



Effects of Kolb's Experiential and Gardner's Multiple Intelligence Learning Models on Students' Achievement and Interest in Basic Electricity in Technical Colleges

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ABSTRACT

The study investigated the effects of Kolb's Experiential and Gardner's multiple intelligence learning models on students' achievement and interest in Basic Electricity in Technical Colleges in Gombe state. Six research questions and nine null hypotheses guided the study. The hypotheses were tested at 0.05 level of significance. Quasi-experimental design was adopted for the study. The samples for the study were 118 NTC2 students made up of 95 males and 23 females. Purposive sampling technique was used to select two schools from Gombe and Yamaltu Deba Educational zones. Two intact classes tagged Kolb's and Gardner were used. The instruments used for data collection were 50 objective questions, an interest inventory and a psychomotor test question developed by the researcher which was administered as pretest, posttest to the two groups. Pearson correlation coefficient formula was used to establish the reliability of the instrument which yielded 0.81 correlation coefficient. Cronbach Alpha was used to establish the reliability of the interest inventory and 0.84 was obtained. The research questions were answered using mean scores whereas the hypotheses were tested using ANCOVA. The mean scores and ANCOVA results were calculated using SPSS version 23. The result showed that the academic performance and interest of the students taught with Gardner was significantly impacted. Results also showed that the effect of Gardner on academic performance and interest was not significant in relation to gender. The implication of the result for education is that Gardner multiple intelligence learning model is an effective mode of teaching capable of improving students' performance and interest in Basic Electricity. In view of the findings, it was recommended among others that Gardner multiple intelligence learning model should be adopted in technical colleges, secondary schools and vocational schools for instruction in Basic Electricity to improve academic performance and interest ability of the students.

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INTRODUCTION

Technical education is the education meant for skill development and preparation of an Individual for paid or self-employment. It is an aspect of Technical and Vocational Education (TVET) whose purpose is to prepare a person(s) for employment in any occupation or groups of occupation (Uwaifor, 2019). According to

International Labour Organization (ILO, 2015), all Technical and Vocational training programmes are aimed towards acquisition of relevant knowledge, practical skills and attitudes for employment in a particular trade or occupational area.

In Nigeria today, Technical Education is perceived as one of the solutions to high

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unemployment rate due to its ability to create jobs for unemployed youths and enhancing sustainable national growth and development (Abdulrahman, 2013). This is because when individual acquire skill or capacity, they are empowered to shape their own lives and work situation proactively. One of such institution of learning which is concerned with the production of this pool of skilled craftsmen and enhancing national technological growth and human development are the technical colleges where trade courses such as Basic Electricity are taught.

Basic Electricity is one of the fundamental subjects offered in technical colleges with Electrical installation and maintenance works, Radio, Television (RTV) and electronic work (Amadike, 2015). This is because the National Business and Technical Education Board (NABTEB) syllabus outlined Basic Electricity as one among the trade-related subjects offered at the Technical College level (NABTEB, 2011). It is designed to teach and impart knowledge and understanding of electrical and electronic principles, maintenance and repair of domestic and industrial equipment and safe working procedures to students.

Teaching is the art of imparting knowledge, skill, attitudes, ideas, appreciation and change in behavior (Alome & Bargu, 2016). The teacher's job, therefore, is to impart desirable changes in behavior into the learners through the use of appropriate teaching methods namely: Lecture, Discussion, Inquiry/Discovery, Expository, Experimentation, Demonstration, Field-trip/Excursion, etc. Learning on the other hand is a process of gaining knowledge or acquiring skills or having understanding of a new concept and imbibing a better way of carrying out instructional tasks (Olabiyi & Keshinro, 2013). Damisa and Didam (2013) explained that lecture and demonstration methods are teaching methods based on the traditional view point that the teacher is an ocean of knowledge, thus, it is his responsibility to disseminate knowledge to passive listeners or learners. In other words, the teaching methods are executed by activities of the teacher while the learners only observe and listen. Hence, students are not always given enough

opportunities to be fully involved in the learning process, which often result into learning difficulties, disinterest and inability to acquire knowledge and skills they can easily adapt, apply and transfer to new situations under varying technology development. Moreover, research findings over the years especially by Olawale and Augustus (2018) have been consistent on the weakness of traditional instructional approaches in teaching/learning of trades in Technical Colleges in the 21st century that warrants looking for alternative instructional methods. Though the traditional method of instruction (lecture and demonstration) have their merits, but it appears such advantages is not very adequate to ensure students improved performance in the trades offered in technical colleges for instance, lecture method of teaching requires less time for instructional delivery. It as well permits wide coverage of learning experiences, but exclude students' full participation in classroom setting, which could be a contributing factor to students poor performance in Technical college trade such as Basic Electricity hence, the search for alternative instructional method becomes paramount.

