EFFECTS OF KOLB'S EXPERIENTIAL AND GARDNER'S MULTIPLE INTELLIGENCE LEARNING MODELS ON STUDENTS' COGNITIVE 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' cognitive achievement in electrical installation and maintenance work. Two research questions guided the study while three hypotheses formulated were tested at 0.05level of significance. The study adopted a quasi-experimental treatment group design and it was carried out in North West 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 North-West, 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 instrument used for data collection was Electrical Installation and Maintenance work Cognitive Achievement Test (ECAT).The instrument was developed by the researchers. To ensure content validity, the instrument was subjected to face validation by five experts. The internal consistency of the instrument was determined by using Pearson moment correlation coefficient of reliability 0.84. The data collected was analyzed using mean to answer the two 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 cognitive achievement in electrical installation and maintenance work. There was no influence of gender on students' cognitive achievement. However, gender had no significant influence on students' cognitive achievement. The study found no significant interaction effect of methods and gender on students 'cognitive achievement. 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' cognitive achievement in electrical installation and maintenance work

Keyword: Technical College, Electrical Installation and Maintenance Work, Interest, Instructional/Learning Model and Gender

Introduction
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. 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 (Sani, 2018). Electrical installation and maintenance work has the technology potentials to provide the needed solutions to the challenges of the millennium. 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. However, these skill objectives are yet to be achieved in technical colleges. As a result, poor cognitive achievement of students in learning Electrical Installation and Maintenance work have been recorded in recent times. 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 performed very low. This record indicated 66.4 percent failure rate in electrical

installation and maintenance work. Also, National Business and Technical Education Board (NABTEB) May/June chief examiners' report of 2019/2020/2021 indicated that shortcomings of using inappropriate teaching strategy partly accounted for the low academic achievement of students in electrical installation and maintenance work. 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 are the tools used by the teacher for actualizing the set aims and objectives (Bello & 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. To be successful, teachers are expected to select and use a wide variety of innovative instructional strategies. This is because excellent and effective teaching demands high quality techniques and a host of other devices. Nevertheless, the need for exposing the prospective students of electrical installation and maintenance work to quality knowledge and skills, both practical and cognitive, remains a necessity. 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. 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 intelligences 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 intelligences represent not only different content domains but also learning modalities

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

Electrical installation and maintenance work (EIMW) is one of the trades offered in technical colleges in Nigeria. According to National Board for Technical Education (NBTE) (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

Achievement connotes academic performance in school subject as symbolized by a score or mark on achievement test. According to Anene (2005), students' academic achievement is quantified by a measure of the students' academic standard in relation to those of other students of his age tested with the same instrument. Bakare, (2009) also 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 cognitive 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

However, literature abound with statistics that gender parity could be established in science and technology classes that emphasize hands-on/activity based instructional strategies (Nwosu, 2015). 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 and Gardner's multiple intelligence learning model and ascertains its impact on achievement of both male and female electrical installation and maintenance work students.

Research Question
1. What is the effect of Kolb's experiential learning model and Gardner's multiple intelligence learning model on students' cognitive achievement in electrical installation and maintenance work?
2. What is influence of gender on students' cognitive achievement in electrical installation and maintenance work?

Hypothesis
1. Ho_1: There is no significant difference in the effects of Kolb's experiential learning model and Gardner's multiple intelligences learning model on students' cognitive achievement in electrical installation and maintenance work
2. Ho_2: There is be no significant difference in the influence of gender on students' cognitive achievement in electrical installation and maintenance work
3. Ho_3: There is no significant interaction effect of learning models and gender on students' cognitive achievement in electrical installation and maintenance work

Delimitation of the Study
The study covered North West Geo-Political Zone of Nigeria and investigated the effects of Kolb's experiential and Gardner's multiple intelligences learning models on students' academic achievement in electrical installation and maintenance work. The study covered domestic installation and battery charging and repair aspects of electrical installation and maintenance work. Electrical installation and maintenance work students in Second year in all the technical colleges that offered EIMW in North West, Nigeria were involved in the study

Methodology
The study used quasi experimental treatment group design aimed at investigating the effects of Kolb's experiential and Gardner's multiple intelligence learning models on students' cognitive achievement in electrical installation and maintenance work in technical colleges in North Western states in Nigeria. Two research questions guided the study while three hypotheses formulated were 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 North-West, 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 instrument used for data collection was Electrical Installation Cognitive Achievement Test (EICAT). The instrument was developed by the researchers. To ensure content validity of the instrument, the instrument was subjected to face 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 instrument, the instrument was used on 30 sampled NTCII students at government technical college Soba, Kaduna state in north-west geo-political zone of Nigeria. The Pearson moment correlation coefficient was used to determine the internal consistency of the instrument. The reliability coefficient of the instrument was found to be 0.84. The data collected were analyzed using Mean to answer the two 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 Group and Gardner's Multiple Intelligence Learning Model Group in the Cognitive Achievement Test

