TEACHING GEOMETRICAL CONCEPTS IN AKWA IBOM STATE SCHOOLS: EVALUATION OF INSTRUCTIONAL PRACTICES IN STUDENTS' PERFORMANCE AND RETENTION RATINGS

Joyce David Eduok, (Ph.D)
Department of Mathematics,
College of Education, Afaha Nsit,
Akwa Ibom State,
Nigeria.

And

Emmanuel Nkoro Asagha, (Ph.D)
Department of Physics,
Federal College of Education,
Obudu, Cross River State,
Nigeria.

Abstract

We report the effect of learner-centred activity-based and expository teaching methods in facilitating students' performance and retention in geometrical concepts in mathematics Science Colleges in Akwa Ibom State. The non-randomized pre-test, post-test and control group design using a sample of two hundred students from four Science Colleges were used for the analysis. The Mathematics Performance Test (MPT) and Study Habit Inventory (SHI) had reliability indices (α) of .72 derived from the Pearson Product Moment Correlation Coefficient, and (α) of .76 for SHI derived from Cronbach alpha reliability package, respectively. The experimental group was taught using the learner-centred activity-based method while the control group used the expository strategy and the activity repeated in a fortnight for retention test. Using Analysis of Covariance (ANCOVA) with pre-test scores as covariates, the results show that the instructional strategies used had a higher statistical significance for Learner-Centred Activity-Based method compared the expository method. Based on these observations it is recommended among

others that Mathematics and mathematical science teachers should adopt the use of learner-centred activity-based strategy in teaching various concepts at the Science Colleges.

Keywords: Activity-based, Learner-centred, Performance, Retention.

The broad aim of secondary education in Nigeria is to prepare the individual for useful living within the society and for higher education (FRN 2014). The achievement of this objective requires sound background knowledge of the subject of mathematics, the subject that deals with the relationships among shapes, numbers and quantities. The National Council for Teachers of Mathematics (2010) held that understanding mathematical concepts is essential for the development of mathematical competence. Mathematics, according to Nwoke & Nnaji (2011) is the study of quantity, structures, space and change. It developed through the use of abstraction and logical reasoning from counting, calculation, measurement, and the study of the shapes and motion of physical objects. The ingredient for the effective articulation of the abstract elements of science that gives impetus to the development of technologies of any nation is based on mathematics. Mathematics is accepted in the present world of science and technology as the "queen of science and the language of nature" and no nation can hope to achieve any measure of scientific and technological advancement without foundation in mathematics (Moore, 2005). The pivotal position of mathematics to individual fulfilment and national developmental goals has consequently led educational policy makers to position mathematics as a compulsory subject (Eduok, 2016). In this regard, the New Basic Education Curriculum (BEC) and the Revised Senior Secondary School Curriculum (SSEC) make mathematics compulsory core subject in Nigeria. In spite of this importance of mathematics to the students and the nation, the achievements of students in both internal and external examination have remained unsatisfactory for decades.

The Chief Examiner's report (WAEC, 2012) indicated that most students avoid problems in geometry shapes. Could it be due to lack of manipulative skills, misconceptions on the part of the students or instructional strategy used by the teachers? A close look at the past WASSCE questions reveal that there is no year question on geometrical concepts in mathematics are not set. This perhaps shows the role geometrical concepts plays in the development of students' cognitive domain. But the teaching and learning of mensuration at secondary level of education still remain a serious problem due to its perceived abstract nature of the concepts.

According to Adeniji (2007) and Ubah (2013); mathematics achievement though fluctuating, seems to be predominantly and consistently poor. This poor achievement in senior school certificate examination covers the past two decades or more and has continued to be of immense concern to educational administrators,

researchers, parents and teachers. Expository instruction, which involves direct instruction led mostly by the teacher, has been used by educators in the past and has been effective for some students in terms of computing mathematical problems (Alsup & Sprigler, 2003). However, conventional teaching strategies do not always accommodate every learning style and do not teach students the application of mathematics, particularly when to apply learned formulas and algorithms to real world situations and retention of learnt concept (Alsup & Sprigler, 2003). Also, with ineffective methods, instructional resources used are likely to be inadequate and inappropriate. Therefore, the desire to reach more students and increase achievement levels of students has led to an interest of mathematics educators including curriculum planners to consider reform-oriented strategies.