The Basic Electricity craftsmen, therefore, seemed ill-equipped with the necessary knowledge and skills required for performing and coping with technology advancements in the industry. Moreover, research findings over the years especially by Ogwo (2016), Olawale and Augustus (2018) have been consistent on the weakness of conventional instructional approaches in the 21st century in teaching/learning of engineering trades in Technical Colleges. However, literature evidence such as Lazer, (2014) and Stavenga, Wierstra and Hermanussen (2016) shows that instructional approaches that are rooted in Kolb's experiential learning model and Gardner's multiple intelligence learning model are contemporary ways of instruction, capable of improving the learner's learning abilities and developing higher order thinking and strong problem-solving skills in the learner. These skills are nowadays necessary to Basic Electricity craftsmen for performing and

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coping in the world of work that is vast changing with technology advancement.

Kolb's experiential learning model, according to Morrison (2009), maintains that learning is cyclical, involving four principal stages: Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active experimentation (AE). The Concrete Experience (CE) and Abstract Conceptualization (AC) explain how individuals perceive knowledge while Active Experimentation (AE) and Reflective Observation (RO) explain how individuals process knowledge. Kolb postulated four types of learning styles: diverging, assimilating, converging and accommodating.

Gardner's multiple intelligence learning models presupposes that all humans possess a number of distinct intelligences which manifest in different ways to learn and demonstrate understanding (Christison, & Kennedy, 2019). Gardner recognized eight intelligence patterns, which according to him, described different ways individuals' natural talents are manifested and how they learn best. The eight multiple intelligence patterns are: Verbal-linguistic intelligence (word smart), logical - Mathematical intelligence (number and reasoning smart), visual-spatial intelligence (picture smart), musical intelligence (music smart), bodily- kinesthetic intelligence (body smart), interpersonal intelligence (people smart), intrapersonal intelligence (self-smart) and naturalistic intelligence (nature smart).

Interest has been described as the attraction which forces or compels a learner to respond to a particular stimulus. Interest increases learning, therefore, promoting interest in the classroom increases students' intrinsic motivation to learn (Schraw, Flowerday & Lehman, 2011). Schraw, Flowerday & Lehman stated that the provision of an engaged learning environment promotes students' interest in learning. Obodo (2014) maintained that interest controls the motivation to learn, thus, it has a direct relationship with students' achievement in any school subject.

Achievement connotes final accomplishment of something noteworthy after some effort. However, achievement in this study

relates to accomplishment of learning by a student in either cognitive or psychomotor domains of learning. The word, cognitive relates to knowledge and the development of mental and intellectual abilities. It involves thinking, reasoning and remembering.

Cognitive achievement by a student therefore, connotes performance in a school subject as symbolized by a score or mark in an achievement test. Psychomotor involves manipulative or practical skills. Psychomotor achievement, according to McGraw (2013), is the degree of skill demonstrated by an operator in the completion of a task. Therefore, psychomotor achievement in this study refers to achievement attained by a student in psychomotor tasks in a school subject as represented by a score or marks obtained in a performance test. Okoro (2016) explained that performance test involves the use of tools and equipment in a direct assessment of the number of practical skills possessed by the student. Student's cognitive and psychomotor achievement is influenced by several factors among which are the instructional method and the learner's ability (Atherton, 2013). Moreover, achievement may also be influenced by gender factor.

Gender refers to the socially constructed roles, behaviors, activities and attributes that a given society considers appropriate for men and women. Myers (2012), however, explained that gender refers to the characteristics, whether biologically or socially influenced, by which people define male and female. The term gender, therefore, in this work is used to classify males and female students. In education, a number of differences have been established and documented between the achievement of male and female students. The gender gap in education is also visible in vocational courses which prepare students for a career, as statistics have shown that a large proportion of girls achieve distinctions, even in subjects such as engineering and construction where they are a minority (Mahmood, 2011).

However, available literatures on gender issue are sometimes conflicting. While some advocate male superiority, others take



opposite view. For example, Umunadi (2009) in a study found that male students performed better than their female counterparts in Radio, Television and Electronic Work while the study conducted by Oviawe (2010) revealed that gender of the students had no significant effect on their performance in Building Technology. The form of male and female students' achievement in Basic Electricity will be of interest to Basic Electricity teachers particularly in classroom instruction.

