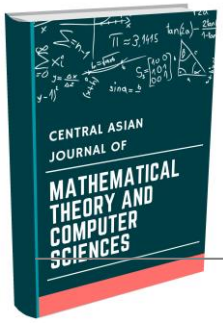

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EFFECTS OF GEOMETRY INTERACTIVE SOFTWARE ON SECONDARY SCHOOL STUDENTS' INTEREST IN GEOMETRY IN WUKARI LOCAL GOVERNMENT AREA, TARABA STATE, NIGERIA

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Abstract

The purpose of this study was to use Geometry Interactive software (GIS) to ascertain students' geometry interest at senior secondary school one (SS1). Quasi-experimental design of non-randomized pre-test post-test control group design was utilized. The research was carried out in Wukari Local Government Area of Taraba State with a population of 1,003 senior secondary one students. From this, 68 students were sampled from two schools out of nine governments owned senior secondary schools. The research instrument was Geometry Interest Inventory (GII). The reliability of the instruments was 0.72. Four research questions were asked and answered with means and standard deviations while the four hypotheses formulated were tested using Analysis of Covariance (ANCOVA) at 0.05 level of significance. The study found among others that students taught using Geometry Interactive Software (GIS) improved in their interest in geometry more than those taught geometry using conventional strategy. Recommendations such as incorporating Interactive Software (IS) among instructional strategies for teaching mathematical concepts as well as encouraging Proprietors of schools to purchase interactive software for their students in the schools were made among others.

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I. INTRODUCTION

The development of any nation is dependent on its improved mathematics education which establishes basis for the technological advancement. Also, science is the bedrock that provides the spring board for the growth of technology, which mathematics is the gate and key to the science (Abakpa, Anyor & Olaifa, 2017). The 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 & Isa, 2015). Mathematics was further expressed as the prime instrument for understanding and exploring the scientific, technological, economic, and social and information world (Zakariyya, 2014). Mathematics is an important subject because it is the basis for scientific, industrial and technological advancement of any country. It is associated with more academic and career opportunities (Iji , Honmane & Omenka, 2016). 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.

From the National Curriculum for senior secondary schools, Ramatu (2014), observed that, mathematics is divided into five sections which include: Number and Numeration; Algebraic processes; geometry, statistics and probability. 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. 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). Geometry can be used in solving problems not only in other areas of mathematics but also in sciences, arts and daily life (AktaĢ & Cansız-AktaĢ, 2012).

Geometry is one aspect of mathematics that is mostly dreaded by the students (Osman, Erhan, Ramazan & Adem, 2015). According to WAEC Chief Examiner's report (2016), Geometry is among the areas students avoid attempting questions on while those who dare it perform poorly. Anyamene, Nwokolo, Anyachebelu and Anemelu **(**2012), observed that students have problems on how to study mathematics. These problems emanate as a result of problems facing the effective teaching and learning of mathematics at all levels of Nigerian educational institutions. Azuka (2013), identified poor teaching methods and lack of knowledge of technological innovations by the mathematics teachers, as the major factors contributing to the low achievement of students in Mathematics. There is an ample evidence of continued low interest in the subject by Nigerian students (Iji, Ogbole & Uka, 2014).

According to Giginna (2013), interest is the degree of likeness an individual has for something such as activity, person or situation It concerns the individual's preference for a particular type of ability. Bulunuz and Jarret (2009) stated that, there is connection between interest and effort. In other words, the more a person is interested in a subject, the more effort he will put into it. They further described an interested person as being engaged, engrossed or entirely taken up by an activity because of its recognized worth. Bulunuz and Jarret concluded that in many learning tasks in school the process and outcome are separated which results in "divided interest" and the students cannot connect executing a task with its outcome. Interest facilitates learning, improves understanding and stimulates effort and personal involvement. Interest is a strong factor in the teaching and learning of mathematics (Iyekekpolor, 2012). If a child is interested in a subject, he would continue to study the subject even when he is hungry and other children are inviting him to play. The degree and the direction of attitude towards mathematics are largely determined by the kind of interest developed by students for Mathematics. Available studies have shown that students generally have weak interest toward mathematics (Ogochukwu, 2010). Hence, this study equally aims at finding out if the interest of the students can be improved via the utilization of Geometry Interactive Software.

According to Blackwell, (2014) technology has been seen as a potential solution to increase educational attainment. The use of technology will help students to have a change of attitude in learning mathematics. Today, teachers, textbooks, chalkboards and traditional facilities are no longer adequate to cope with the amount and type of skills and competences expected of students, teachers need resources that can assist them to carry out their duties efficiently (Anyamene, Nwokolo, Anyachebelu & Anemelu, 2012). The teaching methods over the years have revealed that there have been changes from one position to another, many efforts have been made to improve the teaching methods through the use of instructional material such as Interactive software (Onah, 2015).