The use of learner-centred activity-based instructional strategy which involves the teacher engaging the learners in simple experimental activities such as displaying or exhibiting manipulative instructional materials or models with the intent of showing them their correct ways of using them would be investigated to check this problem. Models or manipulative instructional materials in this usage are concrete models. They are such devices like plane and solid shapes, patterns, forms and constructions produced by teachers and students to present mathematical ideas in order to make visualization and understanding clear and real. Inappropriate usage of these materials by both the teachers and the students may results in students' poor performance in mathematics.

There is quite a large body of research which offers several reasons for students' poor performance in mathematics. These studies include that of Aremu and Tella (2009), and Ubah (2013). The problems identified are in the areas of students' personality characteristics, teachers' competency, and teaching and learning method. Presently, the crucial task in the field of mathematics education is the improvement in the teaching and learning process (Busari, 2004). Educational researchers have tried to experiment with the innovative methods of instruction, inspired by the scientific interventions and technological development in every space of life. Alio and Harbor Peters (2002) stated that teachers' non-utilization of the necessary technique in teaching mathematical problem solving is a contributing factor to students' poor achievement in mathematics.

Students' characteristic such as study habit and teacher variables like teaching methods, competence and appropriate use of resources, are also significant predictors. The pattern of behaviour adopted by students in the pursuit of their studies is termed study habits. Study habits reveal students personality and functioning. Learner's learning character is characterized by his/her study habits. Causes of fluctuating performances among students in mathematics have also been attributed to other extraneous variables including students' study habits (Oluwatimilehin & Owoyele,

2012). Study habits play a very important role in the life of students. Success or failure of each student depends upon his own study habits. Study habits serve as the vehicle of learning. It may be seen as both means and ends of learning. The use of proper study habits help students to perform well in academic work.

Some researchers are of the opinion that study habit influences students' performance and retention in geometrical concepts. Thus the study hopes to find out whether study habit influences students' performance and retention in geometrical concepts. The teacher's method of teaching can either make or mar the entire educational process. Taiwo (1996) asserted that teaching method and students' characteristics have been identified as very important factors in the effective learning of mathematics. Akpan (1996) also posited that teacher effectiveness is a determining factor of students' achievement in mathematics. Kelley (2000) suggested scrutinizing the array of teaching methods and activities so as to ascertain those methods that are adequate for obtaining the best results. The teacher seems to be the most influential factor in moulding the personality and life pattern of an individual.

Evidence abound to show that failure of some of the efforts put in place to improve the standard of mathematics education in Nigeria has not necessarily emanated from poor planning or design but mostly from the dearth of competent and creative mathematics teachers in schools (Lewis, 2007). It is unfortunate to note that most of the students in secondary schools fear the study of mathematics. They believe that mathematics is difficult and somehow only reserved for the intellectually gifted, despite the fact that the subject is very important in ones daily life. Thus, a pragmatic and conscientious step should be taken to arrest these incidents of mass failure in mathematics so that the nation's desire and expectations may not sink beyond remedy.

Statement of the Problem

Mathematics education is at the forefront of concern in Nigerian education system. Mathematics is a service subject that is made compulsory in primary schools, junior and senior secondary schools in Nigeria. This indicates that Mathematics is the bedrock of many professional courses and no nation can hope to achieve any measure of scientific and technological advancement without a solid foundation in mathematics. The expository method of teaching which is the dominant method employed does not appear to yield substantial results in terms of school achievement and retention of learnt materials. Again, with ineffective methods, instructional resources used are likely to be inadequate and inappropriate.

According to the Chief Examiners' report (WASSCE, 2012), students' dismal performance in mathematics examination especially in the West African Senior Secondary Certificate Examination (WASSCE) and National Examination Council (NECO) from 1991 to 2012 has been rated very poor and discouraging to the public

and indicate that it was only in 2004 and 2012 that up to 50% of the students had credit in mathematics. In all other years (twenty years) less than 50% of students had credit pass in mathematics. It shows the dismal performances of students in mathematics over twenty two years' period of (1991 - 2012), and an alarming high percent failure of over 80% for 11 out of 22 years' results considered.

There is a general perception among Secondary School students in that mathematics is abstract in nature and difficult to understand. To make such difficult and complex ideas less abstract, teachers could adopt various instructional strategies and teaching aids. This realization informs the need to employ learner-centred activity-based strategy, using some manipulatives, to teach mathematical concepts. The potency of such learner-centred activity-based method requires empirical evidence, hence this study.

