

Effect of Activity Based Learning on Junior Secondary School Students' Interest and Achievement in Geometrical Contents of Mathematics

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Abstract

The study investigated the effect of activity based learning on Junior Secondary School students' interest and achievement in geometrical content of mathematics. Two research questions and two hypotheses guided the study which adopted pretest posttest non-equivalent group quasi-experimental design. The sample comprised 76 JSS2 students in two intact classes drawn using purposive sampling technique. Data were gathered using 'Students' Interest Questionnaire' (SIQ) and 'Students' Achievement in Geometry' (SAG) whose reliability indices were 0.68 and 0.71 obtained using Cronbach Alpha and Kuder-Richardson20 methods respectively. Mean and standard deviation were used to answer the research questions while ANCOVA was used to test the hypotheses at .05 level of significance. Results showed that activity based learning had a significantly positive effect on students' interest and achievement in geometrical content of Mathematics. It was thus recommended that activity based learning should be used in the teaching and learning of mathematics in schools.

Keywords: Activity Based Learning, Interest, Achievement, Geometrical Content, Mathematics.

Introduction

Mathematics is one of the school subjects that has a wide range of application across many disciplines. According to Salman (2017), the knowledge of Mathematics is useful in tailoring, carpentry, bricklaying, graphics, industry, astronomy, surveying, agriculture, medicine, buying and selling among others. By implication, the knowledge of mathematics is not limited to the academic fields but also to artisans and daily living. This underscores the reason for the inclusion of mathematics as a compulsory subject at the primary and secondary school level in Nigeria (FRN, 2014). A credit pass in the subject is also needed for students seeking admission into many courses in the tertiary institutions (JAMB, 2020). However, in spite of the importance of the subject, students' achievement in the subject has been low, and inconsistent over the years. This was the observation of previous researchers such as Zalmon and Wanu (2017) and Okeke (2021) who posited that Nigerian students have under achieved in mathematics for many years.

One area of mathematics researchers noted that student's find difficult in mathematics is geometry. For instance, researchers Okeke (2021) stated that students usually score low marks in questions involving geometry which has resulted to the persisting problem of poor achievement in the subject. Also, the West African Examination Council (WAEC) (2017, 2019) noted that students experienced weaknesses in the area of geometry. Bot (2017) defines geometry as the study of nature, properties and relationships among shapes such as triangles, squares, cubes, lines, among others. Mak (2016), pointed out that geometry is a requirement for fundamental mathematics concepts like number lines, which are often used in elementary school, arithmetic skills inequalities. This mean that the teaching of geometry should be treated with all amount of seriousness in schools. Accordingly, WAEC (2019) recommended that teachers should leave up to their responsibilities and make the learning of mathematics interactive.

One of the ways of making teaching and learning of mathematics interactive is to use activity based learning in teaching the subject. Activity-based learning (ABL) is a teaching method that stresses students' active learning through a variety of activities in order to enhance the three domains of learning (cognitive, affective, and psychomotor) (Privono & Boedi, 2017). According to Çelik (2018), activitybased learning is when students physically and mentally investigate a subject by simulating a work setting, manipulating tools and materials related with the workplace, or performing a genuine job task. This teaching technique encourages students to engage in reading, writing, conversation, hands-on activities, analysis, and evaluation of the issue at hand. In this method, students are actively engaged in the teaching

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and learning process. Activity-based learning, according to Okwudishu (2011, Pp 27), has the following advantages: reinforces course information, fosters teamwork, boosts students' self-esteem, encourages participatory learning, encourages creative problem solving, and supports the concept of discovery learning. It also energizes and invigorates students, providing variety of learning styles, allow for application of content, practical enhancing communication, provide an enjoyable and exciting learning environment, improves learner retention and motivation, and encouraging fun. Using activities in class can help students remember what they've learned, develop favourable attitudes toward the lesson, and become more interested in it (Camci, 2012). This is unlike the lecture method where the student is a passive receiver of information from the teacher.

