EFFECT OF ELECTRONIC TABLET AS AN INSTRUCTIONAL TOOL ON SECONDARY SCHOOL STUDENTS' RETENTION IN MATHEMATICS IN OSUN STATE, NIGERIA

Dr. Onoge Honmane

Department of Science Education, Federal University Wukari, Taraba State, Nigeria

AUDU Hauwa

Department of Primary Education, School of Early Childhood Care, Primary Education, Adult and Non- Formal Education, Federal College of Education Katsina, Federal College of Education Katsina

OLAOYE Abiodun Emmanuel

Department of Curriculum Studies, School of Education, Federal College of Education Katsina

Abstract

The purpose of this study was to determine the effect of Electronic Tablet as an Instructional Tool (ETIT) on students' geometry retention at senior secondary school one. The research was carried out in Osun west education district of Osun State with a population of 12,431 senior secondary one students. 168 students were sampled from four schools out of 68 government owned senior secondary schools. Quasi-experimental design of nonrandomizedpre-test post-test control group design was adopted. The research instrument was GeometryRetention Test (GRT) which was used for collection of data. The GRT was validated by experts and this gavea reliability index of 0.68. Three research questions were asked and answered using means and standarddeviations. The three hypotheses formulated were tested at 0.05 level of significance using Analysis ofCovariance. The study found among others that the students taught using Electronic Tablet as an Instructional Tool improved intheir geometry than those taught without Electronic Tablet as an Instructional Tool. It was therefore, recommended that Electronic Tablet should be incorporated among instructional materials for teaching mathematics.

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1. Introduction

The development of any nation is dependent on its improved mathematics education programme which establishes basis for the technological advancement. Mathematics was further expressed as the prime instrument for understanding and exploring the scientific, technological, economic, social and information world (Zakariyya, 2014). Importance and contributions of Mathematics to the modern culture of science and technology was further acknowledged, and then asserted that without Mathematics there is no science, without science there is no modern technology and without modern technology there is no modern society (Imoko and Isa, 2015. Despite the importance attached to mathematics as key subject in realizing any nation's scientific and technological aspiration, it has experienced a flood of persistent high failure (Onah, 2015). This may be due to lack of innovative pedagogical strategy that will enable teachers meet the challenges of teaching of the subject especially in this era of information age.

The focus of this study is on geometry. This is because the West African Examination Council (WAEC, 2016) Chief Examiner reported that candidates were observed to be generally weak in geometry. Geometry is a branch of mathematics of Egyptian origin (Euclid, 300 BC). Geometry is a science of space, involving, describing and measuring figures theory of ideas and methods by which one can construct and study idealized model of the physical world as well as other real world phenomenon (Iji, Ogbole & Uka, 2014). In as much as efforts are being made to enhance students' achievement in mathematics, it is equally important to consider students' ability to retain what they have learnt. Retention means recalling pieces of knowledge, processes and skills that were learned earlier in time. The existence of academic institutions is based in large part, on the belief that students remember what they learn (Giginna, 2013). Ezeh (2009) argues that knowledge retention is related to the way the concept is taught to the learners and the teacher's method of teaching may be responsible to guide students in the process of learning. Students' low retention in mathematics may be due to non-utilization of interactive materials in the classroom (Ifamuyiwa & Ajilogba, 2012).

Tablet can be defined as small, wireless, mobile personal computers which have finger-driven touch screens and are backed-up by diverse applications in a well-provisioned application marketplace (Falloon, 2013). Instructional Tool can be referred as devices, which help the teacher to make a lesson much clearer to the learner (Isola, 2010). Tablet as an Instructional Tool is a teaching process in which an instructor uses a tablet as a medium of disseminating and receiving information from his/her students. Tablets have fantastic applications that can be used for drawing, writing, and animation during a presentation. Students can circle, highlight, or write in points as they present their latest research or findings. When they are done, the presentation is saved and can be emailed to the teacher for grading. Textbooks are expensive, they are also hard on the environment and inefficient when the information is outdated, an entire new version must be released. Tablet e-book solves this problem. Students can highlight and bookmark easily the major points on their e-book, they can even be inspired to create their own e-book through Tablet. If Games in the Tablet are used by the students with moderation, this can boost creativity and imagination of the students (**Julie**, 2017).