Purpose of the Study

The purpose of the study was to investigate the effect of learner-centred activity-based teaching method in facilitating students' performance and retention in geometry shapes concepts in mathematics in senior science colleges in Akwa Ibom State, given their study habit. Specifically, the objectives of the study were to:

1. Ascertain the difference in students' performance in geometrical concepts when taught using learner-centred activity-based and when taught using expository instructional strategies based on study habit;

2. Determine the difference in the retention ability of students in geometrical concepts when taught using learner-centred activity-based and when taught using expository instructional strategies based on study habit.

Research Questions

The following research questions were posed for the study:

1. What is the difference in the performances of students in geometrical concepts when taught using learner-centred activity-based and when taught using expository instructional strategies based on study habit?

2. What is the difference in the retention capacity of students in geometrical concepts when taught using learner-centred activity-based and when taught using expository instructional strategies based on study habit?

Hypotheses

Null hypotheses were postulate at .05 probability level for the study. They are as follows:

Ho_1: There is no significant difference in the performances of students in geometrical concepts when taught using learner-centred activity-based and when taught using expository instructional strategies based on study habit.

Ho_2: There is no significant difference in students' retention in geometrical concepts when taught using learner-centred activity-based and when taught using expository instructional strategies based on study habit.

Literature Review

Study Habit and Students' Performance

The theoretical rationale for the use of manipulative in this research study is attributed to the work of Jerome Bruner's instructional theory of mathematics learning which represents the cognitive viewpoint of learning, and the use of concrete tools as an important stage in development of understanding.

Many students do badly academically, due to factors other than low intellectual capacity. One such factor is poor study habits. Every learner has a peculiar method or style of pursuing his or her academic tasks. Such consistent and stereotyped acquisition of knowledge is referred to as Study habits. These also serve as the vehicle of learning. It is essential to learning and fundamental to school life. Its chief purposes are:

- To acquire knowledge and habits, this will be useful in meeting new situations, interpreting ideas.
- To perfect skills, and
- To develop attitudes.

Habits are true indicators of individuality in a person. According to Dictionary of Education (2000), "Habit is a state of the body, natural or acquired, aptitude acquired by practice, custom and manner, whereas Study is described as earnest endeavours, application of books and subjects which one studies. Study Habit is the endeavour towards studies acquired through state of the body which is natural or acquired". Thus, Study habits can be interpreted as a planned programme of subject mastery. Study habit is the behaviour of an individual related to studies. In the process of learning, learner's habitual ways of exercising and practicing their abilities for learning are considered as study habits of learners.

The pattern of behaviour adopted by students in the pursuit of their studies is termed on study habit. Study habits reveal students personality and functioning. Learner's learning character is characterized by his study habits. Study habits serve as the vehicle of learning. It may be seen as both means and ends of learning. The use of proper study habits help students to perform well in their academic pursuit. Success or

failure of each student depends upon his own study habits. Of course, study is an art and as such it requires practice. Some students study more but they fail to achieve more. Others study less but achieve more. Success of each student definitely depends upon ability, intelligence and effort of students. No doubt, regular study habits bring their own rewards in the sense of achievement of success, (Ossai, 2004). Study habit play a very important role in the life of students. Study habit refer to the activities carried out by student during the learning process of improving learning.

Learners, at various level of education often give evidence of ineffective study habit. To a few students success in study comes not by training, in how to study but rather by the development of study procedures that they may have discovered by accident and that seem to serve their purpose. Since study usually is connected with a gaining of ideas from the printed page, the learners need actually is that of attempting to grasp the thoughts of a writer.

The most important requisite for effective study habit is a good system of study; the individual should evolve two fundamental abilities that is regulation of work and the persistence till the end which can influence the proper development of study habits. Proper study habits not only help in upgrading the underachievers but also check the wastage of potentialities of competent students.

Sandhu (2014) conducted a study to find the relation between academic achievement of adolescents with emotional intelligence and study habits. The sample comprised of 200 secondary school adolescents (100 boys and 100 girls) from Government Secondary Schools of Ludhiana City. The data was obtained by using Emotional intelligence Scale and Study Habit Inventory. The result of the study showed significant positive relation between academic achievement and study habits of adolescents in the experimental group when compared to the control group there was no significant positive relation, and also between academic achievement and emotional intelligence. Nancy & Sheeba (2001) conducted survey on relationship between study habits and students academic achievement on sample of 200 senior secondary school students from four different Public schools in Edo state. The researchers observed and concluded that there is positive relationship between study habits and academic achievement when demonstration strategy was used.