Software per se refers to a set of instructions or programs instructing a computer to do specific task. Interactive software in the order word refers to software which accepts input from human as it runs (Merriam Webster, 2013). Software or interactive software, that can be used in teaching can be presented in form of Multimedia aided instruction. By Multimedia instruction we mean computer-mediated information that is presented concurrently in more than one medium (Adegoke, 2011). In the words of Onah (2015), the advantages of this computer software in teaching and learning is enormous. This includes the storage of large amount of information, giving immediate feedback to individual learner, presenting the learner with printed and animated diagrams; to mention but a few. Students enjoy attending classes that utilize Multimedia presentation because they find these classes to be more interesting and exciting (Kenyon, 2002). This enables greater collaboration without consideration for gender differences. Since the Geometry Interactive Software has been recognized as software that does not recognize gender, but only keeps to instruction, it was necessary to find out if Geometry Interactive Software when used in teaching geometry would lead to bridging of gap between boys and girls in their interest in geometry.

II. PURPOSE OF THE STUDY

The purpose of this study was to determine the effectiveness of Geometry Interactive Software (GIS) in mathematics classroom. Specifically the study was to:

1. Determine effect of Geometry Interactive Software (GIS) on Secondary School Students' interest in geometry.

2. Determine the extent to which the use of Geometry Interactive Software (GIS) can influence interest among female Students in geometry.

3. Determine the extent to which the use of Geometry Interactive Software (GIS) can influence interest among male Students in geometry.

4. Determine whether there is a difference in the use of Geometry Interactive Software (GIS) in interest in Geometry among male and female gender of secondary school students.

III. RESEARCH QUESTIONS

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

1. What is the difference in the mean interest rating of SS1 students taught geometry with Geometry Interactive Software (GIS) and those taught using conventional strategy?

2. What is the difference in the interest rating among female SS1 students taught geometry with Geometry Interactive Software (GIS) and those taught geometry using conventional strategy?

3. What is the difference in the mean interest rating among male SS1 students taught geometry with Geometry Interactive Software (GIS) and those taught geometry using conventional strategy?

4. What is the difference in the mean interest rating of male and female SS1 students taught geometry with Geometry Interactive Software (GIS)?

IV. RESEARCH HYPOTHESES

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

1. There is no significant difference between the mean interest scores of SS1 students taught geometry with Geometry Interactive Software (GIS) and those taught geometry using conventional strategy.

2. There is no significant difference in the mean interest rating of female SS1 students taught geometry with Geometry Interactive Software (GIS) and those taught geometry using conventional strategy.

3. There is no significant difference in the mean interest rating of male SS1 students taught geometry with Geometry Interactive Software (GIS) and those taught geometry using conventional strategy.

4. There is no significant difference in the mean interest rating of male and female SS1 students that are taught geometry with Geometry Interactive Software (GIS).

V. METHODOLOGY

The research design for this study was quasi-experimental of non-equivalent group. 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 Wukari Local Government Area in the southern senatorial district of Taraba State, Nigeria. The population of this study was 1,003, SS 1 students made of 517 male and 486 female of students in nine government Secondary Schools in Wukari Local Government Area of Taraba State. Simple random sampling was used to select two schools for the study. Simple random sampling (flip of a coin) was used to assign experimental and control groups, one for each of them respectively. 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 68 students, because intact class that was used for experimental group has 36 students and intact class that was used for control group has 32 students. The Instrument of the study was Geometry Interest Inventory (GII).

The Geometry Interest Inventory (GII) was a researcher structured 24 item questionnaires that had been constructed by the researcher to determine the interest and feeling of students about geometry. The items were designed on the basis of a four-point scale. The four-point scale ranges from strongly agree, agree, disagree and strongly disagree. These items contain both positive and negative statements of feelings and interest from the students' point of view.

It was validated by two mathematics teachers, two mathematics educators and one measurement and evaluation experts. It has a reliability index of 0.72, established using Cronbach Alpha reliability coefficient. The study lasted for four weeks. Data collected and collated were analyzed using mean, standard deviations and Analysis of Covariance (ANCOVA) at 0.05 level of significance.

VI. RESULTS

The results from analysis of data for this study are presented according to the research questions asked and hypotheses formulated.

Research Question 1

What is the difference in the mean interest rating of SS1 students taught geometry with Geometry Interactive Software (GIS) and those taught Geometry using conventional strategy? Answer to this research question is presented in Table 1.

