THE EFFECT OF TWO MODES OF COMPUTER ASSISTED INSTRUCTION ON STUDENTS' ACHIEVEMENT AND RETENTION IN MATHEMATICS IN KEBBI STATE

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ABSTRACT

This study compared the effectiveness of two modes of computer assisted instruction on students' achievement and retention in simultaneous equation. The study was carried out in Jega Education Zone of Kebbi State. A sample of two hundred and seventy one (271) students made up of one hundred and thirty two (132) male students and one hundred and thirty nine (139) female students were randomly selected from the schools that have computers in the zone. One intact class was selected from six (6) schools, three schools for boys and three for girls. One class from each school was used as experimental group I, II and control group making of two intact classes for each group. The design of this study was quasi-experimental. Six (6) research questions and six (6) hypotheses guided this study. The instrument used for data collection was simultaneous equation achievement test (SEAT) for pretest and posttest. Simultaneous equation retention test (SERT) was used for retention test. The six research questions were answered using mean and standard deviation, and six hypotheses was tested using analysis of covariate (ANCOVA). The results of data analysis of this study shows that the mean achievement scores of students taught with computer (37.80) for drill and practice, and (50.62) for tutorial were significantly higher than the mean achievement scores of students who were taught without computer (27.10). The mean achievement scores of students who were taught with computer as tutorial (50.62) was statistically higher than the mean achievement scores of students who were taught with computer as drill and practice (37.80). Students who were taught with both computer as drill and practice, and as tutorial had higher mean retention scores (40.61 and 51.70) than students who were taught without computer (28.06). Students that were taught with computer as tutorial retained higher (51.70) than students who were taught with computer as drill and practice (40.61). Based on the hypotheses tested at $p < 0.05$, there was a significant difference between both mean achievement scores of students who were taught with computer and those who were taught without computer. The researchers recommended that mathematics teachers should use it as one of the strategies to be employed in teaching mathematics.

Keywords: Computer, achievement, retention, effects, mathematics.

INTRODUCTION

1.0 Background to the Study

Mathematics has all through the years been an important subject both in the role it plays in everyday activities and in its usefulness to other sciences. Mathematics is a body of knowledge centered on concepts such as quantity, structure, space, change and also the academic discipline that studies them (Pierce, 2007). Mathematics is further defined by Pierce as the science that draws necessary conclusions. Other practitioners of mathematics such as Sowmya (2005), maintains that Mathematics is a science of pattern and highly needed in everyday life. According to Agwagah (2008), Mathematics is the study of numbers, shapes, quantity, structure, and change or describe things(Macmillan Dictionary,2007).Carl Friedrich Gauss (1777-1855) known as the "Prince of Mathematicians" as cited in Wikipedia (2015), also refers to Mathematics as "the Queen of the Sciences" and the bedrock of other sciences. These definitions emphasize the importance of Mathematics.

Mathematics is widely used throughout the world, in human life and many fields including social sciences, Natural Sciences, Engineering, Medicine and Education. It is a vital tool in science, commerce and technology. According to Iji (2007), Mathematics provides an important key to understanding of the world. In the areas of buying and selling, communication, timing, measurement, moulding, recording among others, the importance is highly acknowledged. Mathematics is one of the core subjects in both junior and senior secondary school curricula in Nigeria, which justifies its recognition as being essential in the development of technological advancement in Nigeria. The Federal Government of Nigeria made Mathematics compulsory and one of the core subjects in both primary and secondary schools because of its usefulness (FGN, 2004). Some of the roles of Mathematics according to Nurudeen (2007) includes: its ability to enhance the thinking capabilities of individuals by making them to be more creative, reasonable, rational as well as imaginative. There is no school curriculum or a national development planning which does not take cognizance of the usefulness and development in school mathematics.

From the National Curriculum for Senior Secondary Schools, Mathematics is divided into six (6) sections which include: number and Numeration, Algebraic Process, Mensuration, Plane geometry, Trigonometry, Statistics and Probability. The focus of this study is on simultaneous equation, which is under Algebraic process. This is because reports have shown that algebra occupies a major content in school mathematics and students perform poorly in Algebra (WAEC Chief Examiner Report, 2014). Algebra is a branch of Mathematics of Arabian Origin. It is a generalization and extension of arithmetic in which symbols are employed to denote operations and letters to represent number and quantity. Algebra is an aspect of Mathematics that opens students mind to critical thinking. According to Michael (2002), Algebra is an aspect of mathematics which every individual must know, as it is a gate way to other areas of mathematics, yet many students struggle with Algebra and are left behind because they find it difficult to understand. It is the importance of algebra that makes it to be in almost all the classes in the National Mathematics Curriculum. Algebra involves solving equations, graphical linear, simultaneous linear and Quadratic equations (Federal

Ministry of Education, 2009). These areas have the potential to open students' mind towards different styles of thinking and understanding. It is good for students to know the basic fundamentals in Algebra so as to meet up with the challenges of other areas of mathematics.