Gender of learners is one of the factors that affect students' academic achievement. Over some decades there has been evidence of growing gender gap in educational achievement in many countries. Gender bias in education is responsible for the inequality in opportunity, access, enrollment, curriculum, subject disciplines and several others (Gibb, Fergusson & Horwood, 2012). Review of studies show inconsistence on results of male and female students' achievement in mathematics public examination and in Mathematics achievement tests. Reports from studies of Anyamene, Nwokolo, Anyachebelu and Anemelu (2012); Gambari, Falode and Adegbenro (2014); Malik and Salman (2016), all show no significant differences among male and female students in Mathematics achievement tests. However, Ogbonna (2007), and Akpan (2017) indicates that there is significant difference among male and female students in mathematics achievement tests. Specifically, most of the studies did not examine the retention of male and female students in geometry but rather, Mathematics in general. Since the Tablet has been recognized as a machine that does not recognize gender, but only keeps to instruction, it was necessary to find out if Tablet as an Instructional Tool when used in teaching geometry would lead to bridging of gap in gender retention in Geometry.

1.3 Purpose of the Study

The purpose of this study was to determine the effectiveness of Electronic Tablet as an Instructional Tool (ETIT) in mathematics classroom. Specifically it determined whether the use of Electronic Tablet as an Instructional Tool (ETIT);

1. increased senior secondary school students' retention in geometry.

2. help to resolve the controversy of the inconsistency in researchers' report in retention in geometry of male and female senior secondary school students.

3. had interaction effect of ETIT and male and female on senior secondary school students' retention in geometry.

1.4 Research Questions

The following research questions were asked to provide guide for the study.

1. What are the mean retention scores of SS1 students taught geometry with (ETIT) and those taught without Electronic Tablet as an Instructional Tool?

2. What are the mean retention scores of male and female SS1 students taught geometry with Electronic Tablet as an Instructional Tool?

3. What is the interaction effect of ETIT and male and female on SS1 students' mean retention scores in geometry?

1.5 Statement of Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance.

1. There is no significant difference between the mean retention scores of SS1 students taught geometry with (ETIT) and those taught without Electronic Tablet as an Instructional Tool.

2. There is no significant difference between the mean retention scores of male and female SS1 students taught geometry with Electronic Tablet as an Instructional Tool.

3. There is no significant interaction effect of ETIT and male and female on SS1 students' mean retention scores in geometry.

Methodology

The research design for this study was quasi-experimental. Precisely, the study used a non-randomized pre-test post-test control group design. The subjects of the study were not randomized into experimental and control groups but were left as intact classes. This was to avoid the disruption of the school programmes. However, the study was conducted in Osun West Education District of Osun State, Nigeria. The population of this study was 12,431 Senior Secondary School one (SS 1) students from sixty eight government Secondary Schools in the study area. Simple random sampling was used to select four schools from 68 senior secondary schools. The choice of senior secondary one was purposive. This was basically because it is at this level that vigorous academic work begins in preparation for both internal and public mathematics examinations. The sample size for this study was 164 students. This was made of 84 students for the experimental group and 80 students for the control group. The choice of which schools and classes to be used as experimental and control was done through simple random sampling with the use of flip of a coin. The Instrument of the study was Geometry Retention Test (GRT). It consisted of 32 items made up of 12 lower order questions and 20 higher order questions. These items were developed in line with the instructional objectives as contained in the senior secondary one text book by the Mathematics Association of Nigeria (2012). GRT covered all the units taught during the period of this study. The Geometry Retention Test (GRT) was a reshuffled post-Geometry Achievement Test that was conducted two weeks after its administration (Bacon & Stewart, 2006). It was validated by two mathematics teachers, two mathematics educators and one measurement and evaluation experts. It has a reliability index of 0.68, established using

Kuder-Richardson (KR-20) formula. The study lasted for four weeks. Data collected and collated were analyzed using mean, standard deviations and Analysis of Covariance (ANCOVA). The choice of ANCOVA for the test of hypotheses was based on it statistically removes the initial differences across the non randomized group by variation due to extraneous variable, thereby increasing the precision of the experiment.

Results

The results were presented and analyzed based on the research questions asked and hypotheses formulated for the study.

Research Question 1

What are the mean retention scores of SS1 students taught geometry with (ETIT) and those taught without Electronic Tablet as an Instructional Tool? Answer to this research question is presented in Table 1.

