Global Scientific JOURNALS

GSJ: Volume 8, Issue 8, August 2020, Online: ISSN 2320-9186

www.globalscientificjournal.com

EFFECTS OF COOPERATIVE AND INDIVIDUALIZED LEARNING STRATEGIES ON STUDENT'S ACADEMIC RETENTION IN MATHEMATICS IN MINNA METROPOLIS, NIGERIA STATE.

Akinlande Lukman Lekan[1], Jacob Emmanuel[2]

Corresponding mail: jacobemma001@gmail.com

ABSTRACT

This study investigated the Effects of Cooperative and Individualized Learning Strategies on Students' Academic Retention in Mathematics in Minna Metropolis, Niger State. The design adopted for the study was a pretest, posttest, post-posttest quasi experimental-control group design. The sample for this study consisted of One hundred and forty seven (147) intact students chosen from three randomly selected senior secondary schools in Minna Metropolis, Niger State. A simple random sampling technique was used to select the three schools and three classes. The three (3) intact classes were assigned to experimental and control groups by balloting. Experimental groups one and two were exposed to cooperative and individualized learning strategies respectively while the control group (group three) was taught same topics with the conventional method. Mathematics Achievement Test (MAT), a 50 – item objective questions was used to collect data for pretest, posttest and post-posttest. A reliability coefficient (r) of 0.86 was obtained using Kuder-Richardson correlation coefficient formula (K-R 21). One research question was raised and one research hypothesis was formulated and tested in this study. The data were analyzed using Analysis of Covariance (ANCOVA). The hypothesis was tested at 0.05 level of significance. The findings of the study revealed that students taught with cooperative learning strategy retained significantly better in mathematics than those taught with conventional method. It was therefore recommended among other things, that mathematics teachers should continuously make effective use of cooperative learning strategy as a new teaching method in teaching mathematics as it guarantees improvement in students' academic retention in mathematics.

KEYWORDS: *Retention, Cooperative Learning, Individualized Learning, Conventional/ Traditional Learning, Analysis of Covariance (ANCOVA).*

INTRODUCTION.

It is evident in the world today that if there is no mathematics there will be no science, if there is no science there will be no technology, and if there is no technology, there will be no modern society. Transitively, therefore, if there is no mathematics, there will be no modern society. But the present modern society in this twenty first century of the third millennium is uniquely characterized by information technology and (thus by extrapolation) mathematics applications in everyday life. Information technology, which has mathematics as its bedrock has permeated different facets of life and makes life easy in the present dispensation. The effect of information technology is felt in almost every aspect of life activities such as industrial activities, educational, business, etc. It is suffices to say that life without the knowledge of mathematics would be very difficult in the later part of the twenty first century. In other words, mathematics is the soul of science and technology and an indispensable single element in modern societal development. It is therefore enough to say that mathematics is the bedrock of technology. For proper understanding of sciences, mathematics plays a major role, hence it is been referred to as the queen of all sciences.

Mathematics is the science of space and numbers –the study of space is called geometry; the study of numbers is called arithmetic while the hybrid of geometry and arithmetic is called algebra. Abdullahi (2004) observed that among the factors contributing to student's low enrolment and performance in physics is poor mathematics ability. Therefore, the importance of mathematics in teaching and learning of science cannot be under estimated. A strong

background in mathematics is crucial for many careers and job opportunities in today's increasing technological society. It is the wheel in which science, technology and economy move. Its importance at any level of educational pursuit makes it compulsory at pre- primary, primary, secondary and tertiary levels of education (FRN, 1998; Adedayo, 2001; Efunbajo, 2001; Amoo, 2002). Among the training mathematics provides are the ability to develop powers of logical thinking, accuracy with figures and spatial awareness. All these are in a bid to vindicate how important or indispensable mathematics is in today's modern world of science and technology. Thus, mathematics was made compulsory in all the Nigerian secondary schools. Despite all these importance attached to mathematics and their crucial roles in technology, various researchers (Adedayo, 2001; Amoo, 2001a; Amoo, 2002) have shown that student's performance in mathematics is nothing to write home about. They remarked that the performance of students nation-wide in the senior secondary certificate examination is below expectation. In Nigeria, some examination bodies were set up to examine students' performance in many subjects, mathematics inclusive. These bodies are: West African Examinations Council (WAEC), National Examinations Council (NECO) and National Business and Technical Education Board (NABTEB). Despite these efforts, mathematics has not secured its rightful position in the mind of students due to lack of interest as a result of this poor teaching strategy. Research works of Kurumeh and Imoke (2008) showed low academic achievement of students in mathematics at all levels; right from the primary school level to the secondary schoollevel. Mathematics has been a threat to students because of problem associated with its instruction. The resultant effect of this problem is that the performances of students become poorer year by year. The academic achievement of secondary school students has been very poor in recent times especially in mathematics. Reports on mathematics education over the years have indicated poor

