EFFECT OF COMPUTER SIMULATION ON ACHIEVEMENT AND INTEREST OF STUDENTS IN ALGEBRA AT JUNIOR SECONDARY SCHOOL, MINNA METROPOLIS

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Abstract
This study investigated the effect of computer simulation on achievement and interest of students in Algebra at junior secondary school level. A quasi- experimental, non-equivalent control group design was used in carrying out the research. The researcher used all the Junior Secondary Schools II (JSS II) students in Chanchaga local government area of Niger state as the population of the study. Fifty-four students, from two schools (male and female), were used as sample for the study. Intact classes were assigned by balloting to either experimental or control group; and taught separately by their regular mathematics teachers who were trained for the purpose. Algebra Achievement Test (AAT) and an Algebra Interest inventory were used as instrument for both the control and experimental groups. Four research questions and four hypotheses guided the study. Mean and Standard Deviation were used in analyzing the research questions while Analysis of Covariance (ANCOVA) was used in testing the hypotheses at $p<0.05$ level of significance. The results showed that the use of computer simulation approach in teaching improves students' achievement and interest in algebra. There was no significant interaction effect between the teaching method and gender on students' achievement and interest in algebra. The study recommended the incorporation of computer simulation approach in mathematics teaching, organization of workshop and seminars for teachers on the use of computer simulation approach in the teaching and learning of mathematics especially in algebra.

Keywords : Computer Simulation, Achievement, Interest, Algebra, Junior Secondary School.

Introduction

Mathematics is one of the core subjects in our secondary school curriculum. Mathematics has being essential in the overall development of a nation (Usman, 2002). Mathematics is a subject that respond to the needs of the society and whose competence is vital to every person in order to have requirements for effective teaching and research in science and technology. It was assumed that mathematics is developed to make life meaningful (Kajuru& Bello 2012). The fact that mathematics is an important subject is not cajoled. Even an ordinary man on the street will agree to this fact. Indeed, mathematics is an important subject and necessary for progress anywhere in the world (National Open University of Nigeria, 2006).Therefore, the growing importance of mathematics to Nigeria as a developing country cannot be overemphasized. This could account for the reason why one of the objectives of secondary education under the National Policy on Education (2004) is to equip the students with the skills to life effectively in a modern age of science and technology. The nation has therefore placed great emphasis on the study of mathematics and technology (Kolawole & IIugbusi, 2007). Despite the considerable relevance of mathematics to human existence and despite the enviable position it occupies in the community of disciplines, students performance in mathmatics at public examination have continued to decrease year after years (Kolawole and IIugbusi, 2007).

Inspite the importance and popularity of mathematics among Nigerian students, the performance of students at our secondary schools today are not encouraging (Aburime, 2009). According to kurumaneh and Actor (2008), the difficulties of students in learning mathematics could be attributed to the approach to which the contents are being presented to the students the abstractness of mathematical concepts and poor foundation among others. Kolawole and IIugbusi, (2007) observed that the alarming rate of students under performance in mathematics at all examination and at all levels may be due to some factors such as; lack of qualified and experienced mathematics teachers, location of school, sex of teacher, type and nature of public examination items and the difficulties teachers experienced in teaching most of the mathematics concepts. Adeleke (2007), observed that the rate of students' poor achievement is alarming and equally disturbing and it is observed that most students have some mathematical knowledge but do not have understanding of the basic principles of mathematics, thereby making them to memorize mathematical facts and concepts. Adeleke (2007) further stressed that one particular area which students' problem have been documented is algebra. It then becomes the duty of the teacher to teach mathematics in a way to encourage the understanding of the required basic structure of mathematics. One ways of achieving this is through a careful and thoughtful selection of appropriate teaching strategy that will help students in understanding mathematics concepts especially in algebra rather than passive reception of ideas.

Tokpah (2008) revealed that computer could be used in the classrooms to improve students acquisition of basics skills in specific subject area, reduce the drudgery of learning by blending text with multimedia, broaden curriculum objective through the use of stimulations to aid in problem based and collaborative learning which enable teachers to strengthen their mode of content delivery and technology literate citizens for the work place (Abdullah, 2005; pierce & Stacy, 2004; Adym, 2005). Computer Simulation is a computer program containing a manipulative model of a real or theoretical system by (Thomas & hoper 2004). The program enables the students to change the model from a given state to a specified goal state by directing it through a number of intermediate states. Thus simulation program accepts commands from the user alters the state of the model and when appropriate displays the new state.