Instruction based on Kolb's experiential learning model and Gardner's multiple intelligence learning models are contemporary approaches that are considered imperative to maximize students' learning potentials. These learning models, therefore, seem to possess instructional tools that Basic Electricity teachers can use to assist students learn more effectively and acquire knowledge and skills they can easily adapt, apply and transfer to different contexts under varying technology situations in Basic Electricity.

Purpose of the Study

The purpose of this study is to determine the effects of Kolb's experiential learning model and Gardner's multiple intelligence learning model on students' achievement and interest in Basic Electricity in Technical Colleges.

Specifically, the study is designed to determine the effect of:

1. Kolb's experiential learning model (KELM) and Gardner's multiple intelligence learning model (GMIM) on students' cognitive achievement in Basic Electricity.
2. Gender on students' cognitive achievement in Basic Electricity when taught using KELM and GMIM
3. KELM and GMIM on students' psychomotor achievement in Basic Electricity.
4. Gender on students' psychomotor achievement in Basic Electricity when taught using
 1. KELM and GMIM
 2. KELM and GMIM on students' interest in studying Basic Electricity.

6. KELM and GMIM on male and female students' interest in Basic Electricity.

Research Questions

The following research questions were posed to guide the study:

1. What is the effect of Kolb's experiential learning model (KELM) and Gardner's multiple intelligence learning model (GMIM) on students' cognitive achievement in Basic Electricity?
2. What is the effect of gender on cognitive achievement of Students when taught Basic Electricity using KELM and GMIM?
3. What is the effect of KELM and GMIM on students' psychomotor achievement in Basic Electricity?
4. What is the effect of gender on students' psychomotor achievement in Basic Electricity when taught using KELM and GMIM?
5. What is the effect of KELM and GMIM on students' interest in Basic Electricity?
6. What is the effect of gender on students' interest in Basic Electricity when taught using KELM and GMIM?

Hypotheses

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

1. There is no significant difference between the effect of Kolb's experiential learning model (KELM) and Gardner's multiple intelligence learning model (GMIM) on students' cognitive achievement in Basic Electricity.
2. There is no significant difference between the effect of gender on Basic Electricity cognitive achievement of students when taught using KELM and GMIM.
3. There is no significant interaction effect of treatments given to students (male and female) taught with KELM and GMIM with respect to their mean scores

- in Basic Electricity cognitive achievement test.
4. There is no significant difference between the effect of KELM and GMIM on students' psychomotor achievement in Basic Electricity.
 5. There is no significant difference between the effect of gender (male and female) on Basic Electricity psychomotor achievement of students when taught using KELM and GMIM.
 6. There is no significant interaction effect of treatments given to students (male and female) taught with KELM and GMIM with respect to their mean scores in Basic Electricity psychomotor achievement test
 7. There is no significant difference between the effect of KELM and GMIM on students' interest in Basic Electricity.
 8. There is no significant difference between the effect of treatment and gender on students' interest in Basic Electricity.
 9. There is no significant interaction effect of treatments and gender students taught using KELM and GMIM with respect to their mean scores on Basic Electricity interest inventory.

METHODOLOGY

A quasi-experimental design was adopted in this study. Specifically, the pretest, posttest, non-equivalent comparison group designs were adopted for the study. According to Gall, Gall and Borg (2017) quasi-experimental design can be used when it is not possible for the researcher to randomly sample the subjects and assign them to treatment groups without disrupting the academic programme of the

schools involved in the study. Therefore, this design was considered suitable to conduct this study because intact classes (non-randomized groups) were assigned to the two different groups in order to determine the comparative effect of Kolb's experiential learning model and Gardner's multiple intelligence learning model on students' cognitive and psychomotor achievement in Basic Electricity.

The pre-test was first conducted before the commencement of the treatment. The pre-test exercise provided baseline data that was used to compare students in both groups. The quasi-experimental process was conducted following the guide as symbolized below:

It is symbolically represented thus:

Group A: O1 X1 O2,

 Group B: O1 X2 O2,

Where;

O1 represent pre-tests

O2 represent post-tests

X1 -Kolb's experiential learning model treatment

X2 -Gardner's multiple intelligence learning model treatment

--- --- indicates that both treatment groups were non-randomized

RESULTS

Research Question 1

What is the effect of Kolb's experiential learning model (KELM) and Gardner's multiple intelligence learning model (GMIM) on students' cognitive achievement in Basic Electricity?

The mean of pre-test scores and post-test scores of the two groups are presented in table 1.