academic performances and negative attitudes of Nigerian students (Agwagah, 1993; Ezema, 2000). The reports of Chief Examiner, West African Examination Council (WAEC) on General Mathematics (2),(2002, 2004, 2007, 2009 and 2011) revealed that there was no significant improvement in the performance of the candidates. It was observed that some aspects of the syllabus were poorly handled by the candidates. The areas where candidates performed poorly include: Circle theorems, Areas of circle, Sector and Segment of a circle, Trigonometry, Angles of Elevation and Depression, Mensuration, Bearing and Distances and Construction. It was observed that the problem affecting mathematics achievement can be related to teacher's method of presenting the content of the curriculum to students. The trend has been consistent for the past number of years. This is not encouraging and does not augur well for a nation that is determined to advance in its technological development.

Researchers (Adedayo, 2001; Amoo, 2001a, Amoo, 2002) have advanced reasons for this issue of poor performance in mathematics by secondary school students. Teacher characteristic variables such as lack of commitment by the teachers and the teaching methodology that might have affected students when learning mathematics were observed as the major problems associated with under achievement in mathematics. They also opined that the conventional "talk and chalk" method of instruction has failed to produce good results over the years especially in developing countries such as Nigeria. Many scholars and other users of mathematics had one time or the other complained about the decline in teaching and learning of mathematics at the secondary school level. Such complaints among others are: poor teaching of mathematics because of its nature; that is mathematics is seen as most difficult subject to learn (Amoo,2001a). Psychological fear of the subject, large classes contribute to poor performance in mathematics. Another set of problems facing the teaching and learning of mathematics among others include:

Mathematics teachers do not use instructional materials due to lack of instructional materials in schools (Adedayo, 2001; Amoo, 2002). Attempt by teachers wanting to cover so many topics (areas) within short time (Efunbajo, 2001). Besides over-crowded classrooms and students' negative attitude towards mathematics, use of inefficient teaching methods by mathematics teachers is among the many other factors responsible for student's low achievement in mathematics (Betiku & Ochepa, 2004).

Available statistics (Adedayo, 2001, Amoo, 2001a) report that those who teach our students are those who take up teaching simply because there is no other job. They lack both professional and academic competence expected of them which is partly responsible for mass failure we always have annually in secondary schools.

Purpose of the Study

The main purpose of this study was to investigate the effects of cooperative and individualized learning strategies on academic retention in mathematics among senior secondary school students.

Specifically, the study attempted to investigate the retention level of students taught mathematics using cooperative and individualized learning strategies.

Research Question

This research question was raised for the study:

> Do senior secondary school students taught mathematics using Cooperative learning strategy and Individualized learning strategy differ in mean retention scores from those taught with Conventional method?

Research Hypothesis

This hypothesis was formulated and tested in this Research.

Ho: There is no significant difference in the mean retention scores of senior secondary school students taught mathematics using Cooperative learning strategy, Individualized learning strategy and those taught with Conventional method.

Retention

Mathematics concepts are believed to be the concepts that cannot be learnt properly by mere memorization through rote learning. The major problem faced by most students is inability to remember what they have learnt. This problem is often caused by too much theoretical expressions or formulae by the mathematics teachers while learners remain passive listeners (Odili, 2006). Different instructional strategies have relatively differed in effectiveness on students' academic performance and retention. The implication of this is that retention plays an important role for us to correctly and effectively apply whatever we have learnt.

Retention is defined as the act of retaining something or the condition of being retained, or the ability to remember things. Also, relating this to teaching and learning, it means the act of remembering what has been taught in the classroom. Correct and effective use and/or application of whatever one had learnt would aid retention. Retention therefore, is a crucial construct that teachers should maximize among students. Permanent and meaningful learning is the target of our educational endeavour. The more active the learner is in the learning process, the better the retention level of what is taught. Understanding and retention are the products of meaningful learning when teaching is effective and meaningful to the students (Bichi, 2002). Retention means storage of information over some period of time, this time period is called retention

interval (Bichi, 2002). If for some reasons, the subject is unable to produce the response at the end of the retention interval forgetting has occurred. Learning through inquiry activities enhances elaborative thinking and better understanding which lead to more meaningful learning. This has the potential of increasing depth of understanding, the quality of reasoning and the accuracy of long term retention. Eze (2002) states that retention is a crucial construct that most classroom teachers strive to maximize among their students.

