



Effects of Kolb's Experiential and Gardner's Multiple Intelligence Models on Students Interest on Basic Electricity in Technical Colleges in Gombe State, Nigeria

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ABSTRACT

The study investigated the effects of Kolb's Experiential and Gardner's multiple intelligence learning models on students' interest in Basic Electricity in Technical Colleges in Gombe state. Two research questions and two null hypotheses guided the study. The hypotheses were tested at a 0.05 level of significance. A quasi-experimental design was adopted for the study. The study sample consisted of 118 NTC2 students, who were 95 males and 23 females. A purposive sampling technique was used to select two schools from the Gombe and Yamaltu Deba Educational zones. Two intact classes tagged Kolb's and Gardner were used. The instrument used for data collection was an interest inventory developed by the researcher which was administered to the two groups. 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 students taught with Gardner significantly impacted the interest of the students. Results also showed that the effect of Gardner on interest was not significant about gender. The result for education implies that Gardner's multiple intelligence learning model is an effective mode of teaching capable of improving students' interest in Basic Electricity. Given the findings, it was recommended among others that Gardner's multiple intelligence learning model should be adopted in technical colleges, secondary schools and vocational schools for instruction in Basic Electricity to improve the interest ability of the students.

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INTRODUCTION

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).

Gardner described the eight intelligence patterns as follows: Verbal linguistic Intelligence

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is the ability to think in words and to use spoken and written words or languages to express ideas, and appreciate meaning and accomplish other goals. Logical-mathematical Intelligence is the ability to think conceptually and abstractly, and also involves the capacity to use numbers to calculate, quantify, and analyze problems logically as well as use inductive and deductive reasoning. Visual-Spatial Intelligence is the capacity to think in images and pictures, to visualize accurately and abstractly. Musical Intelligence is the ability to produce and appreciate rhythm, pitch and timbre. Bodily-Kinesthetic Intelligence is the ability to control one's body movements and to handle objects skillfully as well as to solve problems or fashion out products. Interpersonal Intelligence is the ability to work and interact with others and understand their moods, feelings and temperaments. Intrapersonal Intelligence refers to the ability to understand oneself, recognize one's feelings, strengths and weaknesses and to use the information to plan and direct one's life. Naturalist Intelligence is the ability to recognize and categorize plants, animals and other objects in nature.

Gardner's multiple intelligence learning models has been widely embraced by educators, and has enjoyed numerous adaptations in a variety of educational settings (Giles, Pitre and Womack, 2013). Armstrong (2010) maintained that if a teacher is having difficulties in reaching a student in the more traditional linguistic or logical ways of instruction, the multiple intelligence learning models offers several other ways in which the material might be presented to facilitate effective learning. He, therefore, advocated that teachers applying the multiple intelligence learning model in the classroom should present their lessons using a wide variety of instructional techniques involving the use of words, numbers, logic and music, group activities, physical activities, pictures, self-reflection and the physical surrounding in order to adequately cater for the students' diverse intelligence.

Proponents of Gardner's multiple intelligence learning models such as O Shea (2013) advocate instructional techniques such as Active learning, Collaborative learning, Authentic

instruction and Self-assessment in implementing Gardner's multiple intelligence learning model in the classroom. These instructional techniques address at least six multiple intelligence models such as Active learning (verbal-linguistic, logical-mathematical), Collaborative learning (interpersonal intelligences and Bodily-kinesthetic intelligences), Authentic instruction (visual-spatial intelligences) and Self-assessment (intrapersonal intelligence). The four instructional techniques will, therefore, be applied in the classroom to address the six multiple intelligence models related to this study. Instructional techniques are processes or strategies adopted by teachers to inject variety in their teaching, stimulate the teaching and maintain the learners' interest in the teaching/learning process (Ukoha and Eneogwe in Ogwo, 2016).

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. This means that when learners are involved in the learning process with interest learning is facilitated and achievement can be enhanced. Students' interest in any learning activity can, therefore, be sustained by the active involvement of the learner in all aspect of the learning process. In other words, learner's interest in an activity increases the strength of ego-involvement of the learner, and does not allow the learner to be distracted by trivial extraneous events around him. Obodo (2014) maintained that interest controls the motivation to learn, thus, it has a direct relationship with students' achievement in any school subject.

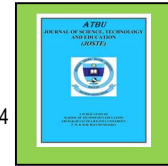
Gender refers to the socially constructed roles, behaviours, activities and attributes that a given society considers appropriate for men and women. Myers (2012), however, explained that gender refers to the characteristics, whether biologically or socially influenced, by which people define male and female. The term gender, therefore, in this work is used to classify males and female students. In

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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.