Computer simulations may involves extensive planning and require significant investment of labor and financial resources. Despite the significant results recorded in other subjects and the advantages derived from computer simulation as outlined evidence shows that not much has been done in the use of computer simulation as a teaching strategy in mathematics education and specifically in algebra.

Thus, there also the need for further investigation on whether male and female students would respond differently to algebra when computer simulation is used. Subject-specific interest is an important determinant for successful leaning and advanced achievement (Fisher, Dobbs-Oates, &Amoid 2012).

A large amount of research has focused on the role of either teacher beliefs and support behaviors, or parental domain-specific and school-related attitudes and support, for the development of students mathematics interest and achievement (Frenzel, Goetz, Pekrun, & Watt 2011). In view of the above, this study attempted to determine the effect of computer simulation on achievement and interest of students in Algebra at junior secondary School Level.

Statement of Problem

Over the years the performances of students in Mathematics in Junior Secondary Schools in Nigeria schools have been very poor based on Niger ministry of Education Junior Secondary School Examiners Report (2010) . The concern about performance of standings in mathematics lead to several suggestions for improvement. Ranging suggestions, Revolve around the in

appropriate teaching methods as the major cause of students' poor performance in mathematics. Hence, mathematics researchers are in search of innovative teaching methods and strategies that will enhance achievement in mathematics.

According to some researchers such as Akpan (2002) have advocated the use of innovative strategies such as computer simulation approach which incorporates inquiry and cooperative learning in teaching science and science related subjects (Mathematics). There are several studies in the area of Mathematical simulation but to the best of the researcher's knowledge non have investigated the effect of computer simulation in Teaching Junior Secondary School class mathematics content (Algebra). Algebra is a very technical and abstract aspect of mathematics which is always difficult for students to understand, which eventually make students to memorize and learning do not take place, Based on the foregoing, the researchers intend to stimulate algebraic topics using computer for teaching Algebra at Junior Secondary School. The researchers intend to find the effect of computer simulation technique on students' academic achievement and interest in algebra.

Aim and Objectives of the Study

The aim of this study is to investigate the effect of computer simulation on the achievement and interest of students in Algebra at Junior Secondary School in Minna Metropolis, Specifically the study seeks to:

1. Determine the effect of computer simulation on the mean achievement scores in Algebra of JSS II students.
2. Determine the effect of computer simulation on the mean achievement scores of male and female students.
3. Determine the effect of computer simulation on students interest score in Algebra.
4. Determine the effect of computer simulation on the mean interest scores of male and female students.

Research Questions

The following research question will guide this study

1. What is the mean achievement score of student taught Algebra with computer simulation and those taught with conventional approach in Algebra achievement test (AAT)Ω
2. What are the mean achievement scores of male and female students taught Algebra using computer simulation in the Algebra achievement test (AAT)Ω
3. What is the mean interest scores of student taught Algebra with computer simulation and those taught with conventional approach in AlgebraΩ
4. What are the mean interest scores of male and female students taught Algebra using the computer simulationΩ

Hypotheses

The following Null hypotheses was formulated & tested at the 0.05 level of significance

HO_1: There is no significant difference between the mean achievement scores of students taught with computer simulation and those taught with convectional approach.

HO_2:There is no significant difference between the mean achievement scores of male and female students taught Algebra with computer simulation.

HO_3: There is no significant difference between the mean interest scores of students taught with computer simulation and those taught with traditional method as measured by the Algebra Interest Inventory (AII).

Ho_4: There is no significant difference between the mean interest scores of male and female student taught with computer simulation in algebra as measured by the algebra interest inventory (AII).

Methodology

The study adopt a quasi–experimental research design, in which pre-test, post-test non-equivalent group design was used specifically.

Sample and Sampling Technique

The sample classes of the J.S.S II students of 2013/2014 academic session was purposively sampled. Two schools were purposively sampled because only the two schools have access to computer facilities and electricity. The two schools selected are of two streams of J.S.S II students, one class was choosing through simple random sampling. Simple random sampling technique was used to select two intact classes from the schools by the researchers with a flip of a coin determined which of the intact classes become the experimental group and the one that becomes the control group.

Teacher Made Algebra Achievement Test (TMAAT) and Algebra Interest Memory (AII), developed by the researchers was used for data collection. The algebra achievement test was developed by the researcher following the table of specification, the TMAAT consisted of 20 multiple choice test items covering the three methods of solving equation out of 20 questions 7 were of higher order while 13 were of lower order the pretest was administered one week before the experiment and the post test was administered after the experiment.

