICIPANT 13, it was deduced that working in group led to better result in domestic installation based on sharing ideas among group members.

2. Would you prefer that group learning be used frequently and why?

Majority of the students who participated in the qualitative study responded "yes" to this question with various reasons. Reasons given were that working in group promoted speed, and cooperation, helped individual students build on each other's weakness(es), gave room for shared roles and responsibility which makes work less burdensome and easier, led to accuracy in work as everyone is involved in evaluating shared ideas, promoted constructive argument which is helpful for learning and promoted learning from each other. Typical excerpts which serve as evidence to these reasons are given below.

> The group work in our domestic installation makes the work easier, understandable and faster. It also deals with cooperations and makes us united (PARTICIPANT 2).
>
> Working in group enables an individual to be more strengthened, to know and have knowledge in the things the individual may not be clear about, based on ideas and opinions shared (PARTICIPANT 3).
>
> The reason why I want and prefer group project learning frequently, is because when you are in group, the work is reduced because roles are been given to each and everyone in the group to play or take part, that makes it easier (PARTICIPANT 4).
>
> I prefer that group project learning should be use frequently because while working in groups you will gain more experience from your colleges who knows the work better than you (PARTICIPANT 5).

It builds conflicts resolution skills, collaborative learning helps students to navigate disagreements, find common ground and resolve conflicts constructively (PARTICIPANT 7).

3. Things students liked about learning domestic installation in groups

The reports revealed that students liked a number of things about learning domestic installation in groups. Typical of these are: gaining of knowledge and skills for problem solving and creativity in domestic installation and gaining of new ideas. Evidence to these are reports from PARTICIPANT 1:

> Group members bring unique ideas and approaches enhancing problem-solving and creativity

and PARTICIPANT 2 who stated that:

> In group project, domestic installation work, it reduces the work for a person, it makes you know things you have not come in contact with before, there is encouragement for one another.

One participant reported that learning domestic installation through group activities helps one identify his potentials. According to the participant:

> … It brings out the potential in students (PARTICIPANT 9).

And PARTICIPANT 12 reported:

> … It (group learning) makes us understand more and faster.

5. Discussion

The result from the quantitative phase of the study revealed that both conventional teaching method and the cooperative learning enhanced students' practical performance in domestic electrical installation. This suggests that the both instructional methods were effective in learning domestic electrical installation among students. The result however revealed that students exposed to instruction in domestic electrical installation through cooperative learning performed slightly higher than their counterparts exposed to instruction in domestic installation through the conventional teaching method. The difference in their practical performance was found to be statistically significant at .05 alpha level. The

result also showed that the experimental group had a higher mean gain in practical performance compared to the control group. This suggests that cooperative learning contributed significantly to improvement in practical performance. This is an indication that for the studied groups, cooperative learning was more effective than the conventional teaching method. This could likely be due to the collaborative and interactive nature of cooperative learning which encourages peer learning and engagement. This aligns with the conclusion of Lu and Smiles (2022) that cooperative learning encourages learning engagement, satisfaction and retention. Again, the result showed that the score of students in the experimental group had a lower posttest standard deviation (*SD* = 6.68) compared to the pretest standard deviation (*SD* = 9.85). This suggests that the scores of students in the experimental group were more clustered around the mean. This implies that the intervention enhanced consistent learning among students. On the other hand, the posttest standard deviation (*SD* = 11.50) was higher than the pretest (*SD* = 9.52) for the control group. This is an indication that conventional demonstration method led to greater variability and gaps in performance. This suggests that while conventional method may help some students improve, it may not benefit all students equally, whereas cooperative learning offers a more uniform improvement among the students, reducing the achievement gap (Ghodbane & El Achachi, 2019).

This result corroborates the result obtained by Gull and Shehzad (2015) that cooperative learning was effective in enhancing students' academic achievement in an education subject among female students from a college in Pakistan. The result similarly agrees with that of Tumba and Andeyarka (2014) who found that cooperative learning significantly enhanced students' academic performance in radio and television servicing trade in technical colleges in Taraba State, Nigeria. Also, the result aligns with the result by Trujillo-León et al. (2022) that cooperative learning had significant influence on students' problem-solving skills in secondary schools in Callao, Peru. The result is further supported by that of Chatila and Husseiny (2017) who found that cooperative learning had significant effect on acquisition of scientific skills among grade seven students in Beirut, Lebanon.