STATEMENT OF THE PROBLEM

The rapid rate of Technological development in the industry and the increasing demands on learning capacities in Basic Electricity call for a change in the instructional delivery system used in training Basic Electricity craftsmen in Technical Colleges. It is observed that most of the Basic Electricity craftsmen graduating from Technical Colleges often find it difficult to adapt and apply their knowledge and skills to trace and rectify problems in electricity installations and industries under varying technological situations. Furthermore, there seems to be few Basic Electricity craftsmen who can effectively repair faults in modern Electrical systems. Even at that, inadequate teaching/learning in Technical Colleges has been identified by Damisa and Didam 2013 as partly responsible for Basic Electricity craftsmen's inability after graduation to effectively apply their knowledge and skills to solve problems in modern Electrical installations.

The conventional teaching/learning methods (lecture used in conjunction with demonstration method) predominantly applied in

training Basic Electricity craftsmen in Technical Colleges do not always give students enough opportunities to actively participate in the learning process, because the teaching methods are executed by teacher-centered activities while the learners only observe and listen. This often results in learning difficulties, disinterest and poor performances among students. Moreover, research findings over the years have been consistent on the weakness of traditional instructional approaches in teaching/learning of engineering related trades such as Basic Electricity in Technical Colleges. Though the conventional method permits large coverage and participation in class, they seem inadequate for equipping Basic Electricity craftsmen with the knowledge and skills required to perform effectively in the 21st century and cope with the vast changing and developing field of technology.

However, literature has shown that teaching/learning processes rooted in Kolb's experiential learning model and Gardner's multiple intelligence learning model are capable of improving the learner's learning abilities and developing problem solving and higher order thinking skills in the learner. These skills are nowadays necessary to Basic Electricity students for performing and coping in the Electrical and Electronics world of work that is in a rapid change of technology development. Therefore, a shift in the instructional delivery system is needed to assist Basic Electricity craftsmen in Technical Colleges learn more effectively and easily acquire knowledge and skills they can adapt, apply and transfer to new situations under varying technological development in Basic Electricity. The hope is that it will also help these craftsmen rectify problems more effectively in Electrical machines and installations as well as cope with the increasing complexity of Basic Electricity in the world of work. Hence, what are the effects of Kolb's experiential and Gardner's multiple intelligence learning models on students' interest in Basic Electricity in Technical Colleges in Gombe State?

Purpose of the Study

The purpose of this study is to determine the effects of Kolb's experiential learning model

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and Gardner's multiple intelligence learning model on students' interest in Basic Electricity in Technical Colleges.

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

1. KELM and GMIM on students' interest in studying Basic Electricity.
2. 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 KELM and GMIM on students' interest in Basic Electricity?
2. 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 KELM and GMIM on students' interest in Basic Electricity.
2. There is no significant difference between the effect of treatment and

gender on students' interest in Basic Electricity.

METHODOLOGY

A quasi-experimental design was adopted in this study. Specifically, 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' interest in Basic Electricity.

RESULTS

Research Question 1: 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 1.

Table 1: 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 1 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 2: What is the effect of gender on students' interest in Basic Electricity

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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 2.

Table 2: 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 2 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 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

Hypotheses 1, & 2

1. There is no significant mean difference between the effect of KELM and GMIM on students' interest in Basic Electricity
2. There is no significant mean difference between the effect of gender (male and female) on students' interest in Basic Electricity.

Summary of Analysis of Covariance (ANCOVA) test for hypotheses 7, 8 & 9 are presented in table 3.

Table 3: 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

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Error	6192.396	112	55.289
Total	290259.000	118	
Corrected Total	31567.263	117	

*Significant at sig of F < .05

The data presented in Table 3 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 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.

DISCUSSION OF FINDINGS

The data presented in Table 1 provided answer to research question 5. Findings revealed that Kolb's experiential learning model and Gardner's multiple intelligence learning model are effective in improving students' interest in Basic

Electricity, but the effect of Gardner's multiple intelligence learning model in improving students' interest in Basic Electricity is higher than Kolb's experiential learning model. Analysis of covariance was employed to test hypothesis seven (Table 3) at the calculated F-value (.088) significance of F (.190) and confidence level of .05. The result revealed that the null hypothesis of no significant mean difference between the effect of Kolb's experiential learning model and Gardner's multiple intelligence learning model in the Basic Electricity interest inventory was accepted. This means that there was no significant mean difference between the effect of Kolb's experiential learning model and Gardner's multiple intelligence learning model on students' interest in Basic Electricity.

