

Effect of Origami on Students' Retention in Geometry

Dr. C. N. Obi, Prof. U. N. V. Agwagah & Dr. J. J. Agah.

Department of Science Education University of Nigeria, Nsukka Nigeria

Abstract: *This study was designed to determine the effects of Origami instructional approach on JS I students' retention in geometry. Two research questions and three hypotheses were formulated to guide the study. The study adopted a quasi-experimental non-equivalent pretest posttest control group design and was restricted to Nsukka local Government Area of Enugu State. Two Co-educational Secondary Schools were drawn for the study, using simple random sampling technique. Out of the two drawn schools, one was randomly assigned to Origami Group (OG) while the other one to the Control Group (CG). A sample of 101 JS one students was involved (65 female and 36 male). The instrument for data collection was geometry retention test (GRT). Data collected were analyzed using mean, standard deviation and analysis of covariance (ANCOVA). The result of the study revealed that use of Origami in teaching geometry to junior secondary school students enhanced their retention in geometry. The study also revealed that the use of Origami had no statistically differential effect on male and female students' retention. The study also revealed that there was a significant interaction effect between gender and instructional material, on retention of the concepts taught during the study. Based on the findings, the researchers recommended that use of Origami should be adopted in the teaching of geometry (mathematics) in primary, secondary, and tertiary levels of education system. It was also recommended that seminars, workshops and conferences should be mounted by professional bodies, federal and state ministries of education on the use of Origami for mathematics teachers, students and others. This will enable the mathematics educators, serving teachers, students and all to benefit from such an approach.*

Key Words: *Origami, Retention, Geometry and Instructional approach*

I. Introduction

Inability of students to retain what they have learnt, has been pointed out as one of the contributing factors to students' poor achievement in mathematics. Retention is the ability to remember things. Among the attributes of retention that are closely related to success, are the power to recall (i.e., memory) and to recognize (Ogbonna, 2007). Memory is the capacity to retain an impression of the past experiences. Memory, according to Ogbonna (2007), is classified based on duration, nature and retrieval of perceived items. Iji (2003), asserted that man is endowed with limited capacity for memorization and to correctly and effectively use or apply whatever one has learnt, retention must come to play an important role. Researching on retention and achievement in mathematics, Agwagah (1994) investigated the effect of instruction in mathematics reading on pupil's achievement and retention in mathematics. The main purpose of the study was to determine the effect of instruction in mathematics reading on the achievement and retention of rural primary school pupils in addition and subtraction of numbers. Two hypotheses guided the study. The study was a quasi-experimental research. The sample for the study consisted of one hundred and forty-two (142) primary four pupils selected randomly from two rural primary schools (one each from Anambra and Enugu states of Nigeria). The instrument employed for the study was a researcher developed and validated ATASN and lesson plans. Data collected were analyzed using mean scores, standard deviation and ANCOVA.

The result of the study indicated that students who were taught mathematics reading achieved higher and retained more of the content taught. The above reviewed study is similar to the present study in terms of design and method of data analysis. They are also related in the sampling technique. They however differ in scope and sample.

In another study, Iji (2003) explored the effects of logo and basic programs on achievement and retention in geometry of junior secondary school students. The study took place at Ahoada Education zone of River State. The main purpose of the study was to determine the efficacy of the use of logo program method (LPM) and basic program method (BPM) in teaching junior secondary geometry in Nigeria. The design of the study was quasi-experimental in nature and it took a sample of 285 JSS 1 students drawn from three out of six of the Co-educational schools that have computers in Ahoada education zone. Two instruments were used for the study:

- (i) The Geometry Achievement Test (GAT)
- (ii) Geometry Retention Test (GRT)

Data analysis techniques employed for the study were mean, standard deviation and ANCOVA. The result revealed that students taught with LPM and BPM achieved higher than those taught with CPM. Also, the

low achievers improved in the level of their geometry achievement among others. It was recommended among other things that since the methods were relatively new, they should be incorporated in the mathematics curriculum for the pre-service teachers program. This will help them to learn and use the LPM and BPM in their teaching.

The two studies are similar in the sense that both of them are rooted to relatively new approaches. Again, they are similar in terms of design, subjects and content areas. The two are also related in comparing achievement and retention of male and female students. Will the present study produce similar results as in the above reviewed study?

In another study, Ogbonna (2007) explored the effects of two constructivist instructional models on students' achievement and retention in number and numeration. The study was conducted at Umuahia Educational zone of Abia State. The main purpose of the study was to determine empirically the effects of IEPT and TLC constructivist instructional models on junior secondary school students' achievement and retention in mathematics. The design of the study was quasi-experimental and it took a sample of five hundred and seventy 570 JS II students drawn from three (3) out of thirty-six (36) co-educational secondary schools in Umuahia Education zone. Three instruments were used for data collection, namely pre-mathematics achievement test (PREMAT), post mathematics achievement test (POSTMAT) and delayed post-test (DELPOSTEST) or mathematics retention test (MRT). Mean scores, standard deviation and ANOCOVA were employed for data analysis.

