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Effects of Kolb's Experiential and Gardner's Multiple Intelligence Learning Models on Students' Critical Thinking and Psychomotor Achievement in Electrical Installation and Maintenance Work

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Abstract

This study investigated the effects of Kolb's experiential and Gardner's multiple intelligence learning model on students' critical thinking and psychomotor Achievement in Electrical Installation and Maintenance work. Three research questions guided the study while three hypotheses formulated were tested at 0.05 level of significance. The study adopted a quasi-experimental treatment group design and it was carried out in Kaduna state, Nigeria. The population for the study was 1300 National Technical Certificate II (NTC II) students offering Electrical Installation and Maintenance work in technical colleges in Kaduna state, Nigeria. The simple random sampling technique was used to select 127 students consisting of 109 male and 18 female students assigned to two treatment groups using intact class. The instruments used for data collection were Electrical Installation and Maintenance work Critical Thinking Test (EICTT) and Electrical Installation Psychomotor Achievement Test (EIPAT).The instruments were developed by the researcher. To ensure content validity, the instruments were subjected to face validation by five experts. The internal consistencies of the instruments were determined by using Pearson moment correlation coefficient of reliability 0.80 and 0.72. The data collected was analyzed using Mean to answer the three research questions while ANCOVA was used to test the three null hypotheses. The study found out, among others, that Gardner's multiple intelligence learning model was more effective than Kolb's experiential learning model in improving student's critical thinking and psychomotor achievement of students in Electrical Installation and Maintenance Work. There was an influence of gender on students' critical thinking favoring males. However, gender had significant influence on students' critical thinking. The study found a significant interaction effect of methods and gender on students 'critical thinking. The study recommended among others that NBTE should incorporate Gardner's multiple intelligence learning model in the teaching/learning of Electrical Installation and Maintenance Work in Technical Colleges. In addition, workshops, seminars and conferences should be organized by Federal Ministry of Education and States Science and Technical Schools Management Board for teachers to enable them update their knowledge and skills on the use of Gardner's multiple intelligence learning model for improving students' critical thinking and psychomotor skill in Electrical Installation and Maintenance Work.

Keywords: Critical Thinking, Experiential Learning, Multiple Intelligence, Psychomotor Achievement

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Introduction

Technology education is critical to sustainable development of the nation. It has been transforming human life in one way or another for many years. It is glaring that the pace of technological transformation has been very rapid in recent times precipitating numerous challenges on daily basis. Inherently, issues challenging the sustainable existence of humankind and general wellbeing such as automation, globalization, workplace change and policies increasing personal responsibility are growing (Jerald, 2009). These have necessitated a need to equip current and future citizens in general and Electrical Installation and Maintenance Work students in particular, with skills to address the rapidly evolving technology needs and challenges of the 21st century (Abdullahi, 2010). These skills go beyond the science process skills, but the broader skills such as critical thinking, psychomotor skills and creativity skills (Silva, 2008; Nwosu, 2015). Electrical Installation and Maintenance Work has the technology potentials to provide the needed solutions to the challenges of the millennium (Salihu, 2014).

The potentials of Electrical Installation and Maintenance work in providing the desired national sustainability is mirrored in the intents of its inclusion in the curriculum of Technical Colleges. The learning experience is aimed at the acquisition of appropriate level of literacy, numeracy, manipulation and life skills such as psychomotor and critical thinking for useful living within the society (Federal Ministry of Education, 2004). However, these skill objectives are yet to be achieved in technical colleges as a result, poor academic achievement of students in Electrical Installation and Maintenance work have been recorded in recent times. Technical and Vocational educators have identified some factors militating against the attainment of the objectives to include teachers' methodology and strategies. To acquire the relevant learning experiences and skills in electrical installation and maintenance work for example, requires the use of relevant instructional methods and techniques

Instructional methods and techniques are ways by which teachers present their course materials to learners and engage them in the task of learning the curriculum contents. Instructional methods and techniques are the tools used by the teacher for actualizing the set aims and objectives (Bello and Aliyu 2013). If the tools are faulty or inappropriate, the aims and objectives of the teaching and learning will not be achieved. It is clear from the foregoing that the possibility of Electrical Installation and Maintenance work to provide the needed solutions to the challenges of the millennium depends on the ability of Electrical Installation and Maintenance work teachers to select and maximally utilize appropriate instructional techniques and methods for their lesson delivery. The teaching methods are expected to reflect a modern society, mandating the need for functioning, thinking-oriented, decision-making students. There is an overall lack of political and public confidence in Technical College training systems and a profound mismatch between the radically new key competencies demanded from students in the knowledge society and the teaching skills that teachers are

equipped with, in teacher training institutions (Abdullahi, 2010). Nevertheless, the need for exposing the prospective students of Electrical Installation and Maintenance work to quality knowledge and skills, both practical and critical thinking remains a necessity. Technical educators maintain that the task can only be accomplished with a radical change from the use of teacher-centered approach in Technical college programmes to the use of student-centered approaches such as the Kolb's experiential learning model (Nwosu, 2015).