Group	N	Pre-test Post-test				Mean Gain
		$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}$
KELM	82	25.95	5.99	59.39	7.82	33.44
GMILM	45	25.67	6.37	60.40	7.25	34.73

The results presented in Table 1 show that Kolb's experiential learning model group had a Mean score of 25.95 and Standard Deviation of 5.99 in the pre-test and a Mean score of 59.39 and Standard Deviation of 7.82 in the post-test making a pre-test, post-test Mean gain of 33.44. Gardner's multiple intelligence learning model group had a Mean score of 25.67 and Standard Deviation of 6.37 in the pre-test and a post-test Mean of 60.40 and Standard Deviation of 7.25, with a pre-test, post-test Mean gain of 34.73. With these results, the Gardner's multiple intelligence learning model improved students' cognitive achievement in electrical installation and maintenance work than the Kolb's experiential learning model

Table 2

Mean and Standard Deviation of Pre-test and Post-test on the influence of Gender on Cognitive Achievement Scores of Students Taught Using Kolb's Experiential Learning Model (KELM) and Gardner's Multiple Intelligence Learning Model (GMIM)

Group	Gender	N	Pre-test scores		Post-test scores		Mean Gain
KELM			$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}$
	M	74	26.89	5.48	59.36	8.10	32.47
	F	8	17.25	2.55	59.62	4.87	42.37
GMIM	M	35	24.97	5.86	61.11	6.70	36.14
	F	10	27.30	8.57	57.90	8.85	30.6

The data presented in Table 2 show the influence of gender on Electrical Installation and Maintenance Work students' cognitive achievement when exposed to Kolb's experiential learning model. Result shows that the male students taught with Kolb's experiential learning model had a pre-test mean of 26.89 with a standard deviation of 5.48 and a post-test mean of 59.36 with a standard deviation of 8.10. The difference between the pre-test and post-test mean for the male students was 32.47. The female students taught using Kolb's experiential learning model had a pre-test mean of 17.25 with a standard deviation of 2.55 and a post-test mean of 59.62 with a standard deviation of 4.87. The difference between the pre-test and post-test mean for the female students is 42.37. Hence, the females' students taught with Kolb's experiential learning model achieved higher (42.37 > 32.47) than their male counterparts. Also, the data presented in Table 2 presented showed the influence of gender on Electrical Installation and Maintenance Work student's cognitive achievement when exposed to Gardner's Multiple Intelligence Learning Model. Result shows that the male students taught with Gardner's Multiple Intelligence Learning Model had a pre-test mean of

24.97 with a standard deviation of 5.86 and a post-test mean of 61.11 with a standard deviation of 6.70. The difference between the pre-test and post-test mean for the male Electrical Installation and Maintenance Work students was 36.14. The female students taught using Gardner's Multiple Intelligence Learning Model had a pre-test mean of 27.30 with a standard deviation of 8.57 and a post-test mean of 57.90 with a standard deviation of 8.85. The difference between the pre-test and post-test mean for the female students was 30.60. Hence, the males taught with Gardner's Multiple Intelligence Learning Model achieved higher (36.14 > 30.60) than their female counterparts. Therefore, there is no gender influence on students' cognitive achievement in Electrical Installation and Maintenance Work.

Table 3
Analysis of Covariance (ANCOVA) of the Difference in the Mean Scores of Methods, gender and interaction effects of Methods and gender on cognitive achievement of Electrical Installation and Maintenance Work Students Taught with KELM and those Taught with GMIM
Tests of Between-Subjects Effects

Dependent Variable: post-test

Source	Type III Sum of Squares	Df	Mean Square	F	Sig
Corrected Model	259.158[a]	4	64.790	1.122	0.349
Intercept	18907.691	1	18907.691	327.439	0.000
Cognitive pre-test	148.688	1	148.688	2.575	0.111
Method	8.253	1	8.253	0.143	0.706
Gender	8.647	1	8.647	0.150	0.699
method * gender	109.832	1	109.832	1.902	0.170
Error	7044.779	122	57.744		
Total	460672.000	127			
Corrected Total	7303.937	126			

a. R Squared = .035 (Adjusted R Squared = .004)

*Significant at sig of F< 0.05
The results in Table 3 presented showed that the interaction effect of methods and gender has an F-ratio of 1.902 with associated probability value of 0.170 was obtained with as to the difference in the mean interaction effect of Learning Models and Gender on cognitive achievement scores of electrical installation and maintenance work students taught with Kolb's experiential learning model and those taught with Gardner's multiple intelligence learning model. Since the associated probability (0.170) is greater than 0.05, the null hypothesis of no significant Interaction effect of Learning Models and Gender on student's cognitive achievement in electrical installation and maintenance work was accepted. Hence, there was no significant difference in the mean interaction effect of Learning Models and Gender on cognitive achievement scores of students when exposed to Kolb's Experiential Learning Model and Gardner's Multiple Intelligence Learning Model