The algebra interest inventory is a 20-iterm interest inventory developed by the researcher it has a 4-point modified likert type response scale the scale and the scoring are shown below:-
Strongly agreed (SA) – 4,Agreed (A) ---3, Disagreed (D) –2, Strongly Disagreed (SD) –1
The pre-algebra interest inventory was administered to the student immediately after the pre-teacher made algebra achievement test while the post- algebra interest inventory was administered to the students immediately after the post-teacher made algebra achievement test .

The Teacher Made Algebra Achievement Test (TMAAT) was subjected to content and face validation while the Algebra Interest Inventory (AII) was subject to construct validation approach. The content validation of TMAAT was ensured through strict adherence to the test blue print attached the test blue print and the unit lesson plans was also validated by experts in mathematics education and physics in department of science education from College of Education, Minna, Niger state.

Reliability of the Instruments

The researchers carried out a trial testing of the teacher made algebra achievement test and algebra interest inventory to estimate the internal consistency or reliability coefficient of the instruments. The instrument was administered to J.S.S II students from one of the school in the population but not among the sampled schools.
The internal consistency of the algebra achievement test was 0.79 using kunder Richardson 20 (K-R 20) and cronbach Alpha coefficient was used to determine the reliability of 0.84 for the interest inventory.

Method of Data Collection
The experimental groups used computer simulation approach while the control groups used the conventional method.

The PREAT and PREII were administered before the actual study. The actual teaching was done in the first second and third week while the POSTAAT and POSTAII was administered in the fourth week the score from the post test was recorded and used to provide information on student's achievement and interest across gender and treatment groups. Two lesson notes were prepared for the study by the researcher one for the experimental group and the other for the control group. The lesson notes for experimental group contained the demonstration using computer simulation software (micro soft math).

Method of Data Analysis
The research questions were analyzed using means (x^{-}) and standard deviation (S.D) hypotheses was analyzed using analysis of covariance (ANCOVA).

DATA ANALYSIS AND PRESENTATION OF RESULTS
Data analysis and the results of the study are presented as follows:

Research Question 1
What is the mean achievement scores of students taught Algebra with computer simulation and those taught with conventional approach in the Algebra Achievement Test (AAT)Ω

Table 1: The mean achievement scores of students taught mathematics using computer simulation and conventional approach

Subject Group	No. of Students (N)	Pre test Mean ($\bar{X}$)	Pre test Standard Deviation (SD)	Post test Mean ($\bar{X}$)	Post test Standard Deviation (SD)
Experimental	27	47.6667	24.12175	74.3333	19.02776
Control	27	39.5185	24.97173	48.5926	19.41667
TOTAL	54				

From the data above, the experimental group which represents those taught with computer simulation approach, obtained a higher mean achievement score of 47.6667and a standard deviation of 24.12175 in pre-test (PREAAT) and a mean score of 74.3333 and a standard deviation of 19.02776 in the post test (POSTAAT). While the control group representing those taught with the conventional approach, it was observed that they had a mean score of 39.5185 and a standard deviation of 24.97173 in the pre-test while in the post test, they had a mean achievement score of 48.5926 and a standard deviation of 19.41667.The better performance of the experimental group over that of the control group showed that students taught mathematics using computer simulation learnt mathematics concept better than those taught mathematics by the conventional method.

Research Question 2
What are the mean achievement scores of male and female students taught using the computer simulation in the Algebra Achievement Test (AAT)Ω

Table 2: The mean achievement scores of male and female students taught mathematics using computer simulation and the conventional approach

Group	Subject No. of Students (N)	Pre test Mean ($\bar{X}$)	Standard Deviation (SD)	Post test Mean ($\bar{X}$)	Standard Deviation (SD)
Male	12	53.5000	20.48193	31.4167	17.30091
Female	15	43.0000	26.34054	68.6667	18.81519
TOTAL	27				

Table 2 revealed that the male students had a mean score of 53.5000 and a standard deviation score of 20.48193 in the pre-test and a mean score of 31.4167 and a standard deviation of 17.30091 in the post test. While their female counterparts had a mean score of 43.0000 and a standard deviation score of 26.34054 in the pre-test and a mean score of 68.6667 and a standard deviation score of 18.81519 in the post test. The result above showed that the mean achievement scores of males in both the pre-test and post test scores were significantly higher than their female counterpart.

