



Effect of Kolb's and Joplin's Experiential Learning Models on Senior Secondary School Students' Achievement in Probability in Udi Education Zone

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Abstract

This study examined the effect of Kolb's and Joplin's Experiential Learning Models on Senior Secondary School Students on Achievement in Probability. In this study, 97 Senior Secondary School Students 2 (SSS 2) from Udi Education Zone were sampled using multistage sampling procedure. The study adopted Quasi-experimental design, specifically; pretest-posttest nonequivalent group design. An instrument called Probability Achievement Test (PAT) was employed for data collection in this study. The instrument was validated by experts. The reliability index value of PAT was 0.89 and Kuder Richardson Formula 20 (K-R 20) was used. The data collected were analyzed using mean and standard deviation to answer research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. The findings of the study revealed that there is a significant difference in the mean achievement scores of students taught probability using Kolb's experiential and Joplin's experiential learning models in favor of those exposed to Kolb's experiential learning model. From the findings, it was also revealed that, gender had no interaction effect on students' achievement in learning of probability. It was recommended among others that teachers should adopt Kolb's experiential learning model in teaching and learning of mathematics.

Keywords: Achievement, Experiential Learning models, Mathematics, Probability

Introduction

Mathematics is a subject and also a career course which is essential in our everyday activity. Mathematics according to Siagian (2015) is a critical component of the learning subjects that is required for every nation's social, economic, and technical growth, as well as students' day-to-day activities. It is to this effect that the Federal Government of Nigeria through the National Policy on Education (Federal Republic of Nigeria {FRN}, 2014) and with particular reference to aims and objectives of both Basic and Post Basic education, spelt out the objectives of secondary school mathematics.

In spite of all the importance and priority attached to mathematics over the years, students achieve poorly in it at all levels of our educational systems (WAEC, 2019). According to Ugwuanyi (2015) found a disappointingly high failure rate in

mathematics in basic and post basic schools. The West African Examination Council (WAEC) Chief Examiners' reports of 2019 to 2023 show that the average number of candidates who enrolled for the examinations scored below credit pass in mathematics were 51.00%, in 2019, 64.00% in 2020, 68.70% in 2021, 65.82% in 2022, 61.32% in 2023 respectively. This poor achievement was in mathematics generally with probability inclusive.

Probability is the branch of mathematics concerning numerical descriptions of how likely an event is to occur, or how likely it is that a proposition is true; this can range from an event being impossible to some likelihood to being absolutely certain. According to Summer (2020), probability is the language through which most of the mathematics ideas are communicated. Unfortunately, WAEC has identified



probability as a weak area for students in their examinations.

Many factors may be responsible for students' poor academic achievement in mathematics, especially in probability. Some of these factors include; intelligence quotient (IQ), study habits, age, parents' educational attainment, environmental factor, examination malpractice, interest of the student and personal factors (Andrea & Roldan, 2016). However, the choice of a method should not only be considered in enhancing the achievement of learners based on their gender.

Gender is a factor that has influenced many educational programmes and learner attainments all over the world. It is a factor that has been considered by many researchers in the study of mathematics. Gender is a state of being male or female. Tong, Loc, Uyen and Cuong (2020) opined that science subjects especially mathematics are given masculine outlook by educational practitioners, this is due to the long held view that women are weaker vessels who cannot stand the stress and strain involved in problem solving. In a similar vein Josiah and Abel (2021) found a non-significant relationship between gender, age, mathematics anxiety and college students' achievement in algebra. Filgona (2016) noted imbalance against girls in geography, science, technology and mathematics. According to the author, these are perceived as masculine subjects. From these reports above, it could be seen that the issue of gender is still inconclusive as regards to achievement and hence, there is also the need for further investigation on whether male and female students would respond differently on probability when Kolb Experiential and Joplin Experiential Learning Models are used.

Kolb is cyclical and emphasizes a holistic learning process through four stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation. It assumes that learners move through these stages in a sequence. This model is designed to enhance critical thinking and apply knowledge in varying contexts (Kolb, 1984). In Nigeria, this method may face challenges due to the rigid curriculum structure, time constraints, and large class sizes, which hinder effective engagement in all four stages.

Joplin Laura on the other hand, is a linear five-step process—focus, action, support, feedback, and debrief. Joplin places heavy emphasis on the learner's ability to meet challenges with the right amount of support and feedback (Joplin, 1981). It is more streamlined than

Kolb's model, making it potentially more adaptable to the large class sizes and limited resources in Nigerian schools, where teachers might not have the time to guide students through Kolb's cyclical stages.

