ACT OF ACTIVITY-BASED LEARNING ON PUPILS LEVEL OF COGNITIVE ATTAINMENT IN GEOMETRY

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Abstract

The study investigated impact of activity –based learning strategy (ABL) on pupil's level of cognitive attainment in geometry. The study was carried out in primary school in Owerri Municipal Council Area of Imo-State. Based on the objectives of the study, three hypotheses were posed for the study. A sample size of 50 pupils was used for the study. The experimental group had 25 pupils while the control group had 25 pupils. The experimental group was taught geometry using activity –based learning strategy while the control group was taught using the conventional method. The instrument used for data collection was 25 multiple –choice test questions constructed by the researchers. It has a reliability coefficient of 0.79 determined using Kuder-Richardson (K-2O) methods. The data generated was analyzed using mean and t-test statistical tool. The results showed that there was a positive impact of activity-based learning in developing cognitive skills in the pupils, activity based learning is more effective for the development of higher order thinking skills among the pupils and the use of activity based –learning improved male and female pupils

achievement at different levels of cognition. One of the recommendations is that ABT should be adopted at the primary level to teach mathematics, especially geometry.

Key words: Activity-Based Learning, Cognitive Levels, Geometry

Mathematics is the key to all sciences (Etukudo 2000). Today's World largely depends on science and science in turn depends on mathematics. The compulsory nature of mathematics came with it an assumption that all human beings in the society should have the knowledge of the subject mathematics. In Nigeria, mathematics has continued to be one of the compulsory core subjects at all levels of education. It is based on this fact that, every school child should acquire appropriate mathematical skills and knowledge to solve human problems in all spheres of life, (Nigeria Educational Research and Development Council NERDC, 2008). The teaching and learning of some mathematical concepts have not only been frustrated by the nature of the topics but also by clumsy methods and instructional materials used (Etukudo, 2000; Etukudo & Ufin, 2006). The resultant effect is the poor achievement level of students both in internal and external examinations. In view of this Iji (2002) in trying to find solution to this ugly situation of poor performance of students in mathematics in public examinations, identified teaching methods used by the teachers as one of the factors. This points to the fact that good teaching method helps the learners to learn more qualitatively and quantitatively and poor teaching method would lead to poor learning and poor performance. Salau (2002) lamented the poor achievement of students in mathematics and points out that introduction of suitable instructional materials and methods are the likely solution. Literature and available records have shown a variety of efficacious and innovative teaching strategies that have been identified by researchers to alleviate this problem of poor performance of students in mathematics. These innovative strategies are the ones that will allow students to control their learning process as well as develop the required interest in mathematics. The Nigerian primary school mathematics curriculum is developed and structured around five main concepts namely; Algebra, arithmetic, trigonometry, statistics and geometry.

Geometry is an important branch of school mathematics that has everyday application in the life of the child especially in modeling, construction and comparing quantities (Sidhu, 2006). It is the aspect of school mathematics involving the measurement of length, area, volume and surfaces and enables the child to use the knowledge of mathematics in building and construction even when he eventually becomes an engineer. This shows that without a good geometrical knowledge of mathematics, the engineer' remains incomplete in his life. The knowledge of geometry

assists students to appreciate shapes and situation around their environment and as well helps to develop their inductive reasoning skills that become necessary ingredients for learning mathematics.

Irrespective of the high level of importance placed on geometry in school mathematics curricula, many students find it abstract and difficult to comprehend (Amoo, 2011). Geometry is one aspect of mathematics that creates Phobia and Anxiety among students which is evident in their outcome. The state common entrance examination chief examiner's report (2013) showed that geometry was one of the areas that most of the students found very difficult to handle during examinations. They cannot solve simple calculations such as determining the volume of spheres, surface area and perimeter of shapes. Appeh (1999) in Anyiche and Onyedike (2012) further observed that poor preparation of the students due to poor teaching and dearth of facilities are considered as the main reasons for students' poor performance at public examinations. The inability of students to engage actively in the learning process tends to dispose the students to constant rote learning and examinations malpractice leading to their poor academic performance. Galadima (2002) also noted that poor quality instructional technique employed by the teachers is one of the major causes of poor achievement among primary school pupils in mathematics. Ofeze (2011) suggested that mathematics teaching should be structured such that knowledge is built on a foundation already possessed; encourage student to learn by doing, ensuring that learning grows out of useful experience and experimentation by effective use of teaching strategies. The use of effective teaching strategy in teaching and learning mathematics concepts shifts the process from teacher-centered approach to student activity-centered. This recommendation seems to call for an option of giving activity-based learning strategy (ABL) a trail being a practical approach that has the interest of the learner at heart.