Kambiz and Godbole (2014) also studied the relation between achievement motivation and study habits to academic performance in high school student in Hyderabad. A sample of 400 students consisting of boys and girls were selected for the study. The tools used to collect data were study habits inventory and achievement motivation scale. The data were collected in small groups were analyzed using mean score, standard deviation, Pearson's correlation and regression. The result indicated that there was significant positive relationship of achievement motivation and study

habits to academic performance of learners in student-centred demonstration group performed significantly better not minding their study habits. The result also showed the extent of contribution of study habits to academic performance and was concluded that study habits have proved to be effective on academic performance of students and helped them for better performance and academic achievement.

Aluede and Onalomhemhen (2001) showed that after research on Study habits counseling on the various areas of inventory, students in experimental group showed a significant improvement in the scores (i.e. study habit) and retention when compared to the control group where there was no significant improvement. This shows that counselling significant on good Study habits can bring about improvement in the students' academic performance and retention when expose to experimental group. Students who are not privileged to benefit from Study habits counselling strategies are not likely to improve their academic performance. Kaur (2003) in her study, Study habits as Determinants of Academic achievement in Science, concluded that high achievers are having comparatively good Study habits than low achievers. Ahuja and Blench (2004) in their study on socialized personality achievement, exploring the links found that students with better study habits tend to show better academic achievement.

In another related study conducted by Hart and Keller (2005) in Hong – Kong. They reported that students were found to have placed the greatest responsibility for their low performance on their own lack of motivation, improper study habit patterns and inattention to the school work. Ossai (2011) conducted a study on study habits of senior secondary school students in Maiduguri metropolis with a sample of 150 senior secondary two students from public schools and found that study habit skills significantly affect students' academic performance since learners in the experimental group out perform those in the control groups in terms of achievement and retention of learnt concepts.

Kumari (2001) studied the relationship between study habits, attitude and motivation to academic achievement and analysis of data revealed that there was statistically significant relationship between Study habits and academic achievement and retention in the experimental group than in the control group. No statistically significant relationship was found between attitude and motivation with academic achievement.

According to Abdullahi, Atsua, Amuda, and Ago (2013), the ideal study habit may involve planning and organization of time of study, motives and habits of note taking, remembering and learning strategies, planning and preparation for assignment and examination taking technique. These study habit techniques if properly adhered to by students, may likely improve students' academic performance. The researchers

submitted that findings on study habit techniques of students have been a strong predictor of academic performance of students and retention. Studies which show no significant relation between academic achievement and study habits include Dube and Khuntia (2000) who in their study on effectiveness of a module in guidance and counselling for B.Ed. students in terms of students' reaction to study habits found that study habits of students have no effect on their achievement and retention.

Design of the Study

This study was conducted in Senior Science Colleges in Akwa Ibom State, Nigeria. The research design adopted for this study was non-randomized pre-test, post-test, control group design. The design was considered appropriate as the respondents were used in their intact class setting.

Population and Sample

The population of this study consisted of all the 1,037 students (591 males and 446 females) Senior Secondary two (SS2) students in the five Senior Science Colleges in Akwa Ibom State during the 2014/2015 academic session. SS2 students were preferred because students in this class have settled down enough for this sort of study having spent at least one year in the senior secondary level. The study sample consisted of two hundred (200) SS2 students comprising 88 males and 112 females selected from four (4) out of the five (5) existing Senior Science Colleges in the state. Purposive sampling technique was used in the selection of the schools used for the study.

The criteria for selecting the schools were:

i. Schools with functional and separate mathematics laboratory and library.
ii. Schools that have won prizes in mathematics and science competitions.
iii. Schools with graduate teachers consistently, with at least B.Sc degree in Mathematics Education.

The four (4) schools that met the above criteria were purposively selected. One intact class was randomly selected in each school making a total of four intact classes. This was done in order not to interrupt the normal Mathematics class time table since the same teacher is to teach the same group of students for the research purpose. The schools were assigned such that two (2) schools had experimental group and the other two (2) had control group.

Instrumentation

Two instruments were used in gathering data. The instruments were: "Mathematics Performance Test (MPT) and Study Habit Inventory (SHI)''.