The result revealed that the use of IEPT and TLC constructivist instructional models enhanced significantly students' achievement and retention in mathematics. It was recommended among other things that, the two instructional models should be included in the mathematics educational method of teacher training institutions. This might help in no small measures to minimize the mass failure of students being currently experienced all over the nation.

The above reviewed study is similar to the present study in terms of design and method of data analysis. They are also related in comparing achievement and retention of male and female students. However, the two studies differ in terms of subjects and content area. Again while Ogbonna (2007) concentrated on new instructional models, the present study is on a relatively new instructional material.

In summary, it has been observed that most of the reviewed works are mainly on teaching methods. The researchers deem it necessary to explore the effects of this relatively new instructional material (origami) on students' retention. Origami (the art of paper folding), is widely used in developed countries to teach children to think logically and to follow directions. Origami, as an ancient paper art form, activates prior knowledge as well as encompassing hands-on learning, step-by-step instruction, schema building, spatial reasoning and logical concept mapping (Gardner, 1993).

The purpose of this study was to determine the effect of origami on students' retention in geometry.

Research Questions

The following research questions guided the study:

- 1) What is the mean retention scores of students taught geometry using origami?
- 2) What are the mean retention scores of male and female students taught geometry using origami?

Hypotheses

The following null hypotheses were formed to guide the study and were tested at 0.05 level of significance.

H₀₁: There is no significant difference in the mean retention scores of students taught geometry using origami and those taught using the conventional approach.

H₀₂: There is no significant difference in the mean retention scores of male and female students taught geometry using origami.

H₀₃: There is no significant interaction effect of origami and gender as measured by the geometry retention test.

II. Methods

The research design for this study was quasi-experimental. Specifically, the study used a pretest-posttest non-equivalent control group design. The design was considered appropriate for the study because intact classes were used instead of randomly composed samples. This study was carried out in Nsukka education zone of Enugu state, Nigeria. The choice of Nsukka education zone was due to the general poor performance of students in mathematics in external examination all over the nation and Nsukka Education zone is not an exception. The target population was four thousand, six hundred and twenty one (4621) Junior Secondary One (JS-1) students of 2010/2011 academic session in public secondary schools in Nsukka Local Government Area of Enugu State. The JS 1 students were used because they were in the foundation stage of their secondary school contact with the topic, Geometry. The sample size for the study was one hundred and one (101). Purposive sampling technique was employed to sample five (5) co-educational schools out of twenty-three (23) co-

educational secondary schools. The five schools sampled had the highest population (of 180 students and above) and with a minimal difference between the number of male and female students. Geometry Retention test (GRT) was the instrument used for data collection. The reliability coefficient of GRT was found to be 0.82 using kuder-Rechardson 20 formula. The research questions were answered using mean and the standard deviation. The hypotheses were analyzed using the analysis of covariance (ANCOVA) and tested at 0.05 level of significance. The pretest scores served as the covariates. Analysis of covariance (ANCOVA) was used so as to take care of lack of initial equivalence in the groups since intact classes were used for the study.

III. Result

Research Questions 1

What is the mean retention scores of students taught geometry using origami?

Table 1: Mean and standard deviation of retention scores of taught geometry using origami

Groups	N	Posttest		GRT	
		\bar{x}	SD	\bar{x}	SD
Experimental	53	27.96	5.89	27.98	5.19
Control	48	16.70	5.75	14.47	3.74
Mean Difference		11.26		13.51	

From Table 1, it could be observed that, students taught with Origami (experimental group) had a mean retention score of 27.96 in the POST GAT and 27.98 in the GRT. Table 1, also show that students in the control group had a mean score of 16.70 in the POST GAT and 14.47 in the GRT. The difference in mean score of experimental and control group students in the POST GAT is 11.26 in favour of the experimental group. In their GRT, the difference in the mean score is 13.51, also in favour of the experimental group. The implication of the above result is that the student taught geometry with Origami seems to retain what was taught more than the control group.

Research Questions 2

What are the mean retention scores of male and female students taught geometry using origami?

Table 2: Mean Retention scores of male and female students in the Experimental group of (GRT)

Groups	N	Posttest		GRT	
		\bar{x}	SD	\bar{x}	SD
Male	19	26.78	6.45	21.70	6.78
Female	34	28.61	5.75	21.49	8.81
Mean Difference		1.83		0.21	

Table 2 shows the mean retention scores of male and female students in the experimental group. From Table 2, it could be observed that the mean retention score of the male students in the (GRT) is 21.70 while that of their female counterparts is 21.49. The difference in the mean of male and female students in the GRT is 0.21 in favour of the male.

