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IMPACT OF INDIVIDUALIZED ALGEBRAIC BLOCKS STRATEGY ON STUDENTS ALGEBRA RETENTION: A CASE STUDY OF UPPER BASIC STUDENTS IN ABUJA MUNICIPAL AREA COUNCIL

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ABSTRACT

The study investigated the impact of individualized Algebraic blocks strategy on upper basic students' retention in algebra. The population comprised 32,474 upper basic students in public upper basic schools in Abuja. Simple random sampling was used to select 158 students from two different schools. A quasi-experimental design was adopted for the study which was made up of one experimental group and a control group. Algebra Retention Test (ART) was the instrument used for data collection. The instrument was validated by two mathematics educators and one expert in measurement and evaluation for both face and content validation. Kuder Richardson's formula K_{R-21} was used to estimate the reliability of the instrument and the index of ART was found to be 0.79. Mean and Standard deviation were used to answer research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses formulated at 0.05 level of significance. The study revealed that students taught algebra using individualized algebraic blocks strategy retained more than students taught using lecture method. Female students retained algebra concepts better than the male students in individualized algebraic blocks strategy. It was recommended among others, that teachers should adopt individualized algebraic blocks strategies in teaching algebra aspect of mathematics in upper basic schools to enhance students' retention in mathematics.

Keywords: Individualized algebraic; Algebra retention; Abuja; Students

INTRODUCTION

Mathematics can be described as the gate keeper for success in all fields of life. It is a common saying that mathematics is the mother of all subjects. One of the main objectives of Mathematics is to prepare students for practical life. Students can develop their knowledge, skills, logical and analytical thinking while learning Mathematics and all these enhance their curiosity and develop their ability to solve problems in almost or all fields of life. Chianson *et al*., (2010). It is therefore important that any society aiming at advancing technologically like Nigeria should inculcate high level of Mathematics literacy among her populace. The rise of modern science and the desire of most nations for development of egalitarian and technological societies and other desirable aspiration have craved the need for the teaching/learning of Mathematics in schools (Okafor, 2011). Mathematics has many branches which include arithmetic, geometry, calculus, statistics topology, mathematical modeling, algebra etc. Algebra is the branch of Mathematics concerned with

the study of the rules of operations and things which can be constructed from them, including terms, polynomials, equations and algebraic structures. Gambari, Shittu and Taiwo (2013)

The instructional methods and strategies used in the teaching and learning of Mathematics is vital, as these constitute what and how Mathematics could be taught in schools. Instructional strategies adopted by the teacher could influence the affective, psychomotor and cognitive outcome of learner (Mohammed and Mohammed 2010). Many teachers do not use teaching methods and teaching aids that can enhance students' retention. In most of Nigeria classroom, mathematics is hardly related to real life situation even when it is obvious to do so with little or no effort (Iji, Ogbole and Uka, 2014) claim that many teachers use only the teaching method they know even if the method is not relevant to the concept under discussion and this to a great extent has affected the teaching and students learning of algebraic concepts. Ilogu (2010) agrees that students learn in a variety of ways and their ability to assimilate and retain also varies and so when objects that they can manipulate are used, their senses are brought into learning. Students can touch and move objects to make visual representations of mathematical concepts. Cope (2015) research in mathematics instruction reveals that students' mathematics understanding will be more effective if manipulative materials are used. Manipulative materials are concrete models that are appealing to several senses, which can be touched and moved around by students. One example of algebra manipulative includes Algebraic blocks.

Algebraic blocks are concrete mathematical aids which have existed in a variety of forms for some considerable time. It consists of pieces of colored rectangular and square woods or plastics that can be used to represent constants and variables in algebra. According to Ross and Willson, (2012), algebraic concepts according to their nature are abstract and therefore concrete aids are required to assist students in the process of conceptualization. Olkun and Tolkun (2014) observe that algebraic blocks strategy is a practical, learner-centered, minds-on and hands-on innovative method of teaching especially difficult and abstract concepts in mathematics. Algebraic blocks can be used individually in mathematics class to make concrete model of abstract mathematical ideas (Ojo and Ojo 2011). Individualized algebraic blocks strategy is a learning strategy in which each student manipulates the algebra blocks individually to achieve the set goal. Amoo (2011) is of the opinion that students should be given the opportunity of thinking and manipulating objects by themselves rather than the teachers and textbooks doing the thinking for them. Those who have the ability to grasp a particular concept in a short amount of time can move on to the next subject, while those who are having difficulties in understanding the concept can move at a slower pace, in order to delve further into the topic. As such, every learner is given the opportunity to get the most out of the experience, even if he/she is in a class where there are other learners who possess different skill levels or strengths and that have effect on retention ability of the students. Also Baroody (2016) is of the opinion that students should be allowed to manipulate objects by themselves as that is the key idea behind individualized instruction. If that is done the learners will not only understand better the materials that are being presented, but that they will be able to effectively retain information for much longer.