Consequently, the activity based learning approach may be a better method to help mathematics teachers tackle the problem of students' poor interest and low achievement in mathematics and indeed geometry. This is because, according to Emaikwu (2012), the teaching method influences students' responses and determines whether they are interested, motivated, and involved enough in a lesson to engage in learning. Students' Interest is a subjective experience of intentness or curiosity about something, and it manifests itself in an activity (Usman, 2010). The tendency to become engaged in and continue an experience is known as interest. It is the desire or eagerness to engage in any action that gives one pleasure, and to continue doing so. It therefore mean that students who are interested in learning mathematics will express the desire to engage in the learning of the subject. According to Owora and Chika (2019), many students are uninterested in the subject that is required and used in everyday life because they believe that competency in the subject is reserved for a select few, while others believe it is a nightmare that should be avoided. Children's curiosity is piqued when they handle things and conduct experiments, and their curiosity is piqued to a greater level when they do so. As such, to improve their interest in learning mathematics, activity based learning may be used.

Any increase in students' interest in mathematics may result to an increase in students' achievement in mathematics. Academic achievement refers to what a student must achieve in several disciplines during the course of a student's academic career. It includes a variety of aspects of a student's academic achievements, such as progress in core academic subjects such as mathematics, science, language, arts, and social studies, as well as subjects that are less frequently emphasized in today's curriculum, such as athletics, music, arts, and commerce (Kaur, 2017). The outcome of any education system is based on the academic achievement of the students. Students' academic achievement is therefore a measure of how well students, teachers, the school and society is doing. As such much emphases is laid on students' academic achievement and therefore, there is the need to employ teaching methods such as the activity based learning that may improve students' academic achievement. ,

Previous studies have shown that activity based learning is effective in improving students' learning. For instance, Oluwatosin (2017) investigated the effect of hands-on activity-based method on interest of senior secondary students in organic chemistry and reported that students taught using hands-on activity-based had significantly higher mean interest scores than those taught using discussion method. Harjinder and Anurag (2017) investigated the effect of Activity Based Method on Achievement Motivation and Academic Achievement in Mathematics at secondary Level and found that students taught Mathematics through Activity based method differ significantly in Academic Achievement as compared to the Control group. Another study conducted by Oribhabor (2020) evaluating the effect of activity-based method of teaching mathematics on Nigerian secondary school students' achievement in mathematics and revealed that students exposed to activity method performed better than those taught using the lecture method. These studies shows that activity based learning appears to be effective in enhancing students' interest and achievement in general. However, studies on the effect of the method on students' interest and achievement in geometrical contents are lacking especially in Cross River state.

Much of the teaching and learning in Nigerian primary and secondary schools have been conducted using the lecture method. According to Kaur (2011), the lecture approach has the following advantages: it is the finest way to distribute new ideas; most people love listening to notable individuals deliver ideas to an audience; and a good lecture may instill in a topic because of the manner of presentation. However, little or no attention is given to specific learners in class nor active engagement of the learner. This may have resulted in the poor state of students' interest and achievement in mathematics. However, the lecture AJSTME, Volume 8, Issue 3. 232-238, May, 2022. ISSN: 2251-0141

method has failed to improve students' interest and achievement in mathematics and geometry in particular. This means that it compulsory to search for a new method of teaching that will actively involve the students in the teaching and learning process. Therefore, this study investigates the effect of activity based learning on junior secondary school students' interest and achievement in geometrical contents of mathematics. Based on the problem of the study, the study investigated the effect of activity based learning on junior secondary school students' interest and achievement in geometrical contents of mathematics.

Research Questions

In line with the purpose of the study, the following research questions guided the study

- 1. What is the difference in the mean interest rating scores of junior secondary school students in geometrical content of mathematics taught using activity based learning and those taught using lecture methods?
- 2. What is the difference in the mean achievement scores of junior secondary school students in geometrical content of mathematics taught using activity based learning and those taught using lecture methods?

Hypotheses

The following hypotheses were tested at 0.05 level of significance in line with the research questions

- 1. there is no significant difference in the mean interest rating scores of junior secondary school students in geometrical content of mathematics taught using activity based learning and those taught using lecture methods
- 2. there is no significant difference in the mean achievement scores of junior secondary school students in geometrical content of mathematics taught using activity based learning and those taught using lecture methods