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	Pretest scores		Posttest scores		Mean Gain
		\bar{X}	SD	\bar{X}	SD	\bar{X}
KELM	58	22.16	6.54	47.63	10.11	25.47
GMIM	60	25.08	6.17	59.67	9.11	34.59

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The data presented in Table 1 shows that Kolb's experiential learning model group had a Mean score of 22.16 and Standard Deviation of 6.54 in the pre-test and a Mean score of 47.63 and Standard Deviation of 10.11 in the post-test making a pre-test, post-test Mean gain of 25.47. Gardner's multiple intelligence learning model group had a Mean score of 25.08 and Standard Deviation of 6.17 in the pre-test and a post-test Mean of 59.67 and Standard Deviation of 9.11, with a pre-test, post-test Mean gain of 34.59. With these results, both Gardner's multiple intelligence learning models and Kolb's experiential learning model are effective in improving students'

cognitive achievement in Basic Electricity, but the effect of Gardner's multiple intelligence learning model in improving students' cognitive achievement in Basic Electricity is higher than the effect of Kolb's experiential learning model.

Research Question 2

What is the effect of gender on cognitive achievement test of students when taught Basic Electricity using KELM and GMIM?

The mean of pre-test scores and post-test scores of male and female students of the two groups are presented in table 2.

Table 2: Mean and Standard Deviation of Pretest and Posttest Gender(male and female) Cognitive Achievement Scores of Students Taught Using Kolb's Experiential Learning Model(KELM) and Gardner's Multiple Intelligence Learning Model(GMIM)

Group	Gender	N	Pretest scores		Posttest scores		Mean Gain
			\bar{X}	SD	\bar{X}	SD	
KELM	M	42	21.67	5.91	47.25	10.02	25.58
	F	16	22.35	6.85	45.00	10.23	22.65
GMIM	M	43	26.40	6.72	53.30	8.08	26.90
	F	17	24.59	6.01	49.96	9.00	25.37

Table 2 shows that male students taught Basic Electricity with Kolb's experiential learning model had a Mean score of 21.67 and Standard Deviation of 5.91 in the pre- test and a Mean score of 47.25 and Standard Deviation of 10.02 in the post-test making a pre-test, post-test mean gain for the male students of 25.58. Female students taught Basic Electricity with Kolb's experiential learning model had a mean score of 22.35 and Standard Deviation of 6.85 in the pre-test and a post-test Mean of 45.00 and standard deviation of 10.23, with a pre-test, post-test mean gain of 22.65.

Also, male students taught with Gardner's multiple intelligence learning model had a mean score of 26.40 and Standard Deviation of 6.72 in the pre-test and a Mean score of 53.30 and Standard Deviation of 8.08 in the post-test making a pre-test, post-test Mean gain for the male students 26.90. At the same time, female students taught Basic Electricity with Gardner's multiple intelligences learning model had a mean score of 24.59 and Standard Deviation of 6.01 in the pre-test and a Mean score of 49.96 and Standard Deviation of 9.00 in the post-test making a pre-test, post-test Mean gain for the female students 25.37. With these results male students taught Basic Electricity with Kolb's experiential learning model and Gardner's multiple intelligence learning model had higher posttest mean scores than female students in the cognitive achievement test. Therefore, there is an effect attributed to gender on students' cognitive achievement in Basic Electricity.

Research Question 3

What is the effect of Kolb's experiential learning model (KELM) and Gardner's multiple intelligence learning model (GMIM) on students' psychomotor achievement in Basic Electricity?

The mean of pre-test scores and post-test scores of the two groups are presented in Table 3.

Table 3: Mean and Standard Deviation of Pretest and Posttest Scores of Kolb's Experiential Learning Model, Gardner's Multiple Intelligences Learning Model Groups in the Psychomotor Achievement Test

Group	N	Pretest score		Posttest score		Mean Gain
		\bar{X}	SD	\bar{X}	SD	\bar{X}
KELM	58	23.12	5.25	51.51	23.03	28.39
GMIM	60	24.92	6.26	57.05	17.84	32.13

Table 3 shows that Kolb's experiential learning model group had a Mean score of 23.12 and Standard Deviation of 5.25 in the pre-test and a Mean score of 51.51 and Standard Deviation of 23.03 in the post-test making a pre-test, post-test Mean gain of 28.39. Gardner's multiple intelligence learning model group had a Mean score 24.92 and Standard Deviation of 6.26 in the pre-test and a post-test Mean of 57.05 and Standard Deviation of 17.84, with a pre-test, post-test Mean gain of 32.13. With these results, both Kolb's experiential learning model and Gardner's multiple intelligence learning model are effective in improving students' psychomotor achievement in Basic Electricity but the effect of Gardner's

multiple intelligence learning model in improving students' psychomotor achievement in Basic Electricity is higher than the effect of Kolb's experiential learning model.