Kolb's experiential learning model takes its root from Kolb's learning cycle. It explained that human beings learn from their experiences of life, even on an everyday basis. It also treats reflection as an integral part of such learning. University of Leicester (2017) reported that experiential learning theory provides a holistic model of the learning process and is a multi-linear model of adult development, both of which are consistent with what people know about how they naturally learn, grow, and develop. According to Kolb (1984), the process of learning follows a pattern or cycle consisting of four stages, one of which involves what Kolb refers to as 'reflective observation'. According to Kolb in the report of University of Phoenix (2017) knowledge results from the combination of grasping experience and transforming it. In Kolb's experiential learning model, there are four distinct segments to learning: description of concrete experience, reflections, generalizations/principles/theories and testing and application. Kolb, A. and Kolb, D. (2005), further explained that ideally (and by inference not always) this process represents a learning cycle or spiral where the learner 'touches all the bases, i.e. a cycle of experiencing, reflecting, thinking, and acting. Immediate or concrete experiences lead to observations and reflections. These reflections are then assimilated (absorbed and translated) into abstract concepts with implications for action, which the person can actively test and experiment with, which in turn enable the creation of new experiences. Kolb (1984) model therefore works on two levels - a four-stage cycle: Concrete Experience - (CE), Reflective Observation - (RO), Abstract Conceptualization - (AC) and Active Experimentation - (AE), and a four-type definition of learning styles, (each representing the combination of two preferred styles, rather than a two by-two matrix of the four-stage cycle styles), for which Kolb used the terms: Diverging (CE/RO), Assimilating (AC/RO), Converging (AC/AE) and Accommodating (CE/AE)

Gardner's Multiple Intelligence Learning Model is a modern model that takes its root from the theory of multiple intelligences who suggests that the traditional notion of intelligence, based on intelligent quotient (IQ) testing, is far too limited. Gardner's Multiple Intelligence Learning Model according to Armstrong (2009) has eight different intelligences to account for a broader range of human potential in children and adults, these include: Linguistic, Logical-mathematical, Musical, Bodily-kinesthetic, Spatial, Interpersonal, Intrapersonal and Naturalist intelligence. Gardner also emphasizes the cultural context of multiple intelligences. Each culture tends to emphasize particular intelligence, suggests that there are a number of distinct forms of intelligence that each individual possesses in varying degrees . According to Gardner, the implication of the model is that learning/teaching should

focus on the particular intelligence's of each person. For example, if an individual has strong spatial or musical intelligence's, they should be encouraged to develop these abilities. Gardner points out that the different intelligence's represent not only different content domains but also learning modalities. Kolb's experiential learning model and Gardner's Multiple Intelligence Learning Model have been found to be an effective technique for increasing academic achievement of students in concepts in computer science among others in non-technical institutions unlike technical colleges.

Technical College is a type of secondary school established either by government or individual to offer technical and vocational trades leading to acquisition of knowledge and skills required for further studies or employment. Bakare (2009) defined technical college as a post primary institution equivalent to secondary school charged with the production of craftsmen and technicians. Technical colleges offer various technical and vocational trades and some of the trades include motor vehicle and mechanic work, radio and television, refrigeration and air conditioning, furniture and cabinet making, welding and fabrication, block laying and concrete work and electrical installation and maintenance work. Federal Ministry of Education, (2004) stated that the length of trades in a technical college, like other senior secondary schools shall be three years for the craft level and four years for the advanced craft level and National Business and Technical Examinations Board (NABTEB) shall award National Technical Certificate (NTC), National Business Certificate (NBC), Advanced National Technical Certificate (ANTC), and Advanced National Business Certificate (ANBC) to the successful graduates of technical colleges. Electrical installation and maintenance work offer in technical colleges is geared towards the graduation of technicians, and craftsmen who have skills and knowledge to meet the demand of electrical/electronic industries.