Retention is measured in collaboration with achievement. This means that, closely related to achievement is retention. Devon port and Lane (2010) define retention as ability to keep and remember experiences and things learnt over a period of time. Similarly, Bennett, Kristina and Ross (2011) posit that retention is the preservation of the mind. This implies that the amount of knowledge learnt and kept, skill maintained or problem-solving behaviors manifested consistently reflects what is retained. Thus retention of algebra knowledge is the ability of male and female students to keep and remember as well as recall or reproduce the acquired knowledge or some part of the knowledge after some period of time must have elapsed. Gender can be the fact of being male or female. In Nigeria and perhaps the whole of Africa, gender bias is still very prevalent. Gender roles are somewhat rigid in Africa particularly in Nigeria, where gender differences are recognized in the day to day activities of boys and girls (Eniayeju, 2007). Studies have shown that male and female students' retention of mathematics concepts continues to differ, hence, the need for continuous investigation. Having known that the impact of algebra can be felt in almost all disciplines and bearing in mind that teaching methods affect students' retention in mathematics, this study is therefore set to find out the effects, individualized algebraic blocks strategy could have on upper basic students' retention in algebra.

One of the major problems confronting the development of science and technology in Nigeria and FCT in particular, is the low academic achievement of Mathematics students' in standardized examinations. Many students in secondary school in Nigeria and FCT often experience difficulties in understanding, assimilating, retaining and applying Mathematics concepts in solving practical problems most especially those in algebra. This leads many of the students to score low in external examinations in Mathematics especially in WASSCE, NECO/SSCE and BECE conducted examinations. Since the knowledge of Mathematics particularly algebra is very important to the extent that without it, there can be no meaningful development in science and technology, it is therefore, the duty of the Mathematics teachers in FCT to continuously search for new and relevant teaching and learning strategies that could help their students to learn, achieve and retain better in Mathematics. Learning of Mathematics with understanding is very important because it will help disabuse the perception students have that Mathematics is difficult and abstract as well as enable them to reduce rote memorization to the barest minimum by visualizing and concretizing the abstract mathematical concepts in algebra. Once these impeding factors are contained, students are most likely to understand, achieve and retain concepts in algebra. Therefore, the problem of this study is to find out the effects of individualized algebraic blocks strategy on students' retention in algebra. The study aimed at ascertaining if the use of individualized algebraic blocks strategy to teach algebra enhanced upper basic students' retention in algebra and also to ascertain if the use of individualized algebraic blocks strategy to teach algebra bridged the gap between upper basic male and female students' retention in algebra.

Two research questions were answered in the course of this study which include;

1. What are the mean retention scores of students taught algebra using individualized algebraic blocks strategy and lecture method?
2. What are the mean retention scores of male and female students taught algebra using individualized algebraic blocks strategy?

Two null hypotheses were also tested at 0.05 levels of significance

$H0_1$: There is no significant difference between mean retention scores of students taught algebra using individualized algebraic blocks strategy and lecture method.

$H0_2$: There is no significant difference between the mean retention scores of male and female students taught algebra using individualized algebraic blocks strategy.

MATERIAL AND METHOD

The research design used for this study was a quasi-experimental design non equivalent intact classes were used. Quasi-experimental research design is used when it is not possible to randomize individuals to treatment and control groups.

Population

The population of this study consisted of all co-educational upper basic one schools in Federal Capital Territory Abuja which according to the Universal Education Board is made up of 32,474 students in upper basic schools in Abuja municipal Area council.

Sample and Sampling Procedure

The sample for this study was 158 upper basic students spread across two intact classes. The method of sampling used was simple random sampling. Two schools were randomly picked by lucky dip from the list of all upper basic schools in AMAC. In each school an intact upper basic one students were used for the study. One of the intact classes were assigned by balloting as experimental and taught using individualized algebraic blocks strategy while the other which was the control was taught using lecture method.

Methods of Data Collection

The instrument used in the study for data collection was Algebra Retention Test (ART).

Algebra Retention Test (ART) was used to measure students retention of algebraic concepts taught after some weeks of the experiment. Data collected were analyzed using mean, standard deviation and ANCOVA. The Kunder Richardson's formula K_{R-21} was used to estimate the reliability of the instrument and was found to be 0.79. Post-test was given to the students after the treatment and retention test was given after two weeks of the treatment.

RESULTS AND DISCUSSION

Research question 1: What are the mean retention scores of students taught algebra using individualized algebraic blocks strategy and lecture method?

Table 1:- The mean retention scores and standard deviation in ART of students in individualized algebraic blocks strategy and lecture method.

Teaching Strategy	No of Students	Type of Test	Mean	Standard Deviation
Individualized	76	post-test	51.36	9.48
		Retention	51.14	8.83
Lecture method	82	Post-test	39.28	9.40
		Retention	37.59	9.66

Table 1 shows the mean retention scores and standard deviation in ART of students in individualized algebraic strategy and lecture method. The table reveals that students taught with individualized strategy had mean retention scores of 51.36 and 51.14 in post-test and post post-test with standard deviation of 9.479 in post test and 8.834 in post post-test. The students taught with lecture method had mean retention score of 39.28 and 37.59 with standard deviation of 9.400 and 9.657 in post test and post post-test respectively. The students taught with individualized algebraic strategy had higher than students taught using lecture method. The post test and retention scores were not at much variance implying that the ability to produce a desired result is sustainable.