Mathematics Performance Test was a researcher - developed instrument designed to measure students' performance and retention in the selected concept area. It consisted

of 15 – multiple choice items with 4 options A – D. It covered the main topics of geometrical concepts in Senior Secondary Two mathematics. To ensure content coverage the items were selected based on Bloom's taxonomy of educational objectives in the cognitive domain as shown in Table 1. A reshuffled version of the instrument was used for retention measurement.

Table 1: A Test Blue Print on Geometry Shape

Concept	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Total	%
Perimeter of figures	1	1	-	-	1	1	4	27
Area of plane figures	-	-	1	1	1	-	3	20
Area of solid shapes	1	1	1	1		1	5	33
Volume of solid shapes	-	-	1	1	1	-	3	20
Total	**2**	**2**	**3**	**3**	**3**	**2**	**15**	**100**
%	**14**	**13**	**20**	**20**	**20**	**13**	**100**	**-**

The Study Habit Inventory (SHI) was adapted from Virginia Gordon's University Survey Inventory. This instrument was a 15 item, four option questionnaires with Strongly Agree; Agree; Disagree; and Strongly Disagree response categories. The items were organized under three subsections: study schedule; note taking; and mathematics skills.

Mathematics Performance Test (MPT) had a reliability index of .72 determined using Pearson Product Moment Correlation Coefficient (PPMC), while Study Habit Inventory (SHI) had reliability index (α) of .76 determined using Cronbach alpha reliability package in SPSS 17. Based on these results the two instruments were considered reliable and capable of measuring the intended events with consistency.

Research Procedures

The researcher first visited the sampled schools for conducting the study and presented a letter of introduction to the schools' management for permission to use Senior Secondary Two (SS2) students and their mathematics teachers for the study. With permission granted, the researcher took two weeks to train a subject teacher

from each sampled school to function effectively as research assistants using the instructional package developed by the researcher. Thereafter, the research assistants were assigned randomly to the treatment and the control groups. This was followed by the administration of the Mathematics Performance Test (MPT) as pre-test and Study Habit Inventory (SHI) before the teaching of the selected concepts commenced. The experimental group was taught geometrical concepts with learner-centred activity-based method while the control group was taught the same concepts using expository strategy - that is, chalkboard drawings and sketches of triangles, rectangles, squares, circle, rhombus, kite, cube, cuboids, cone, pyramids, cylinders, and sphere. They were given the formulae to determine the areas, volumes and perimeters of these figures.

The classroom investigation which lasted for four weeks was strictly supervised by the researcher. At the end the Mathematics Performance Test (MPT) was reshuffled and re-administered as post-test. Two weeks later the Mathematics Performance Test (MPT) was reshuffled again and re-administered as retention test. At the end of each test the scripts were collected by the research assistants and handed over to the researcher for scoring and analysis. The data collected were analyzed using Analysis of Covariance (ANCOVA) with pre-test scores as covariates. All hypotheses were tested at .05 level of significance.

Results

Research Question 1: What is the difference in the performances of students in geometrical concepts when taught using learner-centred activity-based and when taught using expository instructional strategies based on study habit?

Table 2: Mean and standard deviation scores of the students' on pre-test and post-test classified by treatment groups and study habits

Treatment Groups	Study Habit	Sample Size	Pre-test		Post-Test		Mean Difference
			X	SD	X	SD	
Learner-Centred Activity-Based (*Experimental)*	Study Schedule	15	29.87	3.18	48.73	4.45	18.86
	Note taking	33	26.39	6.06	49.76	4.21	23.37
	Mathematics Skills	36	27.61	5.58	47.89	4.66	20.28
Expository Strategy *(Control)*	Study Schedule	30	28.37	3.42	47.33	4.37	18.96
	Note taking	49	27.10	6.25	45.04	5.13	17.94
	Mathematics Skills	37	28.73	5.92	48.24	5.30	1 9.51

Considering research question 1, the post-test - pre-test mean difference of 18.86; 23.37 and 20.28 for the students with definite study schedule, note taking, and mathematics skills development preferred study habits respectively, in learner-centred activity-based group; and 18.96; 17.94 and 19.51 respectively, their counterparts in expository strategy group as displayed in Table 2 show that the students with note taking as their preferred study habit taught concepts in geometry shapes using learner-centred activity-based method had the best performance followed by those with mathematics skills development as their preferred study habit in the same treatment group.