Retention has also been the focuses of more than one study in cooperative learning. We are aware of mathematics concepts to be the concepts that cannot be learnt properly by mere memorization through rote learning. The major problem faced by most students is inability to remember what they have learnt. This problem is often caused by too much theoretical expressions or formulae by the mathematics teachers while learners remain passive listeners (Odili, 2006). Different instructional strategies have relatively differed in effectiveness on students' academic performance and retention. The implication of this is that retention plays an important role for us to correctly and effectively apply whatever we have learnt. Correct and effective use and/or application of whatever one had learnt would aid retention. Any instructional model, which is effective in student's conceptual change, can as well help students retain some concepts effectively. The more active the learner is in the leaning process, the better he or she retains what is taught. According to Johnson and Johnson (1990), learning through inquiry activities enhances elaborative thinking and better understanding which lead to more meaningful learning. This has the potential of increasing depth of understanding, the quality of reasoning and the accuracy of long term retention. Obodo (1990) asserts that retention is measured in collaboration with achievement. His study on differential effects of three teaching models on performance of junior secondary school students in some algebraic concepts showed equal

retention. This indicates that each of the models, which were effective in students' achievement in algebra, could as well help the students retain algebraic concepts effectively. Retention of concepts learnt help in reflective thinking and the use of the retained concepts could be used in creative ways to solve novel problem. Akubuilo (2004) reported that any instructional model, which elicits adequate students' participation, has a profound effect on students' retention. Njoku (2004) opined that models concretize and elucidate difficult and abstract concepts thereby reduce students' problems of comprehension and application of concepts in problem solving. In this way models improve retention of knowledge and transfer of learning. In the light of this, Ochonnogor (1997) in Alice (2007) said that retention and achievement in science, technology and mathematics is an important need that is becoming highly felt by the Nigerian populace.

Materials and Methods

This paper focuses on the methods used for this research work. The paper discusses the procedures and strategies applied by the researcher to gather and analyze data in the course of this investigation.

Formulation for the Research Design

Group 1: E_1 ——— O_1 ——— X_1 ——— O_2 ——— O_R

Group 2: E_2 ——— O_1 ——— X_2 ——— O_2 ——— O_R

Group 3: C ——— O_1 ——— X_0 ——— O_2 ——— O_R

Adopted from Kerlinger (1973).

X_0 ——— Conventional method (Control)

X_1 ——— Cooperative learning Strategy

X_2 ——— Individualized learning Strategy

O_1 ——— Pretest

O_2 ——— Posttest

O_R ——— Retention test

E_1 ——— Experimental Group 1

E_2 ——— Experimental Group 2

C ——— Control Group

(O_1, O_2, O_R, represent the same test instrument)

A pretest was administered to both the experimental and control groups. The test was Mathematics Achievement Test (MAT) and was drawn from WASSCE/NECO past question papers. After treatment was administered to the experimental groups, the MAT was later administered to the experimental and control groups as post-test. The experimental groups were exposed to cooperative learning strategy and individualized learning strategy while the control group was exposed to conventional learning method.

Table 1: Summary of ANCOVA for Experimental and Control Groups on Retention

Source of Variation	Sum of Squares	df	Mean Squares	F	Sig.
Covariate (Pretest)	27049.782	1	27049.782	1866.964	.000
Main Effect (Treatment)	7714.442	2	3857.221	266.224	.000
Model	35033.974[a]	3	11677.991	806.010	.000
Error	2071.876	143	14.489		
Total	267372.000	147			

a. R Squared = .944 (Adjusted R Squared = . 943)

Table 1 above shows the summary of ANCOVA for experimental and control groups on retention. The result shows that main effect of treatment groups on retention produced an F (2, 143) = 266.224, p = .000. This result was significant at .05 alpha level. This indicates that there was significant difference in the mean retention scores of senior secondary school students taught mathematics using Cooperative learning strategy, Individualized learning strategy and those taught using Conventional method. Since the ANCOVA indicates that there was significant

difference among the groups. The result was subjected to further analysis to determine where the difference lies using Scheffe Post hoc test.