The following are some forms of algebraic equation: Linear equation, simultaneous Linear equations, Quadratic equations, Cubic equations and Exponential equations. Simultaneous Linear Equation is a major topic in Senior Secondary School Mathematics Curriculum and also appears in West African Certificate Examination (WASSCE) and National Examination Council of Nigeria (NECO) Certificate Examinations. According to WAEC Chief Examiner's Report (2014), Simultaneous Linear Equation is among the areas students avoid attempting questions on while those who dare to perform poorly. The report further indicated that most candidates ended up getting wrong answer. Some students do not like solving algebraic problems as they look at Algebra as difficult and abstract.

Harbor-Peter (1999) was of the opinion that poor method of teaching and lack of basic knowledge are responsible for the observed poor performance of students in secondary school mathematics. Michael (2002) also noted that poor textbooks and lack of Computer technology in schools are also responsible for poor performance of students in mathematics. Mansil and Wiln (1998) are of the opinion that lack of knowledge and unavailability of computers are responsible for poor performance of students in mathematics. They suggested that teachers be sent on in-service training and retraining so as to meet up with the technological challenges in the society and also improve students' achievement in mathematics.

The attempt to take care of poor achievement of students in mathematics inspired some researchers to use computer technology in the classroom. Such researchers include Hannafin and Saverge (1993), Adeniyi (1997), Barabara, Ford and MaryAnn (1998), Mansil and Wiln (1998), Odogwu (1999), Ifeakor (2005) and Pramila and Harsha (2012). Mansil and Wiln (1998) observed that learners are happier when they engage in mathematics with a sense of personal accessibility, coalescence and application rather than just a body of knowledge and skill.

Statement of the Problem

Poor achievement of students and lack of retention in mathematics is a known fact and of great concern to educators, researchers and mathematicians. Researchers are making great effort to see if there will be improvement on students' achievement and retention in mathematics by adopting various methods of teaching mathematics. Their aim of using various methods is because poor method of teaching mathematics has been identified as one of the reasons for poor achievement of students in mathematics. Students equally perform poorly in simultaneous equation. There are problems associated with solving simultaneous equations like unable to find unknowns, incorrect value of constants, and finally the abstract nature of simultaneous equation that brings confusion to simultaneous expressions. The use of computer in teaching could be as a tutorial, drill and practice simulation or tutee.

Purpose of the Study

The purpose of this study was to compare the effectiveness of computer as drill and practice, and as tutorial on students' achievement and retention in Simultaneous Equation. Specifically to:

1. Compare the effectiveness of using computer and not using computer in learning simultaneous equation.
2. Compare the effectiveness of using computer as drill and practice, and as tutorial in learning simultaneous equation.
3. Find out the mode that enable student to retain more of what they have learnt.
4. Ascertain whether the modes have any effect on male and female students' achievement and retention in simultaneous equation.

Significance of the Study

This study focuses on comparing two modes of using computer in teaching and learning mathematics: computer as drill and practice, and as tutorial. It is hope that this study will enable the mathematics teachers identify the mode of using computer in teaching students for effective teaching and learning. Apart from adding to the number of instructional strategies at their disposal, it might make the teaching of simultaneous equation more enjoyable and hence improve achievement. It will also be useful to programmers and software designers to understand the appropriate way to program for effective teaching and learning.

To states and federal ministries of education the results of this study might provide information with which they can organize seminars, conferences and workshops for mathematics teachers. Such in-service training program will furnish teachers with necessary knowledge on the use of computers for effective teaching and learning and thus promote the use technology.

To policy makers, the result of this study will enable them make policies on acquiring computers for schools in order to improve the level and relevance of learning. It will equally enable them make policies on the use of instructional materials in teaching simultaneous equation and more so in using computer as instructional material to augment teachers' effort. Curriculum planners should include computer education in secondary school curriculum so that student should learn about the use of computer.

To NGOs (Non-Governmental Organizations), the result this study will enable them provides enough computers in the secondary schools. This is because Government cannot provide enough computers in the secondary schools. They can also helps in providing Computer Algebra Applications Software (CAAS) to the schools, because some of the software is too expensive.