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' cognitive achievement in electrical installation and maintenance work was higher than Kolb's experiential learning model. The result indicates that Gardner's multiple intelligence learning model is more effective in improving students' cognitive achievement. However, analysis of covariance was used to test the hypothesis(HO$_1$) (Table 3) at an F-ratio of 0.143 with associated probability value of 0.706 was obtained with as 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 (0.706) was greater than 0.05, the null hypothesis (HO$_1$) was accepted. The result mean that there was no significant mean difference between the effects of Kolb's experiential and Gardner's multiple intelligence learning models on students' cognitive achievement in electrical installation and maintenance work

The above findings are consistent with the findings of Gencel (2008) who, in his studies in other subject found that the experiential learning-based instructions had significant effect upon the students' cognitive achievement than inquiry model. The findings of this study also support some literature evidence such as Bargu, (2013).

Explaining that in a learning setting, Learners at this stage depend on their own thoughts and feelings in creating their opinions. In other words, in this stage people learn by watching and listening. They would carefully observe before making decisions, the result of this study with regard to students' cognitive achievement is attributed to the treatment given to students in Kolb's experiential learning model. The findings according to Sutliff and Baldwin (2011) could be explained by the fact that teacher's adoption of various instructional techniques (such as abstract conceptualization, reflective observation, active experimentation and concrete experience) in the experiential learning classroom appealed to the students' different experience and engaged the students in the learning process which increased their motivation to learn and strengthened their memory. Sutliff and Baldwin further explained that in the experiential learning classroom students are provided with opportunity of lecture on the theory, personally reflect on the content, ask questions, and discuss the content; assign homework, fieldwork, and laboratory projects and direct small group discussions, give concrete examples, show videotapes, and discuss personal experiences. This, in turn, improved their learning and thinking abilities which led to deeper understanding of difficult technology concepts and principles associated with Electrical Installation and Maintenance Work. It implies that students in Kolb's experiential learning model group remembered and applied more of their learning in electrical installation and maintenance work than the other group of students that were taught through Gardner's multiple intelligence learning model

The data presented in Table 2 provided answer to research question two. The findings revealed that gender has no influence on students' cognitive achievement in electrical installation and maintenance work when expose to Kolb's experiential learning model and Gardner's multiple intelligence learning model. However, analysis of covariance was used to test the second hypothesis (Table 3), at an F-ratio of 0.150 with associated probability value of (0.669 was obtained with as to the difference in the mean scores of male and female electrical installation and maintenance work students taught with Kolb's experiential learning model and those taught with Gardner's multiple intelligence learning model. Since the associated probability (0.669) 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 cognitive achievement test when taught using Kolb's experiential and Gardner's multiple intelligence learning models. However, result of the study confirmed against the research findings of Ezeudu, Chiaha and Eze (2013) and Eriba and Ande (2007) which established that boys performed better than girls in achievement test in chemistry. Louis and Mistele (2011) also found a similar result in which male students outperformed female students in mathematics and sciences and Wolf and Fraser (2006) as well discovered inquiry -laboratory activities to be differentially effective in favour of males than females. The achievement in favour of boys in this above probably suggests that girls may perform lower than boys in science education. Similarly, Jovanovic (2012) maintained that there are no genetically based differences between male and female students in their ability to learn. More evidence is still required for any conclusion on gender differences in electrical installation and maintenance work cognitive achievement; otherwise, any observed difference may be attributed to chance

Analysis of covariance was used to test the hypothesis (HO_3) Table 3, at an F-ratio of 1.902 with associated probability value of (0.170) obtained and confidence interval of 0.05. Since the associated probability 0.170 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 cognitive achievement test. The finding of this study is found to be similar to that of Oladejo, Olosunde, Ojebisi and Isola (2011) who discovered that there was no significant interaction effect of treatment and gender on student achievement in Physics. The outcome of the study is also similar to Adekoya and Olatoye (2011) who found out that there is no significant interaction effect of treatment and gender on students' cognitive achievement in pasture and forage crops. The absence of interactive effect of method and gender on the students' cognitive achievement in this study could be attributed to the fact that both Kolb's experiential learning model and Gardner's multiple intelligence learning model provided the opportunity for all the students irrespective of gender to be actively involved in interactive learning situations. The result, therefore, means that students' gender (male or female) will not be a barrier to the learning of electrical installation and maintenance work subject in technical colleges. Hence, 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.

Conclusion
Based on the findings of the study the following conclusions were made:

Kolb's experiential learning model and Gardner's multiple intelligences learning model are effective in enhancing students' cognitive achievement in Electrical Installation and Maintenance Work. However, Gardner's multiple intelligences learning model is more effective than Kolb's experiential learning model. Moreover, gender has no influence on the students' cognitive achievement and also gender has no significant difference on the students' cognitive achievement test when taught with both Kolb's experiential and Gardner's multiple intelligence learning models. The study also concluded that there was no significant difference in the interaction effects of methods and gender on student's cognitive achievement test 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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