Research Question 2: What is the difference in the retention of students in geometrical concepts when taught using learner-centred activity-based and when taught using expository instructional strategies based on study habit?

Table 3: Mean and standard deviation scores of the students' on pre-test and retention scores classified by treatment groups and study habits

Treatment Groups	Study Habit	Sample Size	Pre-test		Retention		Mean Difference
			X	SD	X	SD	
Learner-Centred Activity-Based (*Experimental)*	Study Schedule	15	29.87	3.18	42.13	5.17	12.26
	Note taking	33	26.39	6.06	39.00	4.09	12.61
	Mathematics Skills	36	27.61	5.58	38.58	5.56	10.97
Expository Strategy *(Control)*	Study Schedule	30	28.37	3.42	38.23	5.56	9.86
	Note taking	49	27.10	6.25	38.82	4.01	11.72
	Mathematics Skills	37	28.73	5.92	38.73	4.11	10.00

Considering research question 2, the retention - pre-test mean difference of 12.26; 12.61 and 10.97 for the students with definite study schedule, note taking, mathematics skills development preferred study habits respectively, in learner-centred activity-based group; and 9.86; 11.72 and 10.00 respectively, for their counterparts in expository strategy group displayed in Table 3 show that the students with note taking as their preferred study habit taught concepts in geometry shapes using learner-centred activity-based method had the best retention followed by those with definite study schedule as their preferred study habit in the same treatment group.

Null Hypothesis 1 (Ho1): There is no significant difference in the performance of students in geometrical concepts when taught using learner-centred activity-based and when taught using expository instructional strategies based on study habit.

Table 4: Summary of Analysis of Covariance (ANCOVA) of students' post-test scores classified by treatment groups and study habit with pre-test as covariate

Source of Variation	Sum of Squares	df	Mean Square	F-cal	F-crit	Sig.	Decision at p<.05
Covariate: *Pre-test*	81.16	1	81.16	3.60	3.84	06	ns
Main Effects:							
Instructional Strategies	163.72	1	163.72	7.27	3.84	.01	s
Study Habit	9.71	2	4.85	.22	2.99	.81	ns
2-Way Interaction							
Instructional Strategies * Study Habit	249.79	2	124.90	5.55	2.99	.01	s
Residual	4346.80	193	22.52	-	-	-	-
Total	**4941.56**	**199**	**-**	**-**	**-**	**-**	**-**

* indicate interaction effect

With respect to hypothesis one, the results in Table 4, show that the calculated F-ratio for the effect of instructional strategies on the performance of students in geometrical concepts at df 1,193 is 7.27, while its corresponding calculated level of significance is .01 alpha. The F-cal, 7.27 is greater than the F-crit, 3.84, at .05 alpha, indicating that the Instructional strategies used had statistically significant effect on the performance of students in geometry shapes when taught using learner-centred activity-based and when taught using expository instructional strategies. However, the calculated F-ratio for the influence of study habit on the performance of students at df 2,193 is .22, while its corresponding calculated level of significance is .81 alpha. This F value is less than the F-crit, 2.99, at .05 alpha, indicating that study habit had no statistically significant effect on the performance of students. Hence, Hypothesis one which assumed no significant difference between the performances of the students in the concept based on study habit was not rejected.

Null Hypothesis 2 (Ho2): There is no significant difference in students' retention in geometrical concepts when taught using learner-centred activity-based n and when taught using expository instructional strategies based on study habit.

Table 5: Summary of Analysis of Covariance (ANCOVA) of students' retention scores classified by treatment groups and study habit with pre-test as covariate

Source of Variation	Sum of Squares	df	Mean Square	F-cal	F-crit	Sig.	Decision at p<.05
Covariate: *Pre-test*	56.86	1	56.86	2.88	3.84	.09	ns
Main Effects:							
Instructional Strategies	76.66	1	76.66	3.88	3.84	.04	s
Study Habit	53.41	2	26.71	1.35	2.99	.26	ns
2-Way Interaction							
Instructional Strategies * Study Habit	104.74	2	52.37	2.65	2.99	.07	ns
Residual	3811.63	193	19.75	-	-	-	-
Total	**4043.50**	**199**	-	-	-	-	-

* indicate interaction effect

Considering Hypothesis two, the results in Table 5, show that the calculated F-ratio for the effect of instructional strategies on the performance of students in geometrical concepts at df 1,193 is 3.88, while its corresponding calculated level of significance is .04 alpha. The F-cal, 3.88 is greater than the F-crit, 3.84, at .05 alpha, indicating that the Instructional strategies used had a statistically significant effect on the retention of students in geometry shapes when taught using learner-centred activity-based and when taught using expository instructional strategies. However, the calculated F-ratio for the influence of study habit on the retention of students at df 2,193 is 1.35, while its corresponding calculated level of significance is .26 alpha. This F value is less than the F-crit, 2.99, at .05 alpha, indicating that study habit had no statistically significant effect on the performance retention of students. Hence, Hypothesis two which assumed no significant difference in the retention of the students in the concept based on study habit was not rejected.