Research question 2: What are the mean retention scores of male and female students taught algebra using individualized algebraic blocks strategy?

Table 2: mean retention scores and standard deviation in ART of male and female students taught algebra using individualized algebraic blocks strategy.

Group	Gender	No of Students	Type of Test	Mean	Standard Deviation
IAB	Male	37	Post-test	50.81	9.97
			Retention	50.59	8.99
	Female	39	Post-test	51.92	9.06
			Retention	51.68	8.76

Table 2 shows the mean retention scores and standard deviation in ART for male and female students in individualized and group strategies. The male students in individualized strategy had posttest of 50.81 and retention score of 50.59 with standard deviation of 9.97 in posttest and 8.97 in retention while the female students had posttest of 51.92 and 51.68 in retention with standard deviation of 9.06 in posttest and 8.76 in retention. Female students taught using individualized strategy had mean retention scores higher than male students taught using individualized strategy

Hypothesis one: There is no significant difference between mean retention scores of students taught algebra using individualized algebraic blocks strategy and lecture method.

Table 3 ANCOVA result in ART retention scores of students in individualized and lecture method.

Source	Type III sum of squares	df	Mean square	F	Sig	Remark
Corrected Model	18072.948[a]	2	6024.316	123.255	0.000	S
Intercept	4282.250	1	4282.250	87.613	0.000	S
Group	3779.858	1	1889.929	38.667	0.000	S
Posttest	6007.755	1	6007.755	122.916	0.000	S
Error	11241.668	155	48.877			
Total	551876.000	158				
Corrected Total	29314.615	157				

S = Significant at P < 0.05

Table 3 shows the ANCOVA result in ART retention of students in individualized and lecture method. The table reveals that the difference in retention of students taught using individualized and lecture method is significant at 0.05 alpha levels. This is from the fact that F ratio of 38.667 with associated exact probability P = 0.000 is less than the bench mark probability value of 0.05. This indicates that there was significant difference in the mean retention score of students in individualized algebraic blocks strategy and lecture method. The null hypothesis was therefore rejected.

Hypothesis two: There is no significant difference between the mean retention scores of male and female students taught algebra using individualized algebraic blocks strategy.

Table 4: ANCOVA result in ART retention of male and female students in individualized algebraic blocks strategy.

Source	Type III sum of squares	df	Mean square	F	Sig	Remark
Corrected Model	2931.461[a]	2	1465.731	37.635	0.000	S
Intercept	681.743	1	681.743	17.505	0.000	S
GenderIAB	2.153	1	2.153	0.055	0.815	NS
Posttest	2909.840	1	2909.840	74.714	0.000	S
Error	2765.187	74	38.946			
Total	199192.000	76				
Corrected Total	5696.649	73				

S = significant at P < 0.05 Table 4 shows the ANCOVA result of retention of male and female students in group algebraic blocks strategy. The table reveals that the noted difference in retention of male and female students taught using group is not significant at 0.05 alpha levels. This is from the fact that $F_{(1,74)}$ 0.055 and P = 0.815 > α = 0.05. The null hypothesis was therefore not rejected indicating that there is no significant difference between mean retention scores of male and female students taught using individualized algebraic blocks strategy.

Students' achievement in algebra improved using individualized algebraic blocks strategy. The findings from analysis of data collected show a significant difference in post achievement scores of students taught using individualized strategy and lecture method. This finding contradicts that of Ojo

and Ojo (2011) who found that students taught mathematics using cooperative method achieved higher than those taught using individualistic and lecture method.

Students' retention in algebra improved using individualized algebra blocks strategy. The findings from analysis of data collected show a significant difference in retention scores of students taught using individualized algebraic strategy and lecture method. Also the analysis of the data collected reveals that female students in individualized algebra blocks strategy achieved better than the male students. The finding contradicts Mohammed and Mohammed (2010) study which reveals that male and female students taught using games and simulations did not differ significantly both in achievement and in retention. This finding agrees with that of Unamba E.C *et al.,* (2015) found that students taught mathematics using individualized strategy achieved and retained better than those taught using lecture method.

CONCLUSION

The findings of this study have shown that individualized algebra blocks strategy has significant effect on students' retention than lecture method. However this result imply that the learning approach which is mainly conventional employed by mathematics teachers in teaching might have been partly responsible for the persistent under-achievement and low retention of mathematical concepts by students in mathematics. The implications of this findings hinge on the development of better teaching strategies for teaching of mathematics.

In addition to contributing to the current body of literature about the use of algebraic blocks to increase upper basic students' retention in mathematics, the study provided beneficial information to schools considering adopting instructional models that involve hands-on learning and use of manipulative materials in mathematics education.

Based on the findings of this study, the following recommendations were made:

1. Mathematics teachers should adopt the use of individualized algebraic block strategy in teaching algebra aspect of mathematics in order to enhance students' retention in mathematics
2. Mathematics teachers should use blocks as instructional material while teaching some abstract topics like algebra to enhance students' retention in mathematics.

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