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EXPLORING STUDENTS' EXPERIENTIAL LEARNING ENVIRONMENT IN THEIR CLASSROOM ACTIVITY

Ridwan Enuwa Mohammed

Abstract:

Students' classroom activity is a determinant on their achievement. Therefore, this study explored the physics students' experiential learning strategy on academic achievement in the class. The study adopted the Quasi-experimental of non-equivalent and non-randomized control group design. A total of 102 Senior Secondary School II students were involved in the study. Physics Performance Test (PPT) was the instrument for the study. ANCOVA was used to analyze the scores of students on the hypotheses of the study at level of 0.05. The study revealed a significant achievement in the mean score of the students in favour of those exposed to experiential learning model than those taught with the conventional method. Experiential learning model did not influence the performance of male and female students. It was recommended that experiential learning approach should be adopted above other strategies in the class to enhance to students' academic achievement.

Keyword: Experiential, Gender, Model, Performance

Introduction

Physics is a subject which plays a key role in the progress and development of mankind. It is the study of matter and its movement through space and time in the universe (Wilbert, 2017). It generates fundamental knowledge, essential for the required technological advancement needed to propel the economic engine of the world (Mohammed 2017). It extends and enhances human understanding of scientific disciplines, exciting intellectual adventures and inspires dynamic frontiers of human knowledge about the environment (Jegede & Adedayo, 2013).

The general objectives of the physics curriculum (2013) are stated as to;

1. Provide basic literacy in physics for functional living in the society;
2. Acquire basic concepts and principles of physics as a preparation for further studies;
3. Acquire essential scientific skills and attitudes as a preparation for technological application of physics; and
4. Stimulate and enhance creativity (NERDC 2013, p11)

Therefore, application of scientific skills by learners in their daily activity and experience is key to scientific and technological development of any nation. Teaching and learning physics involve interaction of students to clarify concepts based on their experiences and interaction with matter in the environment. Physics is sometimes referred to as the science of measurements and its knowledge and have contributed greatly to the production of instruments and devices. It provides the basic knowledge and understanding of principles, whose applications contribute immensely to the quality of life in the society. Physics, a subject in the secondary schools has been plagued by one major problem. This is the problem of poor performance in the Senior School Certificate Examinations (SSCE) level (Omosewo, 2002). In spite of its approach learning The teaching and learning of this important subject need serious attention in order to enhance a sustainable technological development in Nigeria (Jegede & Adedayo, 2013).

The teaching of physics in secondary schools is intended to produce young scientists who would be able to design the technological devices that would make day-to-day activities easier and living more comfortable (Ajayi, 2008). Research reports by (Ajayi, 2007; Owolabi & Adedayo, 2012) revealed that performance of students in physics is not encouraging this fact calls for attention. Some of the reasons for poor performance in physics have been blamed on the way science in general and physics in particular is being taught in secondary schools (Ogunneye & Lasisi, 2008), perceived abstract and difficult nature of physics (Nwankwo & Madu, 2014). Wambugu, Changeiywo and Ndiritu (2014) stated in their research work that the teaching methods employed by a teacher has been shown to reflect on students' understanding of the subjects, thereby concluding that it is necessary to use methods which utilize instructional activities that students are involved in doing and thinking of the applications of what they are carrying out.

Learning involves an activity of acquiring knowledge or skill by studying, practicing, being taught, or by experiencing something. It could be measured and relatively permanent change in behavior through experience, instruction, or study. Simon Fraser University defines experiential learning as the strategic, active engagement of students in opportunities to learn through doing and reflection on those activities, which empowers them to apply their theoretical knowledge to practical endeavors in a multitude of settings inside and outside the classroom. Experiential learning is a process through which students develop knowledge, skills, and values from direct experiences outside a traditional academic setting. The experiential learning theory was made popular by educational theorist David A. Kolb, whom along with John Fry, developed the experiential learning theory, which is based on the idea that learning is a process whereby knowledge is created through the transformation of experience. The knowledge results from the combination of grasping and transforming experience (Kolb, 1999). The Kolb's experiential learning model portrays a four stage learning cycle; two dialectically related modes of grasping experience and two dialectically related modes of transforming experience:

Eryilmaz (2004) observed that gender contributes to poor achievements of students in physics. Gender according to Yang (2010) refers to the social attributes and opportunities associated with being male and female and the relationships between women and men, girls and boys, as well as the relationship between women and those between men. According to Mbajorgu (2003), female enrollments in physics and science subjects generally are very poor. This is in line with the study by Gonzuk and Chargok (2001) which revealed that the number of females who study physics in secondary and tertiary institutions is small compared to the number of boys. The poor performance in physics is no gender exception as it cuts across both male and female it is very important to find out the level of failure between male and female so as to proffer adequate solution to it (Aina & Akintunde, 2013).