Table 1: Mean and Standard Deviation of Interest rating of SS1 Students Taught geometry with (GIS) and those Taught using conventional strategy

Group	N	Pre-GII Mean	SD	Post-GII Mean	Mean SD Gain
With GIS	36	41.33	9.734	58.36	5.958 17.03
Conventional	32	44.75	9.890	49.63	8.091 4.88
Mean difference		**3. 42**		**8.73**	**5.31**
Total	68				

Table 1 shows that for pre-test, the GIS had a mean score of 41.33 while the control group had a mean score of 44.75. Their mean difference is 3.42. For post-test scores, the GIS had a mean score of 58.36 while the control group had a mean score of 49.63. Their mean difference is 8.73.

Research Question 2

What is the difference in the mean interest rating among female SS1 students taught geometry with Geometry Interactive Software (GIS) and those taught Geometry using conventional strategy? Answer to this research question is presented in Table 2.

Table 2: Mean and Standard Deviation of Interest rating of SS1 Female Students Taught Geometry with (GIS) and those Taught geometry using conventional strategy

Group	N	Pre-GII Mean	SD	Post-GII Mean	Mean SD Gain
With GIS	15	37.71	11.17	63.00	1.84 25.29
Conventional	14	43.00	10.43	48.00	8.57 5.00
Mean difference		**5.29**		**15.00**	**9.71**
Total	29				

Table 2 shows that for pre-test, the GIS had a mean score of 37.71 while the control group had a mean score of 43.00. Their mean difference is 5.29. For post-test, the GIS had a mean score of 63.00 while the control group had a mean score of 48.00. Their mean difference is 15.00.

Research Question 3

What is the difference in the mean interest rating among male SS1 students taught geometry with Geometry Interactive Software (GIS) and those taught Geometry using conventional strategy? Answer to this research question is presented in Table 3

Table 3: Mean and Standard Deviation of Interest scores of SS1 Male Students Taught Geometry with (IS) and Those Taught Geometry using conventional strategy

Group	N	Pre-GII Mean	SD	Post-GII Mean	Mean SD Gain
With GIS	15	43.90	8.25	55.52	5.91 11.62
Conventional	14	46.11	9.52	50.89	7.71 4.78
Mean difference		**2.21**		**4.63**	**2.42**
Total	29				

Table 3 shows that for pre-test, the GIS had a mean score of 43.90 while the control group had a mean score of 46.11. Their mean difference is 2.21. For post-test scores, the GIS had a mean score of 55.52 while the control group had a mean score of 50.89. Their mean difference is 4.63.

Research Question 4

What is the difference in the mean interest rating of male and female SS1 students taught geometry with Geometry Interactive Software? Answer to this research question is presented in Table 4.

Table 4: Mean and Standard Deviation of Interest rating of SS1 Male and Female Students Taught Geometry with (GIS)

Group	N	Pre-GII Mean	SD	Post-GII Mean	Mean SD Gain
Male	21	43.90	8.246	55.52	5.913 11.62
Female	18	37.73	10.767	62.33	3.132 24.6
Mean difference		**6. 17**		**6.81**	**0.64**
Total	39				

Table 4 shows that for pre-test, the male had a mean score of 43.90 while the female had a mean score of 37.73. Their mean difference is 6.17. For post-test scores, the male has a mean score of 55.52 while the female had a mean score of 62.33. Their mean difference is 1.79.

Research Hypothesis 1

There is no significant difference between the mean interest rating of SS1 students taught geometry with Geometry Interactive Software (GIS) and those taught geometry using conventional strategy. The result of this hypothesis is presented in Table 5.

Table 5: ANCOVA Result of Interest rating of SS1 Students Taught Geometry with (GIS) and those Taught Geometry using conventional strategy

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1300.385[a]	2	650.193	12.947	.000	.285
Intercept	10034.587	1	10034.587	199.809	.000	.755
PreTestInter	7.441	1	7.441	.148	.702	.002
Groups	**1220.528**	**1**	**1220.528**	**24.303**	**.000**	**.272**
Error	3264.365	65	50.221			
Total	204693.000	68				
Corrected Total	4564.750	67				

a. R Squared = .285 (Adjusted R Squared = .263)

Table 5 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.

Research Hypothesis 2

There is no significant difference in the mean interest rating of female SS1 students taught geometry with Geometry Interactive Software (GIS) and those taught geometry using conventional strategy. The result of this hypothesis is presented in Table 6

Table 6: ANCOVA Result of Interest rating of SS1 Female Students Taught Geometry with (GIS) and those Taught Geometry using conventional strategy

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1664.298[a]	2	832.149	23.653	.000	.645
Intercept	3614.446	1	3614.446	102.735	.000	.798
PreTestFemale	176.597	1	176.597	5.019	.034	.162
Groups	**1653.648**	**1**	**1653.648**	**47.002**	**.000**	**.644**
Error	914.737	26	35.182			
Total	91629.000	29				
Corrected Total	2579.034	28				

a. R Squared = .645 (Adjusted R Squared = .618)

Table 6 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.