Summary of the Findings

The findings were as follows:

1. There was a significant effect of the instructional strategies used on the performance of students in geometrical concepts in favour of the students taught by Learner-Centred Activity-Based. However, the calculated F-ratio for the influence of study habit on the performance of students (df 2,193, = .02), and its corresponding calculated level of significance .81 alpha showed that study habit had no significant effect on the performance of students. Hence, Hypothesis one which assumed no significant difference between the performances of the students in the concept based on study habit was not rejected.

2. There was a significant effect of the instructional strategies used on the retention of students in geometrical concepts in favour of the students taught by Learner-Centred Activity-Based. However, the calculated F-ratio for the influence of study habit on the retention of students (df 2,193 = 1.35), and its corresponding calculated level of significance, .26 alpha, showed that study habit had no statistically significant effect on the retention of students. Hence, Hypothesis two which assumed no significant difference in the retention of the students in the concept based on study habit was not rejected.

Discussion of Findings

On the effect of Instructional strategies used on the performances of the students in the concept in geometrical concepts based on study habit, the findings showed that there was a significant effect of the strategies on the performance of students in geometry shapes when taught using learner-centred activity-based and when taught using expository instructional strategies in favour of the students taught by Learner-Centred Activity-Based. However, the calculated F-ratio for the influence

of study habit on the performance of students (df 2,193, = .02), and its corresponding calculated level of significance (.81alpha) showed that study habit had no statistically significant effect on the performance of students. The observation underscored the effectiveness of learner-centred activity-based in facilitating performances of students while at the same time indicating that study habit is not a strong determinant of students' learning outcomes.

With respect to the effect of instructional strategies used on the retention of the students in the concepts based on study habit the findings showed that there was a significant effect of the strategies on the retention of students in geometrical concepts when taught using learner-centred activity-based and when taught using expository instructional strategies. However, the calculated F-ratio for the influence of study habit on the retention of students (df 2,193 = 1.35), and its corresponding calculated level of significance (.26 alpha) showed that, though the students with note taking as their preferred study habit taught concepts in geometrical concepts using learner-centred activity-based method had higher retention followed by those with definite study schedule as their preferred study habit in the same treatment group, study habit influence on the students' retention was not statistically significant. The observation underscored the effectiveness of learner-centred activity-based in facilitating retention of students while at the same time indicating that study habit is not a strong determinant of students' retention.

Conclusion

Based on the findings of the study, it is concluded that the use of learner-centred activity-based using manipulatives in teaching and learning of geometry shapes enhances Senior Secondary Two (SS2) students' performance and retention better than the expository strategy irrespective of their study habits. This therefore implies that if students are exposed to the same instructional strategies, irrespective of their study habits, if they determine to perform well and study hard, they will perform excellently well.

Recommendations

Based on the findings and conclusion drawn, the following recommendations are made:

1. Mathematics teachers should adopt the use of learner-centred activity-based strategy in teaching various concepts at Senior Secondary School level.
2. Curriculum planners for Senior Secondary School mathematics should incorporate learner-centred activity-based strategies in curriculum development.
3. All students should be encouraged to study mathematics irrespective of their study habit.

4. The government and school proprietors should consider establishment of well equipped mathematics laboratory in every school as a priority as this is necessary for effective practical demonstration and active involvement of learners in the teaching learning process.

5. Conferences, workshops and seminar should be organized for mathematics teachers to acquaint them with the use of learner-centred activity-based strategy.

References

Abdullahi, U., Atsua, T. G., Amuda, B. G. and Ago, H. A. (2013). Study Habit Counselling and Academic Performance of Senior Secondary School Students in Maiduguri, Nigeria. *Jorind,* 11(2):36-42.