The teachers' method of teaching may go a long way in enhancing effective learning by the students. The traditional method of teaching physics in schools involves "chalk and talk" activities which is fully teacher centered. In this case, the students are passive learners in the classrooms who regard the teacher as the repertoire of knowledge (Jegede & Adedayo, 2013). Several innovative methods could be adopted to make physics teaching interesting and activity oriented class. These include inquiry method, collaborative learning, experiential learning model, discovery method, and so on. They are purely child-centered approaches. The students are guided to discover facts and construct their own ideas and understanding of the concepts of the study. However, Nwagbo (1995) noted that science teachers shy away from activity-oriented instructional methods that are effective for teaching and learning. It is obvious that researchers have adopted different methods and strategies to make the

teaching of physics interesting and activity based. Experiential learning strategy has been adopted by researchers to encourage participation in class and improve performance of students in physics.

Baker and Robinson (2016) investigated the effects of experiential learning model on the successful intelligence of secondary school agricultural science students. The experiential learning was compared to the conventional teaching method (direct instruction). The study examined the practical intelligence, analytical intelligence and creative intelligence across the three domains among secondary school agricultural science students. It was concluded that students who received the experiential learning produced higher creativity scores that were domain specific. Also, they scored higher in their practical use of knowledge when compared to their direct instruction counterpart. While both experimental and control groups yielded similar analytical knowledge scores.

A study by Weinberge, Basile and Albright (2011) examined the effect of a summer enrichment programmed grounded in experiential learning strategy, intended to increase students' motivation in science and mathematics. A sample of 336 students was asked to complete the Science and Mathematics Students' Motivation Assessment (SMSMA) following the experiential treatment. Through the use of parted sample t-test, it was found that students became more interested and developed a higher expectancy of success in mathematics. Lower attainment value following the experience of students indicates that mathematics did not define them as a person. While in science, statistically significant gains were found in students' interest, perceptions of usefulness, importance of science in defining themselves, and expectations for future success in science.

Kolb's experiential learning model (1984) portrays a four stage learning cycle; two dialectically related modes of grasping experience and two dialectically related modes of transforming experience:

1. Concrete Experience: At this stage a new experience of situation is encountered or a reinterpretation of existing experience takes place.
2. Abstract Conceptualization: This is the process of making sense of what has been happening and involves interpreting the events and understanding the relationships between them.
3. Reflective Observation: This means taking time-out from doing and stepping back from the task and reviewing what has been done and experienced. Here, lots of questions are being asked and communication channels are opened to members of the class.
4. Active Experimentation: This final stage of the learning cycle considers how the learners are going to put what they have learnt into practice.

Cheriyian (2010) tested the effectiveness of Kolb's Experiential Learning Model on Achievement in Mathematics of Students at secondary school level. The samples were 332 secondary school students of government and aided schools following the state syllabus of Kerala. The study found out that achievement in mathematics of students taught using Kolb's Experiential Learning Model is significantly higher than those taught using activity oriented methods. The reviewed studies revealed that;

1. The performance of students taught Physics using experiential learning model (ELM) and those taught without.
2. The difference in performance of students who were taught physics using the experiential learning model and those taught physics without experiential learning approach.
3. The difference in the performance of male and female students who were taught physics using the experiential learning approach.

Research Questions

The following research questions were raised and answered to guide this study:

1. Is there any difference in the performance of students taught physics using the experiential learning model (ELM) and those taught physics without experiential learning model?
2. Is there any difference in the performance of male and female students who were taught physics using the experiential learning approach?