In summary therefore, it could be seen that, the results of some earlier researchers such as Okafor (2014), Monic, Tatkovic and Tatkovic (2020) whose results have shown significance difference in students' achievement in probability when taught using Kolb's and Joplin's models in favour of Kolb's model, while Taneja, Kiran and Bose (2022) and Marshall and Shane (2016) whose results have shown significance difference in students' achievement in probability when taught using Kolb's and Joplin's models in favour of Joplin's model. It is clear from the reports above, that the issue of Kolb's and Joplin's learning model is still inconclusive as regards to achievement of students in probability and hence, there is a need for further investigation on whether students would achieve differently in probability when they are taught using Kolb's Experiential and Joplin's Experiential Learning Models in mathematics especially in probability, hence the need for the study.

Research Questions

The following research questions guided the study:

1. What are the mean achievement scores of students taught probability with Kolb's experiential and those taught probability using Joplin's experiential learning models?
2. What are the mean achievements scores of male and female students' in probability?
3. What are the interaction effects of learning models and gender on students' achievement in probability?

Hypotheses

The following null hypotheses were formulated and were tested at the 0.05 level of significance.

- H₀₁:** There is no significant difference in the mean achievement score of students taught probability using Kolb's experiential and those taught probability using Joplin's learning models.
- H₀₂:** There is no significant difference in the mean achievement scores of male and female students in probability?
- H₀₃:** There is no significant interaction effect of the learning models and gender on students' achievement in probability.



Design for the Study

The study adopted a quasi-experimental design. Specifically, pretest-posttest non-equivalent groups design was used. Nonequivalent group here means a situation whereby, an assignment to experimental or control group was not random. According to Nworgu (2015), quasi-experimental design is used where random assignment of subject to experimental and control group is not possible. In this case, intact or pre-existing groups are used. Quasi-experimental design was used in this study because full randomization of subjects to experimental groups was not possible. In order not to disrupt the normal class structure, intact classes were used in the study.

Area of the Study

The study was carried out in Udi education zone of Enugu State. The zone comprised Ezeagu and Udi Local Government Areas of Enugu State, southeast geopolitical zone of Nigeria. Ezeagu local government area shares border with Udi, Uzo Uwani, Oji River, Awka north Local Government Area. Ezeagu and Udi Local Government Areas are made up of members of the Igbo ethnic group with Christianity as the most practiced religion in the areas. The researcher chose this zone due to the poor achievements of students in mathematics (probability) in that zone, as reported by the Chief WAEC Examiner’s reports of 2016 to 2021.

Population and Sample

The population of this study is 1, 703 SSS2 students in all the Public Secondary Schools in Udi Education Zone of Enugu State. Out of this population, 749 are male and 954 are female students respectively. Udi education zone has 54 Public Secondary Schools. Ezeagu Local Government Area has 29 Public Secondary Schools with population of 529 students comprising of 206 male and 323 female students while Udi Local Government Area has 25 Public Secondary school with population

of 1,174 students which includes 543 male and 631 female students respectively. (Post-Primary School Management Board PPSMB: 2021/2022 Academic Session (attached). A sample size of 97 SSS2 students was used for the study.

Instrument for Data Collection

One instrument was used for the data collection namely; Probability Achievement Test (PAT). The Probability Achievement Test (PAT) was made up of 30 multiple choice test items drawn from the SS two mathematics curriculum on probability. The instrument was vetted by instrument development experts to ensure it measures what it intends to measure. The reliability of the instrument was also obtained to be 0.89 using Kuder Richardson formula 20.

Experimental Procedure

The experiment lasted for six weeks. In the first week, the researcher trained research assistants and also administered pretest on the last day of the week before the treatment to provide the researcher with baseline data about the topic. The treatment of the two experimental groups commenced in the second week and lasted for four weeks. The research assistants in each class guided the students in their experimental groups on how to follow the models. After the treatment, the post-test of Probability Achievement Test (PAT) was administered to the students and the results were obtained.

Data Analysis Technique

The research questions were answered using mean and standard deviation, while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. The choice of ANCOVA was to help establish the homogeneity or equivalence of the two groups before and after the treatment.

Results

Table 1: Mean analysis of the achievement scores of students taught probability with Kolb’s experiential model and those students taught probability using Joplin’s experiential learning model

Treatment	No	Pre-test		Post-test		
		Mean	SD	Mean	SD	Mean Gain
Kolb Model	46	12.63	2.56	27.85	2.05	27.73
Joplin Model	51	11.80	2.21	20.45	1.57	20.49

Table 1 shows that the students who were exposed to Kolb’s experiential learning model had mean achievement score of ($M = 12.63$, $SD = 2.56$) at

the pretest and mean achievement score of ($M = 27.85$, $SD = 2.05$) at the posttest, while those exposed to Joplin’s experiential learning model had mean



achievement score of ($M = 11.80, SD = 2.21$) at the pretest and had mean achievement score of ($M = 20.45, SD = 1.57$) at the posttest. Besides, the mean gain achievement scores of 27.73 and 20.49 for the two groups respectively, indicate that the students exposed to Kolb's learning model had higher posttest mean

achievement score than those exposed to Joplin's learning model. However, the posttest standard deviations of 2.05 and 1.57 for the two groups imply that the students exposed to Kolb's learning model had higher variation in their individual achievement scores than those exposed to Joplin's learning model.