Ahuja and Blench, A. (2004). Socialized Personality Achievement, Exploring the Links. *European Journal and Psychological Assessment,* 20(3): 40 - 51.

Akpan, A. A. (1996). Teacher Effectiveness as a Determinant of Students' Performance in Mathematics: A Theoretical Review. *Journal of Nigeria Education,* 1(1): 89-99.

Alio and Harbor Peters (2002).The Effect of Poly a Problem Solving Technique on Secondary School Student Achievement in Mathematics. Abacus. *Journal of the Mathematics Association of Nigeria,* 25(1): 20 – 25.

Alsup, J. and Sprigler, M. (2003). A Comparison of Traditional and Reform Mathematics Curricula in an Eighth-Grade Classroom. *Education*, 123(4): 689-704.

Aluede, O. O. and Onalomhemhen, P. E. (2001). The Effect of Study Habits Counseling on the Academic Performance of Secondary School Students in English Language. *Journal of Research and Extension,* 38(3): 17-27.

Aremu, A. and Tella, A. (2009). The Relationship between Gender, Age, Mental Ability, Anxiety, Mathematics Self-Efficacy and Achievement in Mathematics. *Cypriot Journal of Educational Sciences*,4, 113-124

Busari, O. O. (2004). Sustaining Students' Interest in Science: Influence of Cognitive and Teacher Variables. *Journal of Science Teachers Association of Nigeria*, 27(1): 7-13.

Dube, A. and Khuntia, S. (2000). Effectiveness of a Module in Guidance and Counseling for B.Ed. Students in Terms of Students' Reaction of Study Habits. *Recent Research in Education Psychology*, 5, 55-69.

Eduok, J. D. (2016). Instructional Strategies, Students' Characteristics and Their Performance and Retention of Concepts in Mathematics in Senior Science Colleges in Akwa Ibom State. *Unpublished Doctoral Thesis, University of Uyo.*

Federal Republic of Nigeria (FRN) (2014). *National Policy on Education.* Abuja: NERDC Press.

Hart, C. and Keller, E. (2005).The Effect of Reading and Studying Skills Programme on Academic Performance and Perseverance. *Journal of General Education*, 29 (2): 89 – 96.

Kambiz, Y. and Godbole V. S. (2014). Studying the Role of Habits and Achievement Motivation in Improving Students' Academic Performance. *Journal of Natural and Social Science,* 3(4): 827-839.

Kaur, R. (2003). Study Habits as Determinants of Academic Achievement in Science. *Unpublished M.Ed. Dissertation, Panjab University, Chandigarh*.

Kelley, A. L. R. (2000). *Handbook of Research Design in Mathematics and Science Education*. Mahuah, NJ: Lawrence or Erlbaum.

Lewis, C. (2007). The Effect of a Constructivist Teaching Approach on Student Academic Achievement, Self-Concept, and Learning Strategies. *Asia Pacific Education Review*, 6(1): 9-10.

Moore, C. (2005). Mathematics for Critical Thinking: *Lead Paper presented at the Annual Conference of M.A.N. Anambra State Chapter, April 2005.*

National Council of Teachers of Mathematics.(2010). Process Standards, Available at *http://www.nctm.org/standards/content.aspx?id=322*.Retrieved on November 12, 2014.

Nwoke, B. I. and Nnaji, L. N. (2011). Effect of Using Mathematics Laboratory in Teaching Mathematics on Students' Achievement in Mathematics. *Journal of Issues on Mathematics*, 14(4): 60-72.

Oluwatimilehin, J. T. B. and Owoyele, J. W. (2012). Study Habits and Academic Achievement in Core Subject among Junior Secondary School Students in Ondo State, Nigeria. *Bulgarian Journal of Science and Education Policy (BJSEP),* 6(1): 98-100.

Ossai, M. C. (2011). Study Habit Predicts Examination Behaviour: An Imperative for Enhancing Quality of College Guidance and Counselling. *Mediterranean Journal of Social Sciences*, 2, 23 -28.

Ubah, A. I. (2013). The Influence of Jigsaw Strategy as a Cooperative Learning Technique on Students' Achievement in Algebra: Implication for Secondary Mathematics Education, in Attaining Vision 20:2020. *Journal of Mathematical Sciences Education*,2(1): 272-281.

West African Examination Council (2012). West African Senior Secondary Certificate Examination (WASSCE) and National Examination Council (NECO) (1991 - 2012). *Chief Examiners' Report, Nigeria.*