Electrical installation and maintenance work (EIMW) is one of the trades offered in Technical Colleges in Nigeria. Bakare (2010) described EIMW as electrical engineering trade offered in Nigerian technical colleges which has Battery Charging and maintenance, Domestic Installation, Industrial Installation, Cable Jointing, Winding of Electrical Machines and Solid State Devices as its components. According to national board for technical education (2007), EIMW was incorporated into the curriculum of technical colleges to facilitate the attainment of the objective on maintenance, service, and installation of electrical equipment and machines. In EIMW according to Bakare (2010), students learn basic practical skills needed to install, operate, maintain, and repair electrical and electronic equipment.

Critical thinking is a rational thinking in the pursuit of relevant and reliable knowledge about the material world. It is a purposeful, self-regulatory judgment which result in interpretation, analysis, evaluation and inference as well as explanation of the evidential, conceptual, methodological or contextual considerations upon which judgment was based (James, 2007). Critical thinking in this study is a reflective thinking which enables Electrical Installation and maintenance work students to draw conclusions, make tacit assumptions,

deduce, interpret and evaluate arguments. The goal of critical thinking, which concurs with the goals of electrical installation and maintenance work teaching, according to Angeli and Valanides (2008) is that critical-thinking skills are necessary for active citizenship in any pluralistic and democratic society, where citizens are daily confronted with tremendous amounts of information and ill-defined problems with real uncertainty as to how they can be best solved. Heong, Yunos and Hassan (2011) discovered that achievement relates positively to Critical thinking skill acquisition at different education levels.

Psychomotor achievement connotes academic performance in school practical subject as symbolized by a score or mark on achievement test. Bakare, (2009) described achievement as the outcome of level of accomplishment in a specific programme of instruction in a subject area or occupation which a student had undertaken in the recent past. Academic achievement of students is the translation of the students' performance in achievement test into scores obtained in a psychomotor test. It is also the level of knowledge, skills or accomplishment in area of endeavours. However, achievement in this study relates to accomplishment of learning by a student in cognitive domain of learning. Unfortunately, Low academic achievement has been observed in electrical installation and maintenance work. It has been observed from the record of (NABTEB, 2019) that the students of electrical installation who sat for National Technical Certificate Examinations perform very low.

This record indicated 66.4 percent failed rate in electrical installation and maintenance work. Also, National Business and Technical Education Board (NABTEB) May/June chief examiners' report of 2020 indicated that shortcomings of using inappropriate teaching strategy partly accounted for the low academic achievement of students in electrical installation and maintenance work.

Gender according to Santrock (2001) involves the biological dimension of being a female or male. This has been a crucial matter to the educationists. Issues that are multidimensional in outlook as they relate to the teaching and learning of technical education in this regard have been very contentious. Providing quality education ensures sustainable development, Adapting an approach that takes into account the relationship and interaction between males and females. However, literature abound with statistics that gender parity could be established in science and technology classes that emphasize hands-on/activity based instructional strategies. In view of the fact that model methods such as the inductive and deductive inquiry have been used as well as other activity based strategies such as cooperative learning on gender issues in electrical installation and maintenance work, the result is still inconclusive. Hence, there is the need to try the Kolb's Experiential Learning Model (KELM) and Gardner's Multiple Intelligence Learning Model (GMLM) and ascertains its impact on critical thinking of both male and female electrical installation and maintenance work students.

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Methodology

The study used quasi experimental treatment group design aimed at investigated the effects of Kolb's experiential and Gardner's multiple intelligence learning models on students' critical thinking and psychomotor achievement in Electrical Installation and Maintenance work in technical colleges in Kaduna state. Three research questions guided the study while three hypotheses formulated was tested at 0.05 level of significance. The population for the study was 1300 National Technical Certificate II (NTC II) students offering Electrical Installation and Maintenance work in technical colleges in Kaduna State, Nigeria. The simple random sampling technique was used to select 127 students consisting of 109 male and 18 female students assigned to two treatment groups using intact class. The instruments used for data collection were Electrical Installation and Maintenance work Critical Thinking Test (EICTT) and Electrical Installation Psychomotor Achievement Test (EIPAT). The instruments was developed by the researcher. To ensure content validity of the instrument, the instruments were validation by five experts. One in Measurement and Evaluation, one in Education Psychology, drawn from both Departments of Science and Adult Education and two in Electrical Technology Department of Industrial Technical Education all from University of Nigeria, Nsukka, and one in Electrical Installation and Maintenance Work from Government Technical College Malali, Kaduna. To establish the reliability of the instruments, the instruments was carried out on 30 sampled NTCII students at Government Technical College Soba, Kaduna state, Nigeria. The Pearson moment correlation coefficient was used to determine the internal consistency of the instruments. The reliability coefficient of the instrument was found to be 0.80 and 0.72 respectively. The data collected were analyzed using Mean to answer the three research questions while ANCOVA was used to test the three null hypotheses.