Table 2: Scheffe Post Hoc Test on Comparison of Mean Scores on Retention

Groups	Mean Scores	Group I (Cooperative)	Group II (Individualized)	Group III (Control)
Group I (Cooperative)	49.57		*0.008	*0.000
Group II (Individualized)	40.20	*0.008		*0.006
Group III (Control)	31.22	* 0.000	* 0.006	

*The mean difference is significant at the 0.05 level.

The result of Scheffe Post hoc test on comparison of mean scores on retention among the three groups in Table 2 above indicates that there was significant difference between the posttest mean retention scores of students taught using Cooperative learning strategy ($\bar{x}$ = 49.57) compared with Individualized learning strategy ($\bar{x}$ = 40.20) and Conventional method ($\bar{x}$ = 31.22). The significant difference is in favor of the Cooperative group followed by the Individualized group over the Conventional group.

Discussion of Results

From the above tables, there is significant difference in the mean retention scores of senior secondary school students taught mathematics with Cooperative learning strategy, Individualized learning strategy and those taught with Conventional method.

The result obtained from this study shows that main effect of treatment groups on retention produced an F (2, 143) = 266.224, p = .000. This result was significant at 0.05 alpha level. This indicates that there was significant difference in the mean retention scores of senior secondary school students taught mathematics using Cooperative learning strategy, Individualized learning strategy and those taught using Conventional method. Scheffe Post hoc test conducted to determine which group was responsible for the observed difference showed that there was significant difference in the posttest mean retention scores of students taught using Cooperative learning strategy ($\bar{x}$ = 49.57) compared with Individualized learning strategy ($\bar{x}$ = 40.20) and Conventional method ($\bar{x}$ = 31.22). The significant difference is in favor of the Cooperative group followed by the Individualized group over the Conventional group.

This finding is in agreement with that of Nichols (2002), which agreed that students in the cooperative treatment group exhibited significantly greater gains in the posttest and retention test in geometry achievement, efficacy, intrinsic valuing of geometry, learning goal orientation and reported uses of deep processing strategies. The finding is also in line with a previous study (Moore, 2005) and provide further proof of the effect of cooperative learning on mathematics concepts retention. The result is also in line with Anyagh (2006) which discovered that ability to remember takes place more effectively when experiences are passed across to the learner via an appropriate instructional method.

However, the findings of this study are inconsistent with the results of the study of AbdulRahim & Al-Shakili (2005) on the impact of cooperative education strategy on academic achievement and retention of information and trends of students which revealed that there was no significant

statistical differences in the academic achievement or retention of information between the two groups of study (cooperative and conventional methods).

Contributions of the Study to Knowledge

The study showed that mathematics concepts will be better understood and retained depending on the learning strategy applied. Therefore, embracing the effective use of cooperative learning strategy in the teaching of mathematics will facilitate:

(i) Mathematics teachers' effectiveness, confidence and efficacy in the classroom during mathematics instruction.

(ii) Mathematics students' ability to learn mathematics concepts better.

(iii) The ability of mathematics students to perform better in mathematics concepts.

(iv) Mathematics students' ability to retain more of the mathematics concepts learnt.

Conclusion

Based on the findings of this study, it was concluded that effective use of cooperative learning strategy significantly enhanced knowledge retention level of students in mathematics. Also, secondary school mathematics teachers should be encouraged to embrace the use of cooperative learning strategies in the teaching of mathematics in our various secondary schools to facilitate students' retention of mathematics concepts.

References

[1] Abdullahi, M.A. (2004). Fostering Physics Education Among Females in Nigeria. Studies in Physics Education. 7, pg 12 – 15.

[2] AbdulRahim, A. Y. & Al-Shakili, B. N. (2005). "The Effectiveness of the Strategy of Collaborative Learning in the Omani Schools." The Educational Magazine, Kuwait, Vol. 19, No. (75), 114-148.

[3] Adedayo, O.A. (2001). The Place of Mathematics in the Nigerian Secondary Schools. Course on Effective Teaching of Mathematics in Secondary Schools. Lagos State Public Service Staff Development Centre, Phase 2, Magodo, Lagos.1– 7.

[4] Adedayo, O.A. (2001). Challenges of Children in Science, Technology and Mathematics: The Role of the 21st Century Woman. *Akoka Journal of Pure and Applied Science Education. A journal of School of Science Education, Federal College of Education (Technical), Akoka.* Vol. 3, No 1, pg 51 – 67.