Research Hypotheses

The following research hypotheses were stated and tested in the course of the study:

H₀₁: There is no statistically significant difference in the mean performance of students when taught physics using the experiential learning approach and those taught physics without experiential learning approach.

H₀₂: There is no statistically significant difference in the mean performance of male and female students when taught physics using the experiential learning approach.

Methodology

The population for this study was all senior secondary school students offering physics in Ilorin. Senior secondary school two was involved in this study. From the scheme of work it is expected that the concept of electricity and electric would be taught in senior secondary two. Two intact classes were sampled from two selected schools in Ilorin. A total of 102 physics students participated in the study as shown in table 1.

Instrumentation

The instruments for this study were Physics Performance Tests (PPT) and Physics Instructional Package (PIP) designed by the researcher. The PRE-PPT and POST-PPT contain 25 questions in each. The pre and posttest content area of the PRE-PPT was topics from the SSII physics syllabus while the POST-PPT content involved questions on electricity and electric fields. The PRE-PPT tested for knowledge levels while the POST-PPT tested for understanding, comprehension, application, and achievement levels. The tests were given to three experts to scrutinize and determine the suitability. All corrections made by these experts enabled the researcher to eliminate and reconstruct ambiguous items in the instrument. This instrument was administered to a set of 20 students that were not part of the participating schools which also enabled the researcher to identify, reconstruct and rule out some items that seemed to be too difficult and too easy in Physics Performance Test (PPT). The reliability of the instrument was carried out using split half method, while KR20 was used to obtain the reliability coefficient of 0.71.

The stimulus instrument Physics Instructional Package was designed by the researcher based on the content of electricity and electric fields (electrostatics, coulomb's law and electric force, electric field lines of force, electric current and ohm's law, resistors and resistance, capacitors and capacitance), the process and steps involved in the Experiential Learning Model (ELM) was explored and implemented. The package consisted of lesson plans for four weeks.

The experimental group was taught using the ELM while the control group was taught without any treatment. During the ELM, the researcher first started by reinterpreting existing experience encountered by students in their environment. The researcher then related the experience with the concept to be learned. The researcher asked the students to discuss their experiences and to make conclusions from the analogies after which the researcher explained the topic in detail. The researcher

treated examples afterwards and gave students exercises to practice. During the fourth week, a posttest was administered to the students and their scores were obtained.

Data Analysis and Results

The data gathered from both the experimental and the control groups were analyzed using frequency and percentage to present the demographic data of the participants. Mean and standard deviation were used to answer the research question one while the other research questions were hypothesized and tested with the use of Analysis of Covariance (ANCOVA).

Table 1: Demographic Information of the groups

Groups	Gender	Frequency (%)	Sub-Total (%)
Experimental II (Exp. Learning Model)	Male	20 (12.5%)	39(24%)
	Female	19 (11.9%)	
Control	Male	19 (11.9%)	63(39%)
	Female	44 (27.5%)	
Total			102(100%)

Table 1 showed the demographic information of the groups (experimental and control groups). Out of 102 (100%) students that were sampled for this study, 39(24%) of the participants were in the experimental group (Experiential Learning Model) out of which 20(12.5%) were male and 19(11.9%) were female, whereas 63(39%) of the participants constituted the control group out of which 19(11.9%) were male and 44(27.5%) were female.

Hypothesis One: There is no significant difference in the mean performance of students when taught Physics using the experiential learning model and those taught without.

Table 2: Analysis of Covariance Showing the Difference in the Performance of Students when Taught Physics Using the Experiential learning Model and Those Taught Physics without

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	636.902 ^a	2	318.451	24.583	.000
Intercept	590.140	1	590.140	45.557	.000
Pre-test	143.940	1	143.940	11.112	.001
Treatment	277.925	1	277.925	21.23	.000
Error	1296.009	99	13.091		
Total	21549.000	102			
Corrected Total	1919.343	101			

$P < 0.05$

Analysis from Table2 showed that the p -value (0.00) was less than 0.05 when 21.23 was obtained as the F - value with a degree of freedom (1, 102) computed at 0.05 alpha level. The null hypothesis one was rejected and thus, there was a statistically significant difference in the performance of physics

students when exposed to the experiential learning model and those exposed to traditional teacher method in favour of experimental group ($F_{(1, 93)} = 21.23, p < 0.05$).