Research Hypothesis 3

There is no significant difference in the mean interest rating of male SS1 students taught geometry with Geometry Interactive Software (GIS) and those taught geometry using conventional strategy. The result of this hypothesis is presented in Table 7.

Table 7: ANCOVA Result of Interest Scores of SS1 Male Students Taught Geometry with (GIS) and those Taught Geometry using conventional strategy

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	355.051[a]	2	177.525	4.091	.025	.185
Intercept	5540.337	1	5540.337	127.675	.000	.780
PreTestMale	146.836	1	146.836	3.384	.074	.086
Groups	**163.353**	**1**	**163.353**	**3.764**	**.060**	**.095**
Error	1562.180	36	43.394			
Total	113064.000	39				
Corrected Total	1917.231	38				

a. R Squared = .185 (Adjusted R Squared = .140)

Table 7 shows that P- value of 0.06 was greater than the significance level of 0.05. Since the p-value of 0.06 is greater than the significance level of 0.05, the null hypothesis of no significant difference was not rejected.

Research Hypothesis 4

There is no significant difference in the mean interest rating of male and female SS1 students that are taught geometry with Geometry Interactive Software (GIS). The result of this hypothesis is presented in Table 8.

Table 8: ANCOVA Result of Interest rating of Male and Female SS1 Students Taught Geometry with (GIS)

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	414.709[a]	2	207.355	8.268	.001	.334
Intercept	6371.930	1	6371.930	254.078	.000	.885
Pretest	8.975	1	8.975	.358	.554	.011
Gender	**329.572**	**1**	**329.572**	**13.142**	**.001**	**.285**
Error	827.596	33	25.079			
Total	123859.000	36				
Corrected Total	1242.306	35				

a. R Squared = .334 (Adjusted R Squared = .293)

Table 8 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.

VII. SUMMARY OF FINDINGS

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

1. The students taught geometry with GIS improved in their interest during the period of this study more than those taught without GIS.

2. The use of interactive software in teaching Geometry influence Female SS1 students' interest in geometry.

3. The use of geometry interactive software in teaching Geometry does not influence male SS1 students' interest in geometry.

4. There was no significant difference in the mean interest scores of male and female SS1 students taught geometry with Interactive Software.

VIII. DISCUSSION OF FINDINGS

The Students taught geometry using Geometry Interactive Software (GIS) improved in their interest during the period of this study. This means that the geometry interactive software enhanced students' interest in geometry. This finding is in agreement with that of Onah (2015) and Iji, Honmane and Omenka (2016), who earlier found that students' interest in mathematics could be improved through the use of captivating teaching strategy using multimedia projection and GSM teaching strategy. Geometry interactive software is expected to be highly stimulating by transforming difficult and boring activities into easy and pleasurable experiences thereby increasing students' interest in geometry. The students in this group must have experienced these possibilities and thus had their interest in geometry increased more than those taught without Geometry Interactive Software. As earlier pointed out in literature (Ramzi, 2014) had posited that today's students are growing with and also getting their information via visual tools like television, mobile device, computers and internet. Getting their interest by traditional teaching methods where a lot of channels compete for their attention is becoming difficult, therefore study materials that are related to what students are used to such as geometry interactive software, video games, television which compels the students' attention and cooperation makes learning a pleasurable experience. The findings showed that the adoption of Geometry Interactive Software (GIS) in the Mathematics classroom enhanced male and female SS1 students' interest in the geometry taught during the period of this study. Again the findings found that both sexes improved in their interest in geometry with Geometry Interactive Software, though the female improved more than their male counterparts. However, this difference was not statistically significant. The result confirms the finding of Williams, Charles-Ogan and Adesope (2017) who find that there is no significant difference in the mean interest of male and female students using Geogebra Interactive Software. This implies that if male and female students are given equal opportunities in the learning process using innovative teaching strategies such as geometry interactive software, the educational inequality in our educational system in terms of gender differences especially in mathematics may be addressed. This finding is in line with Onah (2015), who found that the teaching of mathematics could be made interesting irrespective of gender differences using multimedia projection. Students' interest in geometry may have been an outcome of motivated behavior because it develops and deepens as participants continue to re-engage in geometry.

IX. CONCLUSION

It could be concluded in this study that geometry interactive software enhanced students' interest in geometry irrespective of gender. This implies that if mathematics teachers use innovative teaching software such as the geometry interactive software which is found to have enhanced students' interest, the issue of low interest in mathematics at the senior secondary school level could improve. Similarly, the gender gap created by continued use of unfavourable conventional teaching method in geometry could also be bridged with geometry interactive software.

X. RECOMMENDATIONS

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

1. Interactive Software should be incorporated among teaching strategies for teaching mathematical concepts.
2. Proprietors of schools should endeavor to purchase Geometry Interactive Software for their students in the schools.

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