This result, particularly that Gardner's multiple intelligence learning model is effective in stimulating students' interest in studying Basic Electricity, tends to support the writings of Lazer (2014) who wrote that using Gardner's multiple intelligence learning model in the classroom makes lessons more interesting, which causes students to pay more attention to what is taught and then learned. As Gardner (2006) also explained, using multiple entry points to introduce new material in multiple intelligence classrooms will allow teachers to specifically target several intelligences. This will activate students' interest and get them involved in the learning process and also give them more exposure to the lesson content, and more opportunities to connect with the material. The results could, therefore, be explained by the fact that teaching to students' strengths (intelligences/learning styles) engages the students in the learning process. This, consequently, increased their self-esteem and enthusiasm in studying Basic Electricity.

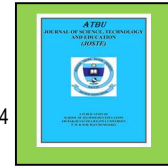
Similarly, the result that Kolb's experiential learning model is effective in stimulating students' interest in studying Basic Electricity supports Koerner (2019) writings which

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stated that experiential learning is an excellent way to provide students with ownership over their learning progress. This also means the higher this ownership, the higher the intrinsic motivation to learn. The result could be explained by the fact that the experiential learning cycle in Kolb's experiential learning model engaged students in this group in the learning process through experiencing (concrete experience e.g. in solving Basic Electrical faults), examining (reflective observation e.g. in steps/procedures involved in tracing and diagnosing of electrical faults), explaining (abstract conceptualization e.g. of signs and symptoms of Basic Electrical faults) and applying (active experimentation e.g. of Basic Electrical fault finding techniques). This seems to have positive effects on students' interest in studying Basic Electricity.

The data presented in Table 2 provided answer to research question six. Findings revealed that gender has effect on students' interest in Basic Electricity in favour of male students. This means that there was influence of gender on students' interest in studying Basic Electricity in favour of males. However, analysis of covariance was used to test hypotheses eight (Table 9) at the calculated F-value (.307), Significance of F (.212) and confidence level of .05. The result revealed that the null hypothesis of no significant mean difference between the effect of gender on students' interest in Basic Electricity was rejected. This means that the mean difference between the effect of gender on students' interest was statistically significant in favour of male students.

The result disagrees with the findings of Jimoh (2016) who found out that there was no significant difference between the mean interest scores of male and female students in Engineering Graphics Interest Inventory. However, the finding of this study with regard to the influence of gender on students' interest in Basic Electricity parallels the findings of Okorieocha (2015) who found a significant gender influence on students' interest towards Basic Electricity in favour of male students in Technical Colleges of Rivers State. The result of the present study also agrees with Owodunni (2016) who

found a significant effect of gender on students' interest in Radio, Television and Electronic Work in Technical Colleges in Lagos state favouring male students. The finding of the present study which revealed a significant mean difference between the effect of gender on students interest in Basic Electricity in favour of male students could be attributed to socio-cultural factors particularly prejudices. Females, normally, are more interested in those courses (such as home economics) which are traditionally regarded as being in the female domain. This being due to the common view that certain technical and vocational programmes such as Electrical Installation and related trades are by their very nature meant for men. The findings could as well be explained by the fact that most women hold a feeling of physical incapacity. As a result, they are less interested in technical jobs especially those taking place in unattractive environment (e.g. woodwork related jobs) which are strenuous and, therefore, require great physical exertion. Females are, therefore, to be encouraged and sensitized on the need to develop positive attitudes towards Basic Electricity subjects and later take up employment in the field.

In addition, Analysis of covariance was used to test hypothesis nine (Table 4) at the calculated F-value (.204), significance of F (.400) and confidence interval of 0.05. 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. This result implies that the effectiveness of Kolb's experiential learning model and Gardner's multiple intelligence learning model on students' interest in studying Basic Electricity does not depend on the level of gender. Hence, there were no significant differential effects of treatments over levels of gender (male and female). Results of the present study have revealed that both Gardner's multiple intelligence learning model and Kolb's experiential learning model are effective in improving students' achievement and interest in studying Basic Electricity, but the effect of Gardner's multiple intelligence learning model is higher in improving

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students' achievement and interest in studying Basic Electricity.

SUMMARY OF THE FINDINGS

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

1. 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.
2. 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

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 interest of Technical College students in Basic Electricity. This means that the effectiveness of Gardner's multiple intelligence learning model on students' interest in Basic Electricity does not depend on the levels of gender. Hence, irrespective of nature of gender, learners will record improved interest in Basic Electricity when Gardner's multiple intelligence learning model is employed to teach Basic Electricity in Technical Colleges. 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: 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' interest in studying Basic Electricity.

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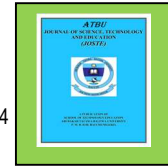
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