Table 3: Pairwise Comparisons Analysis Showing the Effect of the Treatment on Students' Performance in Physics

Treatment	Mean	Mean Difference (I-J)	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b	
					Lower Bound	Upper Bound
Experimental (I)	16.66 ^a	3.42*	0.73	0.00	2.12	5.20
Control (J)	13.24 ^a	-3.42*	0.73	0.00	-5.20	-2.12

Grand Mean = 14.40

* the mean difference is significant at 0.05 level

To determine the direction of the significance, the Multiple Comparison Analysis was depicted in Table 3 to show where the difference lies (i.e. the effect of the treatment on students' performance). Table 4 revealed that students in the experimental group that were taught Physics with experiential learning model had higher mean score of 16.66 than those in the control group that were taught Physics without the experiential learning model had a mean score of 13.24. This implied that students taught with the use of experiential learning model performed better than those taught with the traditional method in Physics Performance Test (PPT).

Hypothesis Two: There is no significant difference in the mean performance of male and female students when taught Physics using the experiential learning approach.

Table 4: Analysis of Covariance Showing the Difference in the Performance of Male and Female Students That Were Taught Physics Using the Experiential Learning Model

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	132.664 ^a	2	66.332	4.310	.021
Intercept	213.962	1	213.962	13.904	.001
Pretest	76.787	1	76.787	4.990	.032
Gender	14.042	1	14.042	.912	.346
Error	554.003	36	15.389		
Total	11520.000	39			
Corrected Total	686.667	38			

*not significant at $p > 0.05$

Table 4 showed that the F -value of 0.91 was obtained with a p -value of 0.35 computed at 0.05 alpha level. Since p -value (0.35) was greater than alpha level (0.05), the null hypothesis four was retained and thus, there was no statistically significant difference in the performance of male and female students that were taught Physics using the experiential learning model ($F_{(1,93)} = 0.91, p > 0.05$).

Discussion of Findings

Findings from this study revealed that the performance of students (both the experimental and control groups) before the treatment was low, however, after the treatment, the academic performance of

students taught using the experiential learning approach was higher than the performance of students taught without. This may be due to the fact that ELM exposed students beyond the traditional and regular method, thereby, resulting in students' higher performance in Physics. This outcome corroborates Wambugu, Changeiywo and Ndiritu (2014) whose findings indicated that the integration of modern teaching approaches in instructional delivery resulted in high students' understanding of the subjects and academic performance when compared with the use of the traditional teaching method alone.

This study also revealed that there was a statistically significant difference in the performance of students when taught Physics using the Experiential Learning Model (ELM) and those taught physics without. Students taught with the use of ELM performed better than those taught without. This is because the ELM allows students to relate the interaction of matter and energy in their environment to the concepts of physics in the classroom. The ELM also allows social learning among students, they compare experiences, share ideas and develop their traditional physics concepts from the environment. This result is in agreement with Cheriyan (2010) who found out that achievement in mathematics of students taught using Kolb's Experiential Learning Model is significantly higher than those taught using activity oriented methods.

In addition, the results obtained from this study revealed that the performance of male and female students taught Physics using experiential learning model do not differ as no statistical discrepancy was found in the performance. Both male and female showed equal interest and participation since ELM encourages social interaction. This outcome supports the findings of Weinberge, Basile and Albright (2011) and Okoli and Abonyi (2013) in their separate studies showed that the performance of male and female students exposed to experiential learning in Mathematics is statistically the same. However, this outcome disagrees with Shaibu and Mari (1997) who observed a gender difference in achievement in science process skills in favor of the female students.

Conclusion

The use of Experiential Learning Model enhanced better performance of students. It was also concluded that the use of Experiential Learning Model benefited equally both male and female students' performance in Physics. This implies that students' performance will be improved, if physics teachers endeavor to use Experiential Learning Model classroom instruction so as to enhance understanding of the concepts of physics topics which are the key to the sustainable development of the Nigerian economy.

1. Teachers should take into consideration both male and female students while teaching using the experiential learning model since, the sustainable development of the Nigerian economy depend on the contribution both male and female.
2. School authorities and educational administrators should see that the experiential learning model is integrated into secondary school curriculum in Science subjects.

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