Activity-based learning is a process whereby learners are actively engaged in the learning process, rather than passively absorbing lectures. It is based on the core premise that learning should be based on doing some hands-on-experiments and activities rather than just listening to the lesson only. Activity-based learning involves discussion, practical activities, and engagement in solving problems, analysis, synthesis and evaluation. Active learning is also defined as any strategy that involves students in doing things and thinking about the things they are doing (Bonwell & Eisom, 1991). If a child is given opportunity to explore the learning environment and provided with an optimum learning environment then, learning becomes joyful and long lasting (Wikepidia, 2012). Activity-based learning is defined as a method where the teacher only acts as a facilitator and learners are at the centre of the learning process by their high involvement in practical activities and discussions. It is the mode of learning

guided by the assumption that (i) significant learning takes place when the subject matter is perceived by the learners as relevant to their own purpose (ii) much significant learning is acquired through doing:

(iii) Learning is facilitated by the learner's responsible participation in the learning process.

(iv) Self initiated learning involving the whole person feeling as well as intellect is the most per vases and lasting type of learning (Okwudishu, 2011).

Bonwel & Eison (1991) state the characteristics of active learning as follows: students are involved in activity more than listening, less emphasis is placed on transmitting information and more on developing student's skills, students are involved in higher-order thinking (analysis, synthesis, evaluation), students are engaged in active and greater emphasis placed on students exploration on their own attitude and value. Research results have shown greater learning when students engage in active learning. According to Mirable in Okwudishi (2011), activity- based learning offers the following benefits: Reinforces course content, develops team building skills, enhances learner's self-esteem, promotes participating learning, allows for creative problem solving, and promotes the concept of discovering learning. Other benefits are that it energizes and invigorates their participants, strengthens learners bond, offers variety that accommodates diverse learning styles, allows for practical application of course content, enhances communication with diverse learning, offers an enjoyable and exiting learning environment, helps improve learners retention and motivation, provides an avenue for learners recognition and reward, and promotes fun.

Revised Bloom's Taxonomy is a classification of thinking organized by levels of complexity. It gives teachers and students an opportunity to learn and practice a range of thinking and provides a simple structure for many different kinds of questions. The development of critical and creative kinds of thinking is a major goal for education in the 21st century. The development of improved thinking among our students should be our focus of attention. The revised Bloom's taxonomy will provide the pathway that would lead to improved thinking. It consists of remembering; the leaner is able to recall, restate and remember learned information. Understanding: the learner grasps the meaning of information by interpreting and translating what has been learned. Applying: the learner makes use of information in a context to differentiate from the one in which it was learned. Analyzing: the learner breaks learned information into its parts to best understand that information and creating: the learner creates new ideas and information using what has been previously learned.

Academic achievement means achievement level of the student, it can be defined as what a student does or achieves at his school. It is a common practice to promote students from a lower class to a higher class on the basis of his academic achievement. It helps in declaring students successful or unsuccessful, choosing students for various courses and selecting students for different jobs. It is the level of learning in a particular area of subject in terms of remembering, understanding, creating and applying and Analyzing usually evaluated by teachers in the form of test scores in their examinations. Achievement according to Elliot, Kratochwill, Cook and Traver (2002), Kurumeh (2006), Musa and Agwagah (2006) and Abakpa (2011) is the measure of accomplishment in a specific field of study. They argue that achievement in mathematics test is the demonstration of the child's ability to attain certain level of instructional objectives in his classroom experiences.