Research Question 4

What is the effect of gender on student's psychomotor achievement in Basic Electricity when taught using Kolb's experiential learning model (KELM) and Gardner's multiple intelligences learning model (GMIM)?

The mean of pre-test scores and post-test scores of male and female students of the two groups are presented in table 4.

Table 4: Mean and Standard Deviation of Pretest and Posttest Gender (male and female) Psychomotor Achievement Scores of students taught using Kolb's Experiential Learning Model(KELM) and Gardner's Multiple Intelligences Learning Model(GMIM)

Group	Gender	N	Pretest score		Posttest score		Mean Gain
			\bar{X}	SD	\bar{X}	SD	\bar{X}
KELM	M	42	24.52	5.13	53.58	23.82	29.06
	F	16	20.08	5.65	32.75	21.61	12.6
GMIM	M	43	26.33	6.27	58.83	14.59	32.50
	F	17	19.50	6.29	32.70	25.48	13.20

The data in table 4 shows that male students taught Basic Electricity with Kolb's experiential learning model had a Mean score of 24.52 and Standard Deviation of 5.13 in the pre-test and a Mean score of 53.58 and Standard Deviation of 23.82 in the post-test making a pre-test, post-test mean gain in the male students of 29.06. Female students taught Basic Electricity with Kolb's experiential learning model had a mean score of 20.08 and Standard Deviation of 5.65 in the pre-test and a post-test Mean of 32.75 and standard deviation of 21.61, with a pre-test, post-test mean gain of 12.67.

Also, male students taught with Gardner's multiple intelligence learning model had a Mean score of 26.33 and Standard Deviation of 6.27 in the pre-test and a Mean score of 58.83 and Standard Deviation of 14.59 in the post-test making a pre-test, post-test Mean gain in the male students of 32.50. At the same time, female students taught Basic Electricity with Gardner's multiple intelligence learning model had a mean score of 19.50 and Standard Deviation of 6.29 in the pre-test and a Mean score of 32.70 and Standard Deviation of 25.48 in the post-test making a pre-test, post-test Mean gain in the

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female students of 13.20. With these results male students taught Basic Electricity with Kolb's experiential learning model and Gardner's multiple intelligence learning model had higher posttest mean scores than female students in the psychomotor achievement test. Therefore, there is an effect attributed to gender on students' psychomotor achievement in Basic Electricity.

Research Question 5

What is the effect of Kolb's experiential learning model (KELM) and Gardner's multiple intelligences learning model (GMIM) on students' interest in Basic Electricity.

The mean of pre-test scores and post-test scores of the two groups are presented in Table 5.

Table 5: Mean and Standard Deviation of Pretest and Posttest Interest Scores of students taught using Kolb's Experiential Learning Model and Gardner's Multiple Intelligences Learning Model

Group	N	Pretest score		Posttest score		Mean Gain
		\bar{X}	SD	\bar{X}	SD	\bar{X}
KELM	58	32.04	5.21	74.84	7.38	42.80
GMIM	60	33.57	4.22	79.73	10.58	46.16

The data presented in Table 5 shows that Kolb's experiential learning model group had a Mean interest score of 32.04 and Standard Deviation of 5.21 in the pre-test and a Mean score of 74.84 and Standard Deviation of 7.38 in the post-test making a pre-test, post-test Mean gain of 42.80. Gardner's multiple intelligence learning model group had an interest Mean score of 33.57 and Standard Deviation of 4.22 in the pre-test and a post-test Mean of 79.73 and Standard Deviation of 10.58, with a pre-test, post-test Mean gain of 46.16. With these results, both Kolb's experiential learning model and Gardner's multiple intelligence learning model are effective in stimulating

students' interest in Basic Electricity but the effect of Gardner's multiple intelligence learning model in stimulating students' interest in Basic Electricity is higher than the effect of Kolb's experiential learning model.

Research Question 6

What is the effect of gender on students' interest in Basic Electricity when taught using Kolb's experiential learning model (KELM) and Gardner's multiple intelligence learning model (GMIM)?

The mean of pre-test scores and post-test scores of male and female of the two groups are presented in Table 6.

Table 6: Mean and Standard Deviation of Pretest and Posttest Gender (male and female) Interest Scores of students Taught Using Kolb's Experiential Learning Model and Gardner's Multiple Intelligences Learning Model.