Method

The study adopted a non-equivalent control group of pretest and posttest quasi-experimental research design. The study was conducted in Obudu LGA, Cross River state, Nigeria. Obudu local government area was used because there are no known studies on the effect of activity based learning on students' interest and achievement conducted in the area. The population of the study involved all the 1 476 junior senior secondary school two (JSS2) students in the 24



public secondary schools in the LGA for first term 2021/2022 academic session. The JSS2 class was chosen because they are not in an examination class and have five geometrical contents in their mathematics curriculum. Purposive sampling technique was use to draw two schools from were two intact classes were randomly selected. The study sample consisted of 76 students (34 males and 42 females). Intact classes were used to avoid disruption of the normal teaching and learning activities of the schools. The two intact classrooms were randomly assigned one each to activity based learning (experimental) and lecture method (control) group respectively. The experimental group had 35 students while the control group had 41 students.

instruments; Two Students' Interest Questionnaire (SIQ) and Students' Achievement in Geometry (SAG) developed by the researchers were used for data collection. The SIQ consisted of 20 items that elicited data on the students' interest towards geometry. The ratings for each were on a four-point scale of strongly agree (SA), agree (A), disagree (D) and strongly disagree (SD) respectively. The SAG contained 20 dichotomously scored multiple choice items with four response options of A, B, C and D that elicited data with respect to students' achievement in geometry. Students' achievement was drawn using Bloom's taxonomy of educational objectives. The SIQ and SAG together with the lesson plans for the experimental and the control groups were faced validated by three experts. Two of the experts are from Mathematics Education Unit while the third expert is from Measurement and Evaluation programme area, Department of Science Education, University of Nigeria, Nsukka. The SIQ and SAG were later trial tested on 20 JSS2 students in a school that was not part of the study. The reliability coefficient of the SIQ was established using Crobach Alpha method because the items were polytomously scaled. The reliability coefficient obtained was 0.68. The reliability coefficient of the SAG was established using Kuder-Richardson 20 method because the items were dichotomously scored. The reliability coefficient obtained was 0.71.

Procedure

The researchers visited the sampled schools to seek their permission to use their school and students for the study. After permission was granted, the researchers recruited the service of two (one from each school) regular class teachers of JSS2 mathematics as research



assistants. The essence was to ensure that the students are not aware they were being used for experiment less they change their behaviour. The researchers were adequately informed about the objective of the research. The research assistant for the experimental group was trained for four days on the use of activity based learning while one of the control group was asked to use the lecture method.

The actual experiment lasted for six weeks. In the first week, the research assistants were trained for four days. On the fifth day, the instruments were administered as pretest on the students in both groups. The normal lesson periods on the school time table were used to conduct the experiment. This lasted for five weeks of five periods of 40 minutes per lesson per day. Two sets of lesson plan, with the same content, specific objectives, duration and evaluation were developed for the two groups, except that the lesson plan for the experimental group was prepared for activity based learning while that for the control group was prepared for lecture method. At the sixth week, items in the same SIQ and the SAG were reshuffled and re-administered to the students as posttest in order to determine the effect of the treatments on the students' interest and achievement in geometry. The students rated the SIQ and answered questions in the SAG and were scored by the teachers. Each correct option in the SAG was scored four points whereas each wrong option attracted zero point. Data collected were analyzed using mean and standard deviations to answer the research questions while the null hypotheses were tested using analysis of covariance (ANCOVA) at 0.05 level of significance.

Results

 Table1: Mean and Standard deviation of mean interest rating scores of students taught using activity based

 learning and those taught using lecture methods

Groups	Pretest		Posttest		Mean Difference	
	Ν	\overline{x}	SD	\overline{x}	SD	
Experimental (activity based learning)	35	39.34	6.43	52.26	6.48	12.92
Control (lecture method)	41	37.59	6.36	42.10	4,50	4.51

Result in Table 1 shows that the mean differences of 12.92 and 4.51 for the experimental and control groups respectively depicts that activity based learning had

positive effect on students' interest in geometrical content of mathematics.

Table 2: Analysis of Covariance (ANCOVA) of the effect of activity based learning on students	' interest in
geometrical content of mathematics	

Source	Type III Sum	Df	Df Mean Square		Sig.	Partial	Eta Dec.
	of Squares					Squared	
Corrected Model	2683.181ª	2	1341.590	65.116	.000	.641	
Intercept	1586.836	1	1586.836	77.020	.000	.513	
Pre interest	734.279	1	734.279	35.639	.000	.328	
Groups	1600.056	1	1600.056	77.661	.000	.515	S
Error	1504.017	73	20.603				
Total	170477.000	76					
Corrected Total	4187.197	75					
$\frac{\text{Corrected Total}}{\text{Notat } S = \text{Significant}}$	4187.197	75	$\frac{2}{2}$ — portiol ato as				