Table 2: Analysis of covariance of the effect of learning model on students' achievement in probability

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Squared	Eta
Corrected Model	1343.384 ^a	4	335.846	105.651	.000	.821	
Intercept	1713.243	1	1713.243	538.956	.000	.854	
Pre-test	9.476	1	9.476	2.981	.088	.031	
Treatment	1185.302	1	1185.302	372.875	.000	.802	
Gender	6.572	1	6.572	2.067	.154	.022	
Treatment * Gender	4.941	1	4.941	1.554	.216	.017	
Error	292.451	92	3.179				
Total	57316.000	97					
Corrected Total	1635.835	96					

Table 2 showed that, $F(1, 92) = 372.875, p = .000$. This revealed that there is a significant difference in the mean achievement scores of students taught probability using Kolb's experiential and Joplin's learning models in favor of those exposed to Kolb's

learning model. Thus, the null hypothesis is rejected ($p < .000$). Moreover, the effect size of .802 indicates that 80.2% variation in the mean achievement score of students in probability is attributed to their exposure to Kolb's learning model.

Table 3: Mean analysis of the achievement scores of male and female students in probability

Gender	N	Pre-test		Post-test		Mean Gain
		Mean	SD	Mean	SD	
Male	39	12.54	2.48	23.97	3.90	23.84
Female	58	11.97	2.35	23.95	4.31	24.38

Table 3 shows that male students had mean achievement score of ($M = 12.54, SD = 2.48$) at the pretest and mean achievement score of ($M = 23.97, SD = 3.90$) at the posttest, while female students had mean achievement score of ($M = 11.97, SD = 2.35$) at the pretest and had mean achievement score of ($M = 23.95, SD = 4.31$) at the posttest. Besides, the mean gain achievement scores of 23.84 and 24.38 for male and female students respectively indicate that female students had higher mean achievement score than male students. However, the posttest standard deviations of

3.90 and 4.31 for male and female students respectively imply that female students had higher variation in their individual achievement scores than those the male students.

Table 2 showed that $F(1, 92) = 2.067, p = .154$. This implied that there is no significant difference in the mean achievement scores of male and female students in probability. This implies that the null hypothesis is not rejected ($p > .05$). Thus, gender has no significant influence on students' achievement in probability.

Table 4: Mean analysis of the posttest achievement scores of male and female students exposed to Kolb’s and Joplin’s learning models

Treatment	Gender	N	Pretest		Posttest		Mean Gain
			Mean	Std. Deviation	Mean	Std. Deviation	
Kolb Model	Male	20	51.95	8.98	76.10	6.41	33.48
	Female	26	51.74	9.28	75.27	7.99	30.71
Joplin Model	Male	19	47.08	8.32	67.00	7.94	29.89
	Female	32	48.41	9.76	66.34	7.59	29.31

Table 4 shows that male students who were exposed to Kolb’s experiential learning model had pretest mean achievement score of ($M = 51.95, SD = 8.98$) and posttest mean achievement score of ($M = 76.10, SD = 6.41$) while the female students exposed to Kolb’s experiential learning model had pretest mean achievement score of ($M = 51.74, SD = 9.28$) and posttest mean achievement score of ($M = 75.27, SD = 7.99$). This implies that male students had higher posttest mean achievement scores than at pretest. Furthermore, the female students also had higher posttest achievement scores than at pretest. Besides, the mean gain achievement scores of 33.48 for male students and 30.71 for female respectively at posttest indicate that the male students exposed to Kolb’s learning model had higher posttest mean achievement score than female students those exposed to the same Kolb’s learning model. On the other hand, male students exposed to Joplin’s experiential learning model had pre-test mean achievement score of ($M = 47.08, SD = 8.32$) and posttest mean achievement score of ($M = 67.00, SD = 7.94$) while female students exposed to Joplin’s experiential learning model had pre-test mean achievement score of ($M = 48.41, SD = 9.76$) and post-test mean achievement score of ($M = 66.34, SD = 7.59$). Besides, the mean gain achievement scores of 29.89 for male students and 29.31 for female respectively at posttest indicate that the male students exposed to Joplin’s experiential learning model had higher posttest mean achievement score than female students those exposed to the same Joplin’s experiential learning model. This implies that male students exposed to Joplin’s experiential learning model had higher posttest mean achievement than the female students exposed to the same learning model.