Group	Gender	N	Pretest score		Posttest score		Mean Gain
			\bar{X}	SD	\bar{X}	SD	\bar{X}
KELM	M	42	24.67	5.91	55.08	7.40	30.41
	F	16	21.97	4.70	50.74	7.49	28.77
GMIM	M	43	25.40	4.03	59.50	11.97	34.10
	F	17	22.63	4.36	54.48	8.04	31.85

Table 6 shows that male students taught Basic Electricity with Kolb's experiential learning model had an interest Mean score of 24.67 and Standard Deviation of 5.91 in the pre-test and a Mean score of 55.08 and Standard Deviation of 7.40 in the post-test making a pre-test, post-test

mean gain in the male students of 30.41. Female students taught Basic Electricity with Kolb's experiential learning model had a mean score of 21.97 and Standard Deviation of 4.70 in the pre-test and a post-test Mean of 50.74 and Standard Deviation of 7.49, with a pre-test, post-test mean

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gain of 28.77. Also, male students taught with Gardner's multiple intelligence learning model had a Mean score of 25.40 and Standard Deviation of 4.03 in the pre-test and a Mean score of 59.50 and Standard Deviation of 11.97 in the post-test making a pre-test, post-test Mean gain in the male students of 34.10.

At the same time, female students taught Basic Electricity with Gardner's multiple intelligence learning model had a mean score of 22.63 and Standard Deviation of 4.36 in the pre-test and a Mean score of 54.48 and Standard Deviation of 8.04 in the post-test making a pre-test, post-test Mean gain in the female students of 31.85. With these results male students taught Basic Electricity with Kolb's experiential learning model and Gardner's multiple intelligence learning model had higher posttest interest mean score than female students in the Basic Electricity interest inventory. Thus, gender has influence on students' interest in studying Basic Electricity.

Test of Hypotheses

Table 7: Summary of Analysis of Covariance (ANCOVA) for Test of Significance of Effect of Treatments (KELM and GMIM), their Gender and Interaction Effect with Respect to their Mean Scores on Basic Electricity Cognitive Achievement Test

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Covariate	357.717 ^a	5	71.543	1.734	.133
Intercept	289850.574	1	289850.574	3.886E3	.000
Method	45116.214	2	22558.107	302.425	.000
Gender	51.460	1	51.460	.308	.310
Method*Gender	425.872	2	212.936	.045	.062
Error	8354.161	112	74.591		
Total	415636.000	118			
Corrected Total	60004.780	117			

^aSignificant at sig of F < .05

The data presented in Table 7 shows F-calculated values for three effects: treatment, gender and interaction effect of treatments and gender on students' cognitive achievement in Basic Electricity. The F-calculated value for treatment is 302.425 with a significance of F at .000. Since the F-calculated value is higher than the significant F value, the null-hypothesis of no significant mean difference between the effect of Kolb's experiential learning model and Gardner's

Hypotheses 1, 2, and 3

1. There is no significant difference between the effect of Kolb's experiential learning model (KELM) and Gardner's multiple intelligences learning model (GMIM) on student's cognitive achievement in Basic Electricity
2. There is no significant difference between the effects of gender on Basic Electricity cognitive achievement of students when taught using KELM and GMIM.
3. There is no significant interaction effect of treatments given to students taught with KELM and GMIM and their gender (male and female) with respect to their mean scores on Basic Electricity cognitive achievement test.

The summary of Analysis of Covariance (ANCOVA) test for hypotheses 1, 2 & 3 are presented in table 7.

multiple intelligence learning model on students' cognitive achievement in Basic Electricity is, therefore, accepted at .05 level of significance.

The result implies that the mean difference between the effects of Gardner's multiple intelligence learning model and Kolb's experiential learning model was significant. The F-calculated value for gender as shown in Table 7 is .308 with a significance of F at .310. Since the F-calculated value is less than the significant F value the null hypothesis of no significant mean



difference between the effect of gender (male and female) on students' cognitive achievement in Basic Electricity is accepted at .05 level of significance. This means that there was no significant mean difference between the effects of gender on students' cognitive achievement in Basic Electricity. The interaction of treatments and gender has F-calculated value of .045 with significance of F at .062. Since F-calculated is less than the significant F value, the null hypothesis of no significant interaction effect of treatments on gender is accepted. This means that there was no significant interaction effect of treatments given to students taught with Kolb's experiential learning model and Gardner's multiple intelligence learning model and their gender with respect to their mean scores on Basic Electricity cognitive achievement test.