TABLE 1: MEAN AND STANDARD DEVIATION OF RETENTION SCORES OF SS1 STUDENTS TAUGHT GEOMETRY WITH ETIT AND THOSE TAUGHT WITHOUT ETIT

Group	N	Post-test Mean	SD	Retn-test Mean	SD
With ETIT	84	20.05	5.45	16.50	4.12
Without ETIT	80	16.01	5.36	13.28	2.84
Mean difference		**4.04**		**3.22**	
Total	164				

Table 1 shows that for post-test, the ETIT had a mean score of 20.05 while the control had a mean score of 16.01. Their mean difference is 4.04. For retn-test scores, the ETIT has a mean score of 16.50 while the control group had a mean score of 13.28. Their mean difference is 3.22.

Research Question 2

What are the mean retention scores of male and female SS1 students taught geometry with Electronic Tablet as an Instructional Tool? Answer to this research question is presented in Table 2.

TABLE 2: MEAN AND STANDARD DEVIATION OF RETENTION SCORES OF MALE AND FEMALE SS1 STUDENTS TAUGHT GEOMETRY USING ETIT

Gender	N	Post-test Mean	SD	Retn-test Mean	SD
Male	43	21.26	5.98	16.33	4.49
Female	41	18.78	4.59	16.68	3.74
Mean difference		**2.48**		**0.35**	
Total	84				

Table 2 shows that for post-test, the male had a mean score of 21.26 while the female had a mean score of 18.78. Their mean difference is 2.48. For retn-test scores, the male has a mean score of 16.33 while the female group had a mean score of 16.68. Their mean difference is 0.35.

Research Question 3

What is the interaction effect of ETIT and male and female on SS1 students' mean retention scores in geometry? Answer to this research question is presented in Table 3.

TABLE 3: THE INTERACTION EFFECT OF ETIT AND MALE AND FEMALE ON SS1 STUDENTS' MEAN RETENTION SCORES IN GEOMETRY

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	9.970[a]	2	4.985	.289	.750	.007
Intercept	1687.143	1	1687.143	97.681	.000	.547
Pretest Achiev	7.290	1	7.290	.422	.518	.005
Groups	730.978	1	730.978	59.646	.000	.270
Groups*Gender	**1.670**	**1**	**1.670**	**.097**	**.757**	**.001**
Error	1399.030	81	17.272			
Total	24278.000	84				
Corrected Total	1409.000	83				

a. R Squared = .007 (Adjusted R Squared = -.017)

The interaction effect of ETIT and male and female on SS1 students' mean retention scores is read from Table 3 across the row heading **Groups*Gender** and column heading **Partial Eta Square** (Groups*Gender: Partial Eta Square = .001). F = .097, df = 1 and Partial Eta = .001. The calculated percentage of interaction effect of ETIT and male and female on SS1 students' mean retention scores (.001 × 100 = .1%) is .1%.

Research Hypothesis 1

There is no significant difference between the mean retention scores of SS1 students taught geometry with (ETIT) and those taught without Electronic Tablet as an Instructional Tool. The test result of this hypothesis is presented in Table 4.

TABLE 4: ANCOVA RESULT OF RETENTION SCORES OF SS1 STUDENTS TAUGHT GEOMETRY WITH ETIT AND THOSE TAUGHT WITHOUT ELECTRONIC TABLET AS AN INSTRUCTIONAL TOOL

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	759.300[a]	2	379.650	30.979	.000	.278
Intercept	2943.905	1	2943.905	240.216	.000	.599
PRETEST	27.860	1	27.860	2.273	.134	.014
GROUPS	**730.978**	**1**	**730.978**	**59.646**	**.000**	**.270**
Error	1973.090	161	12.255			
Total	36924.000	164				
Corrected Total	2732.390	163				

a. R Squared = .278 (Adjusted R Squared = .269)

Table 4 shows that P- value of 0.00 was less than the significance level of 0.05. Since the p-value of 0.00 is less than the significance level of 0.05, the null hypothesis of no significant difference was rejected. This means that there is a significant difference between the mean retention scores of SS1 students taught geometry with (ETIT) and those taught without Electronic Tablet as an Instructional Tool.

Research Hypothesis 2

There is no significant difference between the mean retention scores of male and female SS1 students taught geometry with Electronic Tablet as an Instructional Tool. The result of this hypothesis is presented in Table 5.