Results

Table 1: Mean and Standard Deviation of Pretest and Posttest Scores of Kolb's Experiential Learning Model and Gardner's Multiple Intelligences Learning Model Groups on the Critical Thinking Test

Group	N	Pre test		Posttest scores		Mean Gain
		$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}$
KELM	82	22.63	7.95	56.94	7.02	34.31
GMIM	45	15.18	5.41	54.22	7.71	39.04

The results presented in Table 1 showed that Kolb's experiential learning model group had a Mean score of 22.63 and Standard Deviation of 7.95 in the pre-test and a Mean score of 56.94 and Standard Deviation of 7.02 in the post-test making with a Mean gain of 34.31. Gardner's multiple intelligence learning model group had a Mean score of 15.18 and Standard Deviation of 5.41 in the pre-test and a post-test Mean of 54.22 and Standard Deviation of 7.71,

with a Mean gain of 39.04. With these results, Gardner's multiple intelligence learning model in improving students' Critical Thinking in Electrical Installation and Maintenance Work was higher than Kolb's experiential learning model.

Table 2: Mean and Standard Deviation of Pretest and Posttest Scores of Kolb's Experiential Learning Model Group and Gardner's Multiple Intelligence Learning Model Group in the Psychomotor Achievement Test

Group	N	pretest		posttest		mean gain
		$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}$
KELM	82	30.12	5.61	67.92	4.38	37.34
GMILM	45	30.60	2.63	69.11	3.78	39.53

The results presented in Table 3 show that Kolb's experiential learning model group had a Mean score of 30.12 and Standard Deviation of 5.61 in the pre-test and a Mean score of 67.92 and Standard Deviation of 4.38 in the post-test making a pre-test, post-test Mean gain of 37.34. Gardner's multiple intelligence learning model group had a Mean score 30.60 and Standard Deviation of 2.63 in the pre-test and a post-test Mean of 69.11 and Standard Deviation of 3.78, with a pre-test, post-test Mean gain of 39.53. With these results, the Gardner's multiple intelligence learning model improved students' psychomotor achievement in Electrical Installation and Maintenance Work than the of Kolb's experiential learning model.

Table 3: Mean and Standard Deviation of Pretest and Posttest on the Influence of Gender on Critical Thinking Scores of Students Taught using Kolb's Experiential Learning Model(KELM) and Gardner's Multiple Intelligences Learning Model(GMIM)

Group	Gender	N	Pretest scores		Posttest scores		Mean Gain
KELM			$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}$
	M	74	21.69	7.36	56.97	7.11	35.28
	F	8	31.37	8.42	56.62	6.48	25.25
GMIM	M	35	14.91	5.83	54.63	7.64	39.72
	F	10	16.10	3.66	52.80	8.24	36.70

The data presented in Table 2 showed the influence of gender on Electrical Installation and Maintenance Work student's Critical Thinking when exposed to Kolb's experiential learning model. Result showed that the male students taught with Kolb's experiential learning model had a pretest mean of 21.69 with a standard deviation of 7.36 and a posttest mean of 56.97 with a standard deviation of 7.11. The difference between the pretest and posttest mean for the male students was 35.28. The female students taught using Kolb's experiential learning model had a pretest mean of 31.37 with a standard deviation of 8.42 and a posttest mean of 56.62 with a standard deviation of 6.48. The difference between the pretest and posttest mean for the female students was 25.25. Hence, the males taught with Kolb's experiential learning model achieved higher (35.28 > 25.25) than their female counterparts. Also the data presented

in Table 11 shows the influence of gender on student's Critical Thinking when exposed to Gardner's Multiple Intelligence Learning Model. Result showed that the male students taught with Gardner's Multiple Intelligence Learning Model had a pretest mean of 14.91 with a standard deviation of 5.83 and a posttest mean of 54.63 with a standard deviation of 7.64. The difference between the pretest and posttest mean for the male students was 39.72. The female students taught using Gardner's Multiple Intelligence Learning Model had a pretest mean of 16.10 with a standard deviation of 3.66 and a posttest mean of 52.80 with a standard deviation of 8.24. The difference between the pretest and posttest mean for the female students was 36.70 Hence, the males taught with Gardner's Multiple Intelligence Learning Model achieved higher (39.72 > 36.70) than their female counterparts. Therefore, there is gender influence on students' Critical Thinking in Electrical Installation and Maintenance Work.