Hypothesis 1

H₀₁: There is no significant difference in the mean retention scores of student taught geometry using Origami and those taught using the conventional approach.

Table 3: Analysis of covariance (ANCOVA) of the control and Experimental group students on geometry Retention Test

Score	Sum of squares	df	Mean	f	Sig
Corrected model	4718.41 ^a	4	1179.60	56.60	0.01
Intercept	2485.75	1	2485.75	123.49	0.00
Pre-test	11.45	1	11.45	0.57	0.45
Group (method)	1724.19	1	1724.19	85.66	0.00*
Sex (gender)	0.64	1	0.64	0.03	0.86**
Group* sex	111.48	1	111.48	5.54	0.02*
Error	1932.42	96	20.13		
Total	53618.00	101			
Corrected total	28.02 6650.83	100			

* = Significant, **= No significant, at .05 level of significance.

The result in Table 3 shows that an F-ratio of 85.66 with associated probability value of 0.00 was obtained. This probability value of 0.00 was compared with 0.05 and it was found to be significant because 0.00 was less than 0.05. The null hypothesis of no significant difference in the mean retention scores of the experimental and control groups was therefore rejected and inference drawn that, the experimental group, significantly retained higher than the control group in geometry contents taught.

Hypothesis 2

H₀₂: There is no significant difference in the mean retention scores of male and female students taught geometry using Origami.

From Table 3 it is observed that the probability value of 0.86 was obtained for $F=0.03$ on mean retention scores of male and female students of the experimental group. This associated probability value of 0.86 was compared with already set alpha level of 0.05. 0.86 was greater than the already set alpha value of 0.05 level of significance. The implication of this is that the null hypothesis of no significant difference in the mean retention scores of male and female students was accepted. This means that the mean retention scores of male and female students in GRT is not statistically significant.

Hypothesis 3

H₀₃: There is no significant interaction effect of Origami and gender as measured by geometry retention test.

Table 3 also shows that the probability value of 0.02 was obtained for $F=5.54$ on interaction effect of Origami and gender as measured by geometry retention test. This associated probability value of 0.02 was compared with already set alpha level of 0.05. 0.02 was less than the already set alpha value of 0.05 level of significance. the null hypothesis of no significant interaction between method and gender is therefore rejected. This implies that there is a significant interaction effect of Origami and gender as measured by geometry retention test.

IV. Discussion

One of the findings in this study revealed that the students in the experimental group obtained higher mean POST GAT scores than those in the control group. This shows that the experimental group retained more of the geometry content taught than the control group. This was further confirmed by the ANCOVA results which shows that the experimental group significantly retained higher than the control group in the geometry concepts taught. The findings of this study is in accordance with those of Iji (2003), Ogbonna (2007), and Eze (2008) who confirmed that the use of new practical approaches enhance students retention. The results of this study have shown that, the use of origami in teaching geometry will help students to retain the things they have learnt and in turn improve achievement in mathematics.

It was also found that the mean retention scores of male and female students in the experimental group differ slightly. The difference in the mean of male and female students in the GRT was in favour of the male. However, the mean retention scores of male and female students in GRT was not statistically significant. This finding negates that of Kurumeh and Iji (2009); Ekwueme (1998); Ezeugo (1999); Odugwu (2002); Orji (2002); Usman (1996) and many others who separately found that, there were significant differences in mean achievement of male and female students in favour of males. The finding also contradicts that of Meremikwu (2002) who found among other things that the mathematics achievement of girls in Single Sex School was significantly better than male counterpart in Single Sex School. The gender gap identified by the authors who found significant differences in mean achievement of male and female students in favour of males can be bridged by the use of origami in teaching Geometry.

Finally, the findings on interaction effect of Origami and gender as measured by geometry retention test shows that the use of origami and gender in teaching, affect students' retention in the understanding of geometrical contents. This findings is at variance with that of Ezema (2002), who found that there was no significant interaction effect between gender and instructional method on students' achievement and interest in quadratic equation. It also differs from that of Ogbonna (2004) whose study also showed that there was no significant interaction effect between gender and instructional approach on students' interest in mathematics. The result of this finding is in compliance with Iji (2003) who found a significant interaction effect of instructional material and gender on students' retention. The implication of this finding is that instructional material enhances retention, which in turn aids achievement.

V. Conclusion

Based on the result obtained, the researchers draw the following conclusion. The use of Origami as instructional approach significantly enhances students' retention in geometry when compared to her conventional instructional approach. Similarly, use of origami proved superior to the conventional instruction in promoting similar students' retention in geometry concepts taught during the study.

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