Research question 3

What is the mean interest scores of students taught with computer simulation and those taught with conventional approach in the Algebra Interest Inventory (AII)Ω

Table 3: The mean interest scores of students taught mathematics using computer simulation and the conventional approach

Group	Subject No. of Students (N)	Pre test Mean($\bar{X}$)	Standard Deviation (SD)	Post test Mean ($\bar{X}$)	Standard Deviation (SD)
Experimental	27	2.7407	1.05948	3.5926	0.50071
Control	27	2.4074	0.93064	2.6667	0.96077
TOTAL	54				

From table 4, it is observed that the interest score of the experimental group had a mean score of 2.7407 and a standard deviation of 1.05948 for the pre-test (PREAII) and a mean score of 3.5926 and standard deviation of 0.50071 for the post test (POSTAII). For the students taught with the conventional method (control group), it was observed that they had a mean interest score of 2.4074 and a standard deviation of 0.93064 for the pre-test while a mean interest score of 2.6667 and a standard deviation of 0.96077 for the post test. The higher mean interest score for the experimental group over the control group showed that the experimental group showed more interest in algebra than the control group as indicated in their interest mean scores in AII.

Research question 4

What are the mean interest scores of male and female students taught using the computer simulation in the Algebra Interest Inventory (AII)Ω

Table 4: The mean interest score of male and female students taught mathematics using computer simulation and the conventional approach

Group	Subject No. of Students (N)	Pre test Mean ($\bar{X}$)	Standard Deviation (SD)	Post test Mean ($\bar{X}$)	Standard Deviation (SD)
Male	12	3.5833	0.51493	3.6667	0.49237
Female	15	2.0667	0.88372	3.5333	0.51640
TOTAL	27				

Table 4 revealed that the male students had a mean interest score of 3.5833 and a standard deviation score of 0.51493 in the pre-test (PREAII) and a mean score of 3.6667 and a standard deviation of 0.49237 in the post test (POSTAII). While their female counterparts had a mean interest score of 2.0667 and a standard deviation score of 0.88372 in the pre-test and a mean score of 3.5333 and a standard deviation score of 0.51640 in the post test. This implies that the male students showed greater interest in algebra than the female students.

Hypothesis 1: There is no significant difference between the mean achievement scores of students taught with computer simulation and those taught with conventional method, as measured by the Algebra Achievement Test (AAT).

Table 5: Summary of ANCOVA Result for AAT

Source of variation	Type III Sum of squares	df	Mean sum of square	F	Sign
Intercept	17129.168	1	17129.168	117.687	.000
Pretest	7996.724	1	7996.724	54.938	.000
Groups	5808.552	1	5808.552	39.905	.000
Sex	946.310	1	946.310	6.501	.014
Group* Sex	26.412	1	26.412	.181	.672
Error	7132.442	49	145.560		
Total	223625.000	54			

The result of the analysis in table 5 above showed that there is a significant difference in the mean achievement scores of students taught algebra with computer simulation and those taught the same topics using conventional approach. In other words the null hypothesis of no significant difference was rejected.

Hypothesis 2: There is no significant difference between the mean achievement scores of male and female students taught with computer simulation in algebra, as measured by the Algebra Achievement Test (AAT).

Table 6: Summary of ANCOVA Result for AAT for male and female students taught with computer simulation.

Source of variation	Type III Sum of squares	df	Mean sum of square	F	Sign
Intercept	13851.258	2	13851.258	67.956	.000
Pre-test	2474.406	1	2474.406	12.140	.002
Sex	424.343	1	424.343	2.082	.162
Error	4891.844	24	203.827		
Total	153650.000	27			

The result on table 6 above shows that gender was not significant. Thus, the null hypothesis of no significant difference for gender was not rejected since sex was not significant. The value F is equally not at 0.05 that is (P= 0.154 ; P> 0.05) The treatment using computer simulation in Algebra has no significant difference on gender.

Hypothesis 3: There is no significant difference between the mean interest scores of students taught algebra with computer simulation and those taught with conventional method, as measured by the Algebra Interest Inventory (AII).