TABLE 5: ANCOVA RESULT OF RETENTION SCORES OF MALE AND FEMALE SS1 STUDENTS TAUGHT GEOMETRY WITH ELECTRONIC TABLET AS AN INSTRUCTIONAL TOOL

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	9.970[a]	2	4.985	.289	.750	.007
Intercept	1687.143	1	1687.143	97.681	.000	.547
PretestAchiev	7.290	1	7.290	.422	.518	.005
Groups	730.978	1	730.978	59.646	.000	.270
Groups*Gender	**1.670**	**1**	**1.670**	**.097**	**.757**	**.001**
Error	1399.030	81	17.272			
Total	24278.000	84				
Corrected Total	1409.000	83				

a. R Squared = .007 (Adjusted R Squared = -.017)

Table 5 reveals that the P-value of 0.76 was greater than the significance level of 0.05. Since the p-value of 0.76 is greater than the significance level of 0.05, the null hypothesis of no significant difference was not rejected. This means that there is no significant difference between the mean retention scores of male and female SS1 students taught geometry with Electronic Tablet as an Instructional Tool.

Research Hypothesis 3

There is no significant interaction effect of ETIT and male and female on SS1 students' mean retention scores in geometry. The result of this hypothesis is presented in Table 6.

TABLE 6: ANCOVA RESULT OF INTERACTION EFFECT OF ETIT AND MALE AND FEMALE ON SS1 STUDENTS' MEAN RETENTION SCORES IN GEOMETRY

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	9.970[a]	2	4.985	.289	.750	.007
Intercept	1687.143	1	1687.143	97.681	.000	.547
PretestAchiev	7.290	1	7.290	.422	.518	.005
Groups	730.978	1	730.978	59.646	.000	.270
Groups*Gender	**1.670**	**1**	**1.670**	**.097**	**.757**	**.001**
Error	1399.030	81	17.272			
Total	24278.000	84				
Corrected Total	1409.000	83				

a. R Squared = .007 (Adjusted R Squared = -.017)

Table 6 reveals that the P-value of 0.76 was greater than the significance level of 0.05. Since the p-value of 0.76 is greater than the significance level of 0.05, the null hypothesis of no significant difference was not rejected. This means that there is no significant interaction effect of ETIT and male and female on SS1 students' mean retention scores in geometry. Also, the ETIT interaction effect size on male and female SS1 students' mean retention scores in geometry is small (0.01).

Summary of Findings

The following major findings were based on the data presented in this study:

1. Students taught geometry with ETIT improved in their retention scores during the period of this study more than those taught without ETIT.

2. The adoption of ETIT in the Mathematics classroom enhanced male and female SS1 students' retention in the geometry taught during the period of this study.

3. There was no significant statistical interaction effect with the use of ETIT in the Mathematics classroom on male and female SS1 students' retention scores in geometry.

4.4 Discussion of Findings

The findings showed that students taught geometry with ETIT improved in their retention during the period of this study more than those taught without ETIT. The reason for the better retention of students taught with electronic tablet than those taught without electronic tablet as an instructional tool may have been due to application of learner interaction with tablet. This finding is in line with that of Eze (2009) and Safo, Ezenwa and Wushishi, (2013) whose also found that students that were taught using computer as tutor and as tool, and computer-assisted package had a higher mean retention than those taught with traditional strategy.

The findings also revealed that the adoption of ETIT in the Mathematics classroom enhanced male and female SS1 students' retention in the geometry taught during the period of this study. Again the findings found that both sexes improved their retention in geometry with electronic tablet as an instructional tool, though the female improved more than their male counterparts. However, this difference was not statistically significant. The result confirms the finding of Gambari, Falode and Adegbenro (2014), who found no significant difference in the mean retention scores of male and female students using computer animation and geometry instructional model. This implies that if male and female students are exposed to innovative instructional tools such as electronic tablet as an instructional tool, the gender differences especially in mathematics retention may be things of the past.

The findings also showed that there was no significant statistical interaction effect with the use of ETIT in the Mathematics classroom on male and female SS1 students' mean retention scores in geometry. Though female students retained more than their male counterpart. This result agrees with Eze (2009) who indicated that female student retained more than their male counterpart in Quadratic Equation.

Recommendations

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

1. Electronic Tablet should be incorporated among instructional materials for teaching mathematics.

2. Proprietors of schools should endeavour to purchase Electronic Tablets for their students in the schools.

Conclusions

It could be concluded from this study that electronic tablet as an instructional tool enhanced students' retention in Geometry irrespective of gender. This implies that if mathematics teachers use innovative instructional tools such as electronic tablet which is found to have enhanced students' retention, the issue of low achievement in mathematics at the senior secondary school level may become a thing of the past. Similarly, the gender gap created by continued use of unfavorable instructional tool in geometry could also be bridged with electronic tablet as an instructional tool.

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