Students' mathematics achievement irrespective of sex had been a source of concern to educators, government and individuals. Review of studies shows consistency of performance in the result of male and female student's achievement in mathematics. Results in general mathematics (Etukudo, 2002; Ezeugo & Agwagh, 2000) and in geometry achievement test (Iji, 2002, and Abakpa, 2011) and in Alegbra (Ezeugo & Agwagah, 2000: Mtswn, 2011) do indicate that there is significant difference between male and female students in mathematics achievement tests. Abiam and Odok (2006) however found no significant relationship between gender and achievement in number and numeration, algebraic processes and statistics. They however found the existence of a weak significant relationship in Geometry and Trigonometry. It becomes imperative to ascertain the effect of activity based-learning strategy on pupil's cognitive attainment in geometry.

Statement of the Problem

Mathematics as the bedrock of all scientific and technological advancement. It is a compulsory subject and must be passed to enable a student further his/her education at any level. Geometry as an aspect of mathematics is a human invention that broke out of hand, mind and resolve to solve human problem. Thus, as a creation of mind, it is concerned primarily with idea processing and reasoning. Its understanding can be assessed at the various levels of blooms cognitive taxonomy, namely: remembering, understanding, applying, analyzing and creating. Of all the factors that affect teaching-learning in the educational system of any society, teaching method seems to constitute the primary issue. Over the years, teaching had been teacher-centered and this had resulted in the learner being alienated from the lesson and to sit as a mere observer and listener with persistent poor performance in mathematics especially in geometry. Could

the use of activity- based learning strategy in teaching geometry affect pupil's cognitive attainment?

Purpose of the Study

The main purpose of the study was to investigate the impact of activity-based learning strategy on pupil's achievement in geometry. Specifically the study determined whether:

1. pupils taught geometry using activity-based learning strategy will have better achievement than those taught conventionally.

2. The post-test mean scores of pupils in geometry at different cognitive levels for the control and experimental group differ significantly.

3. Male and Female pupils will differ in their achievement in geometry after being taught using activity based learning strategy with regards to their cognition levels.

Research Hypotheses

The following research hypothesis were tested at 0.05 level of significant.

1. The mean achievement score at different cognition levels of pupils taught geometry using activity based learning strategy is not significantly different from that of those taught conventionally at pre-test.

2. The post –test mean score at different cognition levels of pupils in the experimental group is not significantly different from that of pupils in the control group.

3. There is no significant difference in the post- test mean achievement scores of male and female pupils in experimental group at different cognition levels.

Methodology

The design of the study was Quasi-experimental research type adopting pre-test, post-test and non-equivalent control group design. This was adopted because it was not possible to have a complete randomization of the subjects involved in the study. The population of the study consisted of all primary six pupils in St Paul's' International Primary School in Owerri Municipal Council Area of Imo State with population size of eight- hundred and forty-seven pupils. The sample of the study, consist of fifty primary six pupils. In the sampled school, two intact classes were assigned to experimental and control groups. The experimental groups had 25pupils while the control group had 25

pupils. The instrument used for data collection was Geometry Achievement Test (GAT). It was a 30- multiple- choice objective test questions constructed by the researchers with special attention on geometry considering modeling of 2D and 3D shapes. The construction of the instrument was guided by a table of specification using Revised Blooms' Taxonomy. The face and content validity was established by two experts in mathematics education and one expert in measurement and evaluation. Reliability of the instrument was estimated at 0.86 by using kuder-Richardson (K-20) reliability method. Before treatment both experimental and control groups were given pre-test. After that, the experimental group was taught geometry using activity method by their mathematics teacher trained for two weeks on how to use activity- based learning strategy; however a member of the research team monitored all the activities. The pupils were given opportunity to interact with one another during the process of learning the concept. They used their modeled shapes to solve problems involving surface area, Area, length and volume of 3D shapes. They interacted with each other in the process of learning while the teacher guided them in different situations. The control group was taught the same topics with the lesson plan using the conventional method by their mathematics teacher. The process lasted for three weeks after which a post-test was administered on both groups. The data collected were analyzed using t-test and analysis of covariance (ANCOVA) tested at 0.05 level of significance to test the hypotheses of the study.

Results

H_{01}. The mean achievement score at different cognition levels of pupils taught geometry using activity based learning strategy is not significantly different from that of those taught conventionally at pre-test

Table 1: Achievement Scores of the students of control group and experimental group on pre-test.