Note: S = Significant, NS = Not Significant, η^2_p = partial eta squared

The result in Table 2 shows that the effect of activity based learning on students' interest in geometrical content of mathematics was significant (F(1, 75) = 77.66, p < .05, $\eta^2_p = .515$), thus the hypothesis is rejected. This is because the exact probability value of 0.00 is less than 0.05 set as level of significance. The

effect size of ($\eta^2_p = .515$), moreover, indicates that 51.5 percent changes in students' interest in geometrical content of mathematics is due to the use of activity based learning. Thus, inference drawn is that activity based has a significantly positive effect on students' interest in geometrical content of mathematics.



 Table 3: Mean and Standard deviation of achievement scores of students taught using activity based learning and those taught using lecture methods

Groups	Pretest		Posttes	t		
	Ν	$\overline{\mathbf{x}}$	SD	$\overline{\mathbf{x}}$	SD	Mean Difference
Experimental (activity based learning)	35	27.66	5.60	51.37	12.52	23.71
Control (lecture method)	41	26.24	4.20	31.12	4.78	4.88

Result in Table 3 shows that the mean difference of 23.71 and 4.88 for the experimental and control groups respectively implies that activity based learning had

positive effect on students' mean achievement scores in geometrical content of mathematics.

Table 4: Analysis of Covariance (ANCOVA) of the effect of activity based learning on students' achie	vement in
geometrical content of mathematics.	

Source	Type III Sum	Df	Mean Square	F	Sig.	Partial Eta
	of Squares					Squared
Corrected Model	8372.498ª	2	4186.249	54.490	.000	.599
Intercept	1499.627	1	1499.627	19.520	.000	.211
Pre achievement	630.271	1	630.271	8.204	.005	.101
Groups	6963.312	1	6963.312	90.638	.000	.554
Error	5608.291	73	76.826			
Total	138316.000	76				
Corrected Total	13980.789	75				
		·	2 . 1			

Note: S = Significant, NS = Not Significant, η^2_p = partial eta squared

Result in Table 4 shows that the effect of activity based learning on students' achievement in was significant $(F(1, 75) = 90.64, p < .05, \eta^2_p = .554)$, hence, the null hypothesis is rejected. This is because the exact probability value of 0.00 is less than 0.05 set as level of significance. Additionally, the effect size of $(\eta^2_p = .554)$, indicates that 55.4 percent changes in students' achievement scores in geometrical content of mathematics is attributable to the use of activity based learning. Hence, the inference drawn is that activity based learning has a significantly positive effect on students' achievement in geometrical content of mathematics.

Discussion

The findings of the study showed that activity based learning had a significant positive effect on junior secondary school students' interest in geometrical content of mathematics. The findings reveal that the activity based learning method is more efficacious in improving students' interest in geometry in particular and mathematics in general. The above findings are in agreement with previous findings from Oluwatosin (2017) who revealed that students taught using hands-on activity-based had significantly higher mean interest scores than those taught using discussion method. The above findings could be so because students exposed to activity get engrossed in such activity which could arouse their interest in the activity and in learning thereby leading to improvement in the interest.

Furthermore, the findings showed that activity based learning had a significant positive effect on students' achievement in geometrical content of mathematics. The findings imply that the activity based learning is and effective method for improving students' achievement in geometry and in mathematics in general. The findings corroborate previous findings by Harjinder and Anurag (2017) and Oribhabor (2020) who in their separate studies revealed that students exposed to activity method performed better than those taught using the lecture method. The above findings may be so because students expose to activity based learning discover facts for themselves, cooperate with classmates to solve problems and improving learner retention which could lead to higher achievement scores.

Conclusion

Students' achievement in mathematics is a major point of concern to educationists and stakeholder in Nigeria.



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Based on this, the present study effect of activity based learning on junior secondary school students' interest and achievement in geometrical contents of mathematics. Based on the findings of this study, it was concluded that activity based learning is having significant positive effect on students' interest and achievement in geometrical contents of mathematics. The findings hence provide information on the potency of activity based learning in enhancing students' interest and achievement in learning and mathematics in particular.

Recommendations

Based on the findings of the study, the researchers recommended that:

- 1. Activity based learning should be used in the teaching and learning of mathematics in schools.
- 2. Government should provide mathematics kids for used in schools for activity based learning approach.

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