4. There is no significant difference between the effect of KELM and GMIM on students' psychomotor achievement in Basic Electricity.
5. There is no significant difference between the effects of gender on Basic Electricity psychomotor achievement of students when taught using KELM and GMIM.
6. There is no significant interaction effect of treatments given to students taught with KELM and GMIM and their gender with respect to their mean scores on Basic Electricity psychomotor achievement test.

The summary of Analysis of Covariance (ANCOVA) test for hypotheses 4, 5 & 6 are presented in table 8.

Hypotheses 4, 5 and 6

Table 8: Summary of Analysis of Covariance (ANCOVA) for Test of Significance of Effect of Treatments (KELM, GMIM), their Gender and Interaction Effect with Respect to their Mean Scores on Basic Electricity Psychomotor Achievement Test

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Covariate	401.082 ^a	5	80.216	1.895	.101
Intercept	243694.797	1	243694.797	763.390	.000
Method	24204.582	2	12102.291	13.911	19.001
Gender	292.357	1	292.357	.041	.196
Method*Gender	1.468	2	.734	.002	.398
Error	35753.440	112	319.227		
Total	384944.000	118			
Corrected Total	65872.000	117			

*Significant at sig of F < .05

Table 8 shows F-calculated values for effect of treatment (KELM and GMIM), gender and interaction of treatment and gender on students' psychomotor achievement in Basic Electricity. The F-calculated value for treatment is 13.911 with a significance of F at 19.001. Since the F-calculated value is less than the significant F, the null-hypothesis of no significant difference between the effect of treatments (Kolb's experiential learning model and Gardner's multiple intelligence learning model) on students' psychomotor achievement in Basic Electricity is, therefore, accepted at .05 level of significance. This means

that there is no significant difference between the effect of Kolb's experiential learning model and Gardner's multiple intelligence learning model on students' psychomotor achievement in Basic Electricity.

The F-calculated value for gender is .041 with a significance of F at .196. Since the F-calculated value is higher than the Significant F-value, the null hypothesis is, therefore, rejected at .05 level of significance. This result means that there is significant effect of gender in favour of males on students' psychomotor achievement in Basic Electricity. The interaction effect of

treatment and gender has F-calculated value of .002 with significance of F of .998. Since the F-value is higher than the F-calculated value, the null hypothesis of no significant interaction effect of treatments given to students taught with Kolb's experiential learning model and Gardner's multiple intelligence learning model and their gender with respect to their mean scores on Basic Electricity psychomotor achievement test is accepted at .05 level of significance. This, therefore, means that there is no significant interaction effect of treatments given to students taught with Kolb's experiential learning model and Gardner's multiple intelligences learning model and their gender with respect to their mean scores in Basic Electricity psychomotor achievement test.

Hypotheses 7, 8 & 9

Table 9: Summary of Analysis of Covariance (ANCOVA) for Test of Significance of Effect of Treatments, Gender and Interaction Effect of Treatments Given to Students Taught with KELM and GMIM and their Gender with Respect to their Mean Scores on Basic Electricity Interest Inventory

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Covariate	178.196 ^a	5	35.639	1.571	.174
Intercept	211538.421	1	211538.421	3.826E3	.000
Method	22788.920	2	11394.460	.088	.190
Gender	216.016	1	216.016	.307	.212
Method*Gender	962.467	2	481.234	.204	.400
Error	6192.396	112	55.289		
Total	290259.000	118			
Corrected Total	31567.263	117			

^aSignificant at sig of F < .05

The data presented in Table 9 shows F-calculated values for the effect of treatment, gender and interaction of treatment and gender on students' interest in Basic Electricity. The F-calculated value for treatment is .880 with a significance of F at .190. This shows that the F-calculated value is less than the significant F value. Therefore, the null hypothesis of no significant mean difference between the effect of treatments (Kolb's experiential learning model and Gardner's multiple intelligence learning model) on students' interest in Basic Electricity is accepted at .05 level of significance. The result means that the mean difference between the effect of Kolb's experiential learning model and Gardner's multiple

7. There is no significant mean difference between the effect of KELM and GMIM on students' interest in Basic Electricity
8. There is no significant mean difference between the effect of gender (male and female) on students' interest in Basic Electricity.
9. There is no significant interaction effect of treatments given to students taught with KELM and GMIM and their gender with respect to their mean scores on Basic Electricity interest inventory

The summary of Analysis of Covariance (ANCOVA) test for hypotheses 7, 8 & 9 are presented in table 9.

intelligence learning model on students' interest in Basic Electricity is not statistically significant. F-calculated value for gender as shown in Table 9 is .307 with a significance of F at .212.