Table 4: Analysis of Covariance (ANCOVA) of the Difference in the Mean Scores of Methods, gender and interaction effects of Methods and gender on Critical Thinking of Electrical Installation and Maintenance Work Students Taught with KELM and those Taught with GMIM

Tests of Between-Subjects EffectsDependent post test

Source	Type III Sum of Square	Df	Mean Square	F	Sig.
Corrected Model	329.655[a]	4	82.414	1.548	0.192
Intercept	29564.299	1	29564.299	555.474	0.000
Criticalthinkpretest	88.318	1	88.318	1.659	0.200
Method	33.487	1	33.487	0.629	0.429
Gender	43.210	1	43.210	0.812	0.369
method * gender	0.648	1	0.648	0.012	0.912
Error	6493.274	122	53.224		
Total	404759.000	127			
Corrected Total	6822.929	126			

. a. R Squared = .048 (Adjusted R Squared = .017) ***Significant at sig of F<0.05**

The results in Table 3 showed that an F-ratio of 0.629 with associated probability value of 0.429 was obtained with regard to the difference in the mean scores of students taught with Kolb's experiential learning model and those taught with Gardner's multiple intelligence learning model. Since the associated probability (0.429) is greater than 0.05, the null hypothesis was accepted. Thus, this implies that the use of Kolb's experiential learning model and Gardner's multiple intelligence learning model did not significantly improved critical thinking of students in Electrical Installation and Maintenance Work.

The results in Table 3 showed that an F-ratio of 0.812 with associated probability value of 0.369 was obtained with regard to the difference in the influence of gender on the mean

critical thinking scores of students taught with Kolb's experiential learning model and those taught with Gardner's multiple intelligence learning model. Since the associated probability (0.369) is greater than 0.05, the null hypothesis of no significant mean difference between the influence of gender (male and female) on students' critical thinking in Electrical Installation and Maintenance Work was accepted. Hence, this implies that the use of Kolb's Experiential and Gardner's Multiple Intelligence Learning Models result in no difference in the mean critical thinking scores of male and female students.

The results in Table 4 also showed that the interaction effect of methods and gender has an F-ratio of 0.012 with associated probability value of 0.912 was obtained ie greater than 0.5 with regard to the difference in the mean interaction effect of Learning Models and Gender on critical thinking scores of students, the null hypothesis of no significant Interaction effect of Learning Models and Gender on Student's critical thinking was accepted. Hence, this implies that the use of Kolb's Experiential Learning Model and Gardner's Multiple Intelligence Learning Model result in no difference in the mean interaction effect of methods and gender on students' critical thinking scores in Electrical Installation and Maintenance Work.

Discussion of Findings

The data presented in Table 1 provided answer to research question one. It was revealed that the effect of Gardner's multiple intelligence learning model in improving students' critical is higher than Kolb's experiential learning model. The result indicates that Gardner's multiple intelligence learning model is more effective in improving students' critical thinking. However, analysis of covariance was used to test the first hypothesis (Table 4) at an F-ratio of 0.625 with associated probability value of 0.429 was obtained with regards to the difference in the mean scores of students taught with Kolb's experiential learning model and those taught with Gardner's multiple intelligence learning model. Since the associated probability (0.429) was greater than 0.05, the null hypothesis (HO_1) was accepted. The result means that there was no significant mean difference between the effect of Kolb's experiential and Gardner's multiple intelligence learning models on students' critical thinking in Electrical Installation and Maintenance Work. The findings are consistent with the findings of Heong, Yunos and Hassan (2011), Ramos, Dolipas and Villamor (2013) and Yang (2014) who, in their separate studies in other subjects found that the Multiple Intelligence based instructions had significant effect upon the students' critical thinking than other instructional formats. The findings of this study also support some literature evidence such as Shakirova (2007) explained that critical thinking skills are crucial in this millennium because they enable students to deal effectively with social, scientific, and practical problems. Practical activities in Gardner's multiple intelligence learning model group, aimed at addressing and developing students' verbal linguistic and logical mathematical intelligence. This allowed students to participate actively in the lesson by expressing their views freely, offering suggestions and opinions and asking questions. Encourage active interaction among students and between students and the teacher.