The findings from the qualitative phase of the study revealed that through knowledge sharing, working together in groups, tasks were completed faster and with less burdens. There was also accuracy in task performance. This could have been achieved from active participation and sharing of knowledge by all members of the group. This implies that, engaging students in cooperative learning can boost practical competencies among students in skill-based context such as technical and vocational education and training. This corroborates the findings of Hurst, Wallace and Nixon (2013) that students achieve faster and more accurately when they work in groups. The finding also revealed that cooperative learning boosted confidence, communication, teamwork and leadership skills as well as creativity. This aligns with the findings of Altun (2015) and Ismail et al. (2023) who found that cooperative learning through think pair share aided creativity. These are soft skills usually regarded as employability skills (Asefer & Abidin, 2021; Succi & Canovi, 2019). This finding is an indication that engaging students of TVET in cooperative learning could be a suitable strategy for making TVET students ready for employment. The reports from the qualitative findings of this study revealed that students shared knowledge and through this means, they learnt from each other. There is the common saying "two heads are better than one". The students who learnt domestic electrical installation through cooperative learning shared their ideas, learnt from each other. In the process, they gained knowledge and understanding from each other's shared ideas. This could have informed the better performance of students in the cooperative learning group over students of the conventional learning group.

6. Conclusions

The study used sequential explanatory mixed method design to investigate the effect of cooperative learning on practical performance in domestic installation among students in technical colleges in Bayelsa State, Nigeria. The result of the quantitative study showed that both the cooperative learning and conventional teaching methods enhanced students' practical performance in domestic installation. However, students exposed to instruction through cooperative learning had higher practical performance than students exposed to instruction through the conventional teaching method. This could have resulted from sharing of ideas among peers in the cooperative learning group. Based on these findings, it can be inferred that cooperative learning is an effective teaching method for enhancing practical performance in domestic installation among technical college students in the study area. The result of the study has implications for students, teachers, technical colleges as well as policy makers and other stakeholders in the TVET field at technical college or related level. For students, the result implies that engaging students in cooperative learning could be a suitable method of boosting practical competencies and employability skills among students of TVET towards preparing them for work. This in turn implies that teachers must be equipped with knowledge and skills for implementing cooperative learning among students. It is therefore imperative that TVET teachers need to be exposed to training to enhance their capacity to effectively employ cooperative learning in instructional delivery. Based on the findings of the study, there is also implication for curriculum restructuring by curriculum and programme developers such as the National Board for Technical Education, to integrate student-centred instructional approaches such as cooperative learning in the curriculum of domestic electrical installation curriculum and those of related trades. The finding that cooperative learning promoted communication, teamwork and problem-solving skills and other employability skills implies that it could serve as an instructional method appropriate for preparing TVET students for employment towards achieving SDG 8, which aims at promoting productive employment as well as decent work for all.

7. Recommendations

1. To ensure effectiveness of cooperative learning, members of cooperative learning groups should comprise a mix of varying abilities. This will enhance learning from each other's knowledge and capability to aid learning outcome.
2. Teachers coordinating cooperative learning should engage in active monitoring of groups to ensure active participation. This will enhance unity and teamwork spirit needed for effective learning.
3. The present study was conducted in two technical colleges in Bayelsa State, Nigeria. To enhance generalization of findings, conducting similar study in technical colleges within the South-South region of Nigeria is recommended. Furthermore, conducting similar study using students of other trades is recommended.
4. The study was conducted within just one term of three months. A longitudinal study is recommended to ascertain the long-term effect of cooperative learning on learning outcome in domestic electrical installation and related subjects in technical and vocational schools. Such studies could investigate the retention effect of cooperative learning.
5. The finding that cooperative learning promoted communication, teamwork and problem-solving skills particular was only based on the subjective view of students which could be prone to bias. Future studies should investigate the effect of cooperative learning on development of these skills using experimental design.

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