Table 7: Summary of ANCOVA Result for AII

Source of variation	Type III Sum of squares	df	Mean sum of square	F cal	Sign
Intercept	27.5444	1	27.5444	45.518	.000
Pre interest	.149	1	.149	.245	.622
Groups	11.299	1	11.299	18.672	.000
Sex	.574	1	.574	.948	.335
Group* Sex	.237	1	.237	.391	.534
Error	29.651	49	.605		
Total	571.000	54			

The result of the analysis in table 7above showed that treatment was significant. Thus the null hypothesis of no significant difference in the mean interest scores of students taught Algebra with computer simulation and their counterparts taught same topics using conventional approach was rejected.

Hypothesis 4: There is no significant difference between the mean interest scores of male and female students taught with computer simulation in algebra, as measured by the Algebra Interest Inventory (AII).

Table 8: Summary of ANCOVA Result for AII for male and female students taught with computer simulation

Source of variation	Type III Sum of squares	df	Mean sum of square	F	Sign
Intercept	21.598	1	21.598	81.031	.000
Pre interest	.003	1	.003	.011	.918
Sex	.076	1	.076	.286	.598
Err or	6.397	27	.267		
Total	355.000	27			

The result on table 8 showed that gender was not significant. Thus the null hypothesis of no significant difference for gender was not rejected since sex was not significant.

Discussion of the Findings

Research question one and three were intended to find out the mean achievement and the mean interest scores of students that were taught with computer simulation and those taught the same topics using conventional approach. Analysis of the result as shown in table 1 for research question one indicated that the mean achievement scores of students in the experimental group was significantly higher than the mean achievement scores of the control group both in the pretest and the posttest scores.

Analyses of the result as shown in table 2 for research question two showed that the mean achievement scores of males in both the pretest and posttest scores for experimental and control groups were significantly higher than their female counterparts.

Result from table 3 for research question three showed that there was a higher mean interest score for the experimental group taught with computer simulation over the control group taught using conventional approach. Research questions three and four were sought to find out the mean achievement scores and the mean interest scores of male and female students in algebra. In table 4, the result showed that the mean interest scores were in favour of males in pretest and posttest in both the experimental and control groups.

The result of this study agrees with the findings of Timbade and Wagh (2008), who indicated that students taught using computer simulation performed significantly better in achievement than those taught using the conventional approach. The significance difference of the computer simulation approach over the conventional approach in the algebra topics taught could be attributed to the fact that computer simulation approach could provide such properties as interaction. In other words, the students participate actively and work interactively with the computer simulation programme thereby increasing students' interest and awareness in the lesson.

Hypothesis one sought to find whether a significant difference existed between the mean achievement scores of students taught algebra using computer simulation and their counterpart taught same topics using conventional approach. For the first hypothesis there was a significant difference in the mean achievement scores of students taught algebra using computer simulation approach thereby rejecting the first hypothesis. The second hypothesis was to determine whether there existed a significant difference in the mean achievement scores of male and female students taught algebra using computer simulation and their counterpart taught using the conventional approach. With regards to the hypothesis, table 5 showed that gender was not rejected and the hypothesis was accepted.

The third hypothesis was to determine whether there existed a significant difference in the mean interest scores of students taught algebra using computer simulation approach and their counterparts taught same topics using conventional approach. With regards to the hypothesis, table 6 showed that there was a significant difference in the mean interest scores of students taught with computer simulation. Therefore, the hypothesis was rejected. Hypothesis four sought to find out whether a significant difference exited in the mean interest scores of male and female students. With regards to the hypothesis, table 6 showed that gender was significant at .335 and the hypothesis was not rejected.

Conclusion

The result of this study established the following

1. The use of computer simulation approach significantly enhanced students' achievement in algebra topics taught more than the conventional approach. This was observed in the mean score of the experimental group being higher than that of the control group.

2. There is a significant difference between the mean achievement scores of male and female students both in the pretest and posttest in favour of males.

3. There is no significant interaction effect between the teaching method and gender on students' achievement and interest in algebra topics taught.

4. The mean interest score was higher for both pretest and posttest scores in favour of the experimental group.

Recommendations

In view of the findings of this study and their implications the following recommendations are made.

1. Mathematics experts should be encouraged and funded by government for the production of computers and computer simulation programmes in various mathematics topics for schools.
2. The state and federal ministries of education should invest in massive acquisition and distribution of computers and mathematical software to secondary schools.
3. There is need for the establishment and equipment of Educational Resource Centres in each education zone of the state. Such Centres will provide avenues for collection of computer simulations in various mathematics topics that are relevant and suitable in the teaching and learning of mathematics.

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