[5] Agwagah, U.N.V. (1993). Instruction in Mathematics Reading as a Factor in Students' Achievement and Interest in Word Problem – Solving. Unpublished PhD Thesis, University of Nigeria, Nsukka.

[6] Akubuilo, D.U. (2004). The Effects of Problem Solving Instructional Strategies on Students' Achievement and Retention in Biology with Respect to Location in Enugu State. *Journal of Science Teachers Association of Nigeria. 39(1&2),94-100.*

[7] Alice, D.J. (2007). The use of Analogy to Enhance Performance and Retention of Concepts in Evolution among NCE III Biology Students in Niger State. Unpublished M.Sc (Ed) Thesis, Ahmadu Bello University, Zaria, Nigeria.

[8] Amoo, S.A. (2001a). Curriculum Ideals and Realities for Sustainable Educational Development. A Case of Secondary Mathematics Education Curriculum. A Paper Presented at the 14th Annual National Conference of the Curriculum Organisation of Nigeria, held at Universal Basic Education (UBE), NPEC Building, Wuse Zone 4, Abuja, Nigeria between 18th and 21st September, 2001.

[9] Amoo, S.A. (2002). Analysis of Problems Encountered in the Teaching and Learning of Mathematics in Secondary Schools. Abacus, *Journal of the Mathematical Association of Nigeria (MAN)*, Vol. 27, No 1, Sept., 2002.

[10] Anyagh, M.N. & Yasemin, Y.U. (2006). The Effects of Cooperative Learning on the Abilities of Pre-Service Art Teacher Candidates to Lesson Planning in Turkey. *Australian Journal of Teacher Education*, 31(2). Retrieved on 25th February, 2010 from http://www.eric.ed.gov/ERIC WebPortal/Home.Portal.

[11] Bichi, S.S. (2002). Effects of Problem Solving Strategy and Enriched Curriculum on Students Achievement in Evolution Concepts Among Secondary School Students. Unpublished PhD Thesis, Faculty of Education, Ahmadu Bello University, Zaria.

[12] Efunbajo, A.O. (2001). A Systematic Approach of Teaching Difficult Topics in Primary Mathematics under UBE. A Paper Presented at the 1st Annual Conference of Lagos Chapter of the MAN held in Lagos, 7th – 9th August, 2001.

[13] Eze, C.U. (2002). Effects of Target Task Approach on Students' Achievement and Interest in Senior Secondary School Physical Chemistry. Unpublished PhD Thesis, University of Nigeria, Nsukka.

[14] Ezema, P. (2000). Effects of the Keller Instructional Model on Students Error Minimization and Interest in Mathematics. Unpublished M.Ed Thesis. University of Nigeria, Nsukka.

[15] Federal Republic of Nigeria (FRN), (1998). National Policy on Education. Yaba, Lagos. NERDC Press.

[16] Johnson, D.W., & Johnson, R.T. (1990). Social Skills for Successful Group Work. Educational Leadership, 47(4), 29-33.

[17] Kerlinger, F.N. (1973). Foundation of Behavioural Research, London Hott Richard and Wiston.

[18] Kurumeh, M.S. & Imoke, B.I. (2008). Universal Education: A way forward for the Development of Primary School Pupils in Mathematics Education. ABACUS, 33(1), p49-56.

[19] Moore, J. (2005). "Undergraduate Mathematics Achievement in the Emerging Ethnic Engineers Program." *International Journal of Mathematical Education in Science and Technology*, Vol. 36, No. (5), 529-537.

[20] Nichols, J.P. & Miller, R.B. (2002). Cooperative Learning and Students Motivation. Contemporary Educational Psychology, 19, 167-178.

[21] Njoku Z.C. (2004). Effectiveness of Model for Science and Technology Instruction. *Journal of Science Teachers Association of Nigeria* (39), 45-51.

[22] Obodo, G.C. (1990). The Differential Effects of Three Teaching Models on Performance of Junior Secondary School Students in some Algebraic Concepts. Unpublished Thesis, University of Nigeria, Nsukka.

[23] Odili, G.A. (2006). Mathematics in Nigeria Secondary Schools: A Teaching Perspective. Nimo Rex Charles & Patrick Limited, Lagos.

[24] West African Senior School Certificate Examination (WASSCE). (2002; 2004; 2007; 2009, 2011). Chief Examiner's Report.