Since the F-calculated value is higher than the significant F, the null hypothesis of no significant mean difference between the effect of gender (male and female) on students' interest in Basic Electricity has been rejected at .05 level of significance. With this result there is significant mean difference between the effect of gender (male and female) on students' interest in Basic Electricity in favour of males. The interaction effect of treatment and gender has F-calculated value of .204 with significance of F of .400. This result



means that there is no significant interaction effect of treatments given to students taught with Kolb's experiential learning model and Gardner's multiple intelligence learning model and their gender with respect to their mean scores on Basic Electricity Interest Inventory.

Summary of the Findings

Based on the data collected and analysed in this study the following are the findings of the study:

1. Gardner's multiple intelligences learning model is more effective than Kolb's experiential learning model in enhancing students' achievement in Basic Electricity. The effect was found to be significant.
2. Gardner's multiple intelligences learning model is more effective than Kolb's experiential learning model in improving students' psychomotor achievement in Basic Electricity. The effect was found to be significant.
3. Gardner's multiple intelligences learning model is more effective than Kolb's experiential learning model in stimulating students' interest in Basic Electricity. The effect was found to be non-significant.
4. It was found out that there was an effect of Gender on students' cognitive achievement in Basic Electricity favouring male students. But the effect was not found to be significant.
5. The study revealed that there was an effect of Gender on students' psychomotor achievement in Basic Electricity favouring male students. The effect was found to be significant.
6. The study found out that there was an effect of Gender on students' interest in Basic Electricity favouring male students. The effect was found to be significant.
7. There was no significant interaction effect of treatments given to students taught with Kolb's experiential learning model and Gardner's multiple

intelligence learning model and their gender with respect to their mean scores on Basic Electricity Cognitive Achievement Test

8. There was no significant interaction effect of treatments given to students taught with Kolb's experiential learning model and Gardner's multiple intelligence learning model and their gender with respect to their mean scores on Basic Electricity psychomotor Achievement Test.
9. There was no significant interaction effect of treatments given to students taught with Kolb's experiential learning model and Gardner's multiple intelligence learning model and their gender with respect to their mean scores in Basic Electricity Interest Inventory

CONCLUSIONS

Based on the results of this study, which shows that Gardner's multiple intelligence learning model is more effective in improving students' achievement and interest in Basic Electricity than Kolb's experiential learning model, there was an effect attributable to gender on students' achievement and interest in Basic Electricity. Also, the study found out no significant interaction effect of treatments given to students taught using Kolb's experiential learning model and Gardner's multiple intelligence learning model and gender on achievement and interest of Technical College students in Basic Electricity. This means that the effectiveness of Gardner's multiple intelligence learning model on students' achievement and interest in Basic Electricity does not depend on the levels of gender. Hence, irrespective of nature of gender, learners will record improved performance in achievement and interest in Basic Electricity when Gardner's multiple intelligence learning model is employed to teach Basic Electricity in Technical Colleges. These results, therefore, show that Gardner's multiple intelligence learning model is a viable teaching method for teaching/learning Basic Electricity in Technical Colleges.



Instruction based on Gardner's learning model is a contemporary teaching approach which maximizes students' learning potentials by minimizing the problems caused by the students' individual differences and creating a learning environment appropriate for each student's intelligences. The learning model will give teachers the opportunity to engage the students in the learning process, which will increase their self-esteem and enthusiasm and their willingness to take ownership and responsibility for their learning. Thus, if Gardner's multiple intelligence learning model is adopted to teach Basic Electricity in Technical Colleges, the Basic Electricity craftsmen will, undoubtedly, be equipped with knowledge and skills that will help them easily adapt and apply their skills in Basic Electricity as well as perform and cope more effectively with complexities in the vast changing Technological world of work.

RECOMMENDATIONS

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

1. Workshops, seminars and conferences should be organized by State Science and Technical Schools Board to enlighten and train Basic Electricity teachers on the application of Gardner's multiple intelligence learning model for improving students' achievement and interest in studying Basic Electricity.
2. National Board for Technical Education (NBTE) should consider the review of curriculum for Basic Electricity with a view to incorporating activities that reflect students' multiple intelligences to enable students learn more effectively.
3. Basic Electricity teachers in technical colleges should adopt Gardner's multiple intelligence learning model in their classroom teaching. This will help the teachers equip Basic Electricity craftsmen with the knowledge and skills needed to easily cope and perform more effectively in the world of work.
4. State Science and Technical Schools Board should equip workshops in

technical colleges with relevant modern equipment, tools and machines. This will help improve students acquisition and mastery of psychomotor skills

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