Domain	Group	N	Mean	Df	t-valve	P(0.5)
Remembering	Experimental	25	5.24		0.67	0.67<2.01
	Control	25	5.04			
Understanding	Experimental	25	5.08		-0.75	0.75<2.01
	Control	25	5.28			
Applying	Experimental	25	5.08	48	0.95	0.95<2.01
	Control	25	5.28			
Analyzing	Experimental	25	4.80		1.17	1.17<2.01
	Control	25	4.52			
Creating	Experimental	25	5.24		0.68	0.68<201
	Control	25	5.08			

Critical value of' at 0.05 = 2.01

The calculated t-values are less than the table values. It is clear from the results shown above in the Table 1. That there is no significant difference between the mean scores of the experimental and control group in the cognitive domains of remembering, understanding, applying, analyzing and creating Hence, It is concluded that both the experimental and control groups were the same in the cognitive skills before the treatment.

H_{02}: The post –test mean score at different cognition levels of pupils in the experimental group is not significantly different from that of pupils in the control group.

Table 2 ANCOVA analysis of pupils in experimental and control groups at different cognition levels

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	229.472[a]	4	57.368	.623	.649	.066
Intercept	14852.450	1	14852.450	161.294	.000	.822
Pretest	69.397	1	69.397	.754	.391	.021
Method	59.145	1	59.145	.642	.428	.018
Cognition levels	**1864.002**	**1**	**1864.002**	**236.452**	**.000**	**.015**
Gender cognition	**95.463**	**1**	**45.463**	**.047**	**.316**	**.009**
	.					
Error	3222.903	35	92.083			
Total	156593.000	50				
Corrected Total	3452.375	49				

Table 2 shows that at the cognition row, f- calculated valve 236.002 is greater than Sign. Value 0.009. Based on the results, the null hypothesis is rejected and the alternative accepted at 0.05 level of significance. This implies that a significant difference exists between the experimental group taught geometry using activity –based learning and those taught conventionally at different cognition levels.

H_{03}: There is no significant difference in the post- test mean achievement scores of male and female pupils in experimental group at different cognition levels.

The analysis in Table 2 indicates that there is no significant difference in the achievement of male and female pupils at different cognition levels. The analysis revealed that there is no significant difference as the value (F = 0.047; Sig. = 0.316). Therefore, the null hypothesis is accepted.

Discussion

The results indicated that there was a positive impact of activity- based teaching in developing cognitive skills in the pupils at primary level. ABL method of teaching is more effective for the development of higher order thinking skills in the pupils. These results are supported by the findings of Hung, Jonassen and Liu (2008) , Suydam, Marilyn and Higgins (1977), Coulson and Osborne (1984), Blumberg and Michael (1992), Gallagher et al.(1992) , Norman and Schmidt (1992), Ryan (1993), Dwyer (1993), Dolmans and Schmidt (1994), Woods (1993), Shepherd (1998), van den Hurk et al. (1999) Schmidt and van der Molen (2001) and Schmidt et al.(2006),Martin et al.(1998,Dean (1999),Lieux (2001,Thornton (2001),Schmidt and van der Molen (2001) and Schmidt et al.(2006).

Also the results showed that there is no significant difference in the achievement of male and female pupils at different cognition levels. This result is in tandem with the work of Abiam and Odok (2006) who however found no significant relationship between gender and achievement in number and numeration, algebraic processes and statistics.

Conclusion

The results showed that activity-based learning is effective in improving pupil's higher order thinking skills in geometry irrespective of gender. When pupils cognitive domains in geometry are improved the quality of education and national development will be pointing in the right direction.

Recommendations

The following recommendations are made on the basis of the results obtained from the analysis of the data:

1. The role of Activity- Based Learning (ABL) is well acknowledged in the literature for developing higher order thinking skills. As this study is consistent with past findings, it is therefore, recommended that ABT should be adopted at primary level to teach mathematics especially geometry.

2. The study should be replicated in other subjects.

3. The study should be replicated to compare the ABT with other methods of teaching to find out the relative effectiveness of the different methods with ABT.

4. Workshop, seminar and conferences should be organized for primary school mathematics teachers to enhance their knowledge on the new learner centered instructional approaches for teaching mathematics.

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