Table 2 revealed that $F(1, 92) = 1.554, p = .216$. This implied that, there is no significant interaction effect of the learning models and gender on students’ achievement in probability. This showed that the null

hypothesis is not rejected ($p > .05$). Thus, achievement of students in probability as a result of their exposure to different learning models is not dependent on their gender.

Discussion of the Findings

The findings of this study revealed that Kolb’s and Joplin’s learning models have effects on students’ academic achievement in probability. From the study, it was revealed that students who were exposed to Kolb’s experiential learning model had higher posttest mean achievement scores than those exposed to Joplin’s learning model. Again, it was also seen from the results that, the posttest standard deviation for the two groups of the students exposed to Kolb’s learning model had higher variation in their individual achievement scores than those exposed to Joplin’s learning model. From the test of hypothesis one, the result revealed that there is a significant difference in the mean achievement score of students taught probability using Kolb’s experiential and Joplin’s learning models in favour of those exposed to Kolb’s learning model. The difference in their individual achievement score might have been attributed to the fact that, students found Kolb’s learning model more engaging and hence the students’ higher achievement scores.

The finding of the study is in agreement with Marshall and Shane (2016) which showed that students who received the Kolb’s experiential learning treatment produced higher creativity scores that were domain specific. However, this study is in disagreement with the findings of the study carried out by Tong, Loc, Uyen and Cuong (2020) which show that the students exposed to Kolb’s learning model had less variation in their individual achievement scores than those exposed to Joplin’s learning model. This disagreement might be as a result of administration of improper teaching instruction by different teachers. Teachers who communicate instruction to learners in an improper way



are liable to cause the learners some irreversible academic consequences that might retard their learning abilities.

The result of the findings has shown that male students had higher mean gain at posttest than at pretest, while female students also had higher mean gain at posttest than at pretest. However, the posttest standard deviation of female was higher than that of male, which implied that female students had higher variation in their individual achievement scores than those of the male counterparts. From the test of hypothesis 2, the result revealed that, the null hypothesis is not rejected. In other words, the null hypothesis is accepted showing that there is no significant difference in the mean achievement scores of male and female students in probability, which therefore means that gender has no significant influence on students' achievement in probability. This study is in disagreement with Arokoyu and Obioha (2020) whose result showed that male students achieve better than their female counterparts when taught with experiential learning approach. Again, Taneja, Kiran and Bose (2022) is not in agreement with this present study. Their study highlighted significant difference between both males and females with respect to experiential learning. So also the findings of the present study is in disagreement with Godpower and Ihenko (2017) whose findings showed that gender has a significant influence on achievement of integrated science students. It is obvious that the issue of gender has always been a contentious one in the learning of mathematics by the secondary school students. This disagreement could be as a result of learning models employed by different teachers who might possess different teaching styles, which could be depending on their academic experience and exposure which could translate to what they teach and hence the noticeable difference.

The result of the study shows that male students who were exposed to Kolb's experiential learning model had higher posttest mean gain score than at pretest. So also, the female students who were exposed to Kolb's experiential learning model had higher posttest mean gain than at pretest. On the other hand, male students who were exposed to Joplin's experiential learning model had higher posttest mean gain than at pretest. Again, the female students who were exposed to Joplin's experiential learning model also had higher mean gain than at pretest. It was observed that, female students who were exposed to Kolb's experiential learning model had higher posttest mean gain than the male students exposed to the same

learning model while the male students exposed to Joplin's learning model had higher posttest mean gain than the female students exposed to the same learning model.

From the test of hypothesis three, it was revealed that the null hypothesis is not rejected. This implies that there is no significant interaction effect of the learning models and gender on students' achievement in probability. The findings of this study disagrees with the finding of the study carried out by Nnamani and Oyibe (2016), which revealed that there is a significant difference in the mean achievement of secondary school students in social studies based on gender. So also, Jacob and Linus (2017) study disagrees with the findings of this study which they affirm that there is a significant interaction effect of treatment and gender on students' achievement in mathematics. The differences in the study might lie in the subject matter. Thus, achievement of students in probability as a result of their exposure to different learning models is not dependent on their gender.

Conclusions

Therefore, it can be concluded that Kolb's experiential model is a well-developed model that can be effectively used to explain and analyze teaching methods and learning styles in the educational research community. It is a model whose characteristics are easy to grasp and can be applied readily to an individual session by one teacher and to a degree program as well. Kolb's Model stimulates and challenges students to develop necessary skills irrespective of gender, for effective thinking and problem solving.

Recommendations

Based on the findings of this study and the implications of the study to education, the following recommendations are made:

1. Mathematics teachers can improve their students' achievement in probability by adopting Kolb's experiential learning model.
2. Government should organize trainings, workshops and seminars to train Mathematics teachers at both basic and post level on the application of Kolb's learning experiential model since it is effective in increasing students' achievement in mathematics.



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