The data presented in Table 2 provided answer to research question 2. It was revealed that Gardner's multiple intelligence learning model in improving students' psychomotor achievement in Electrical Installation and Maintenance Work is higher than Kolb's experiential learning model. The result indicates that Gardner's multiple intelligence learning model is more effective in improving students' psychomotor achievement in Electrical Installation and Maintenance Work. The above finding is consistent with the findings of (Meller and Kauffman, (2003), who on their study explained that student's activities in this group include: Active imagination, cartooning, drawing, modelling, building, and painting, sculpturing and set designing. Teachers of Electrical Installation and Maintenance Work can involve students in active hands-on activities such as tracing and rectification of electrical problems, disassembly and assembly of different parts to tap into this intelligence consequently, improved students' technological understanding by applying theoretical principles to real life situations. This, therefore, also enhanced their manipulative skills and mastery of problem-solving strategies which led to their considerable psychomotor achievement.

The data presented in Table 3 provided answer to research question three. Findings revealed that gender has influence on students' critical thinking in Electrical Installation and Maintenance Work in favour of male students. However, analysis of covariance was used to test the second hypothesis (Table 4), at an F-ratio of 0.812 with associated probability value of (0.369) was obtained and confidence interval of 0.05. Since the associated probability 0.369 was greater than 0.05, the null hypothesis (HO_2) was accepted. The results showed that male students did not perform significantly better than their female counterparts in the acquisition of critical thinking skills when taught using Kolb's experiential and Gardner's multiple intelligence learning models. The finding of this study is similar to that of Heong, Yunos and Hassan (2011) and Myer and Dyer (2006)which showed that no higher order thinking skill and critical thinking skill differences respectively existed between male and female students in higher education. The nonexistence of significant gender influence on the acquisition of critical thinking skill unveiled by this study could be elucidated by the fact that both Kolb's experiential and Gardner's multiple intelligence learning models offered unique and equal opportunity. The outcome indicated that Electrical Installation and Maintenance Work students developed higher mental abilities which could be transferred to totally different situations in the components of critical thinking skills.

Analysis of covariance was used to test the third hypothesis (Table 4),at an F-ratio of 0.012 with associated probability value of (0.912) was obtained and confidence interval of 0.05.Since the associated probability 0.912 was greater than 0.05, the null hypothesis (HO_3) was accepted. There was no significant interaction effect of methods and gender on students taught with Kolb's experiential and Gardner's multiple intelligence learning models and their gender with respect to their mean scores on Electrical Installation and Maintenance Work critical thinking test. The finding of this study agrees with Yang (2014) who found a significant interaction effect between computer programming instruction group (logo and non-

logo) and gender on the higher-order thinking skills and mathematical achievement of first grade students. The females in the Logo group performed significantly better on the Computation subscale than the females in the non-Logo group. Electrical Installation and Maintenance Work teachers are encouraged to accept the fact that gender issue (male or female) should not be seen as adversely influencing academic learning in Electrical Installation and Maintenance Work classroom.

Conclusions

Based on the findings of the study the conclusion was made:

Kolb's experiential learning model and Gardner's multiple intelligences learning model are effective in enhancing students' critical thinking and psychomotor achievement in Electrical Installation and Maintenance Work. However, Gardner's multiple intelligences learning model is more effective than Kolb's experiential learning model. It was also concluded that there was significant difference in the performance of students taught with Gardner's multiple intelligence learning model when compared with those taught with Kolb's experiential learning model. Moreover, gender has influence on the students' critical thinking skills acquisition when taught with Gardner's multiple intelligences learning model. The study also concluded that there was no significant difference in critical thinking skills acquisition when taught Electrical Installation and Maintenance Work with Gardner's multiple intelligences and Kolb's experiential learning models in the Technical Colleges of North-Western States of Nigeria.

Recommendations

Based on the findings, the following recommendations are hereby made:

1. The National Board for Technical Education (NBTE) curricular content packages in the minimum standard should be restructured to aid Electrical Installation and Maintenance Work students' training through Gardner's multiple intelligences learning model.
2. Technical College Teachers should use Gardner's multiple intelligences learning model in teaching Electrical Installation and Maintenance Work.
3. The state and local government in conjunction with the Federal Ministry of Education should endeavor to organize in-service training in form of workshops, seminars, conferences and symposia regularly for Electrical Installation and Maintenance Work Teachers to enable them update their knowledge, attitudes and skills on the use of innovative teaching strategies such as Gardner's multiple intelligences learning model.

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