Finally, the result of this study will provide empirical evidence of the mode that enabled students achieve and retain higher in Algebra and so should form a basis for further research by future researchers.

Scope of the Study

This study is delimited to comparing the effectiveness of using computer and not using computer in teaching and learning of simultaneous equation, also, the effectiveness of using computer as drill and practice, and as tutorial in teaching and learning of simultaneous equations. Only Senior Secondary Two (SS II) students were used for the study. This is because students in this class are not beginners in Algebra and will be able to understand simultaneous equations when software is used. Those in SS I are beginners and so may be thrown off with the use of computers as they have not learnt the basics of Algebra. To those in SS III, using computers may distract them as they are already busy with their final examination and may not have time for drill and practice or any further demonstrations. The contents covered are the four methods of solving a simultaneous equation which include substitution, elimination, graphical and matrix methods.

Research Questions

1. What are the mean achievement scores of students who were taught with computer and those who were taught without computer?
2. What are the mean achievement scores of students who were taught with computer as drill and practice, and those who were taught with computer as tutorial?
3. What are the mean achievement scores of male and female students who were taught with computer as drill and practice, and those who were taught with computer as tutorial?
4. What are the mean retention scores of students who were taught with computer and those who were taught without computer?
5. What are the mean retention scores of students who were taught with computer as drill and practice, and those who were taught with computer as tutorial?
6. What are the mean retention scores of male and female students who were taught with computer as drill and practice, and those who were taught with computer as tutorial?

Research Hypotheses

HO_1: There is no significant difference between the mean achievement scores of students who were taught with computer and those who were taught without computer.

HO_2: There is no significant difference between the mean achievement scores of students who were taught with computer as drill and practice, and those who were taught with computer as tutorial.

HO_3: There is no significant difference between the mean achievement scores of male and female students' who were taught with computer as drill and practice, and those who were taught with computer as tutorial.

HO_4: There is no significant difference between the mean retention scores of students who were taught with computer and those who were taught without computer.

HO_5: There is no significant difference between the mean retention scores of students who were taught with computer as drill and practice, and those who were taught with computer as tutorial.

HO_6: There is no significant difference between the mean retention scores of male and female students who were taught with computer as drill and practice, and those who were taught with computer as tutorial.

Literature Review

Many researchers have made effort to develop strategies to improve on the poor achievement of students in mathematics. Such strategies among others include Target task approach used by Harbor-Peters (1999), concept mapping by Ezugo and Agwagah, (2000), Ethno-mathematics by Ezeh (2005), computer use by Michael (2002) and the use of instructional materials by Haliru (2012). All these were in an attempt to improve on students' achievement in mathematics.

- **Issues on Retention.**

According to Macmillan English Dictionary (2007), retention is the act of keeping or storing something. It can also be defined as the ability to remember ideas or facts. Retention of what somebody has learnt so as to be able to retrieve it when there is need for that is necessary. Inability to remember what one has learnt is regarded as a loss of memory (Langer, 1997). He further stated that a loss of memory is a failure to remember the past. The loss of memory or inability to remember the past is detrimental and should be avoided.

Chauham (1987) defines retention as a direct correlates of positive transfer of learning which the primary essence in education is. This indicates that ability to retain what one has learnt is necessary in education in order to achieve the positive transfer of learning. Landry (1999) is of the view that human memory is very weak and so cannot retain everything. Based on this a teacher should be faced with the problem of improving on students' ability to learn, retain and retrieve information. It is even more difficult to retain abstract aspects of mathematics such as algebra than aspects that are easily concretized.

Ogbonna (2007) has retention as a variable in finding the effect of two constructivist instructed models on students' achievement and retention in number and numeration. Michael (2002) also had retention as a variable in finding the effect of CAI on students' achievement. Iji (2003) and Madu (2004) also worked on retention. This present study attempted to find out the effect of using computer as tutor and tool on retention. These go a long way to show that forgetting is discountenanced and retention should be encouraged.

Computer can play vital role in learning process as it can work with imagination of students. Any concept in mathematics can be explained with the help of pictures and this

visual image can help in understanding the concept at ease. In paper and pencil method student can get bored easily and can find it difficult to practice the sum again and again. Computer works as a change and increase the curiosity of students and they can learn interestingly without any difficulty. Also whatever is learnt through computer the contents can be retained for longer time as they use more senses of the students.

According to Taylor (1980), tutor applications can further be classified into five categories; drill and practice applications, tutorial applications; simulations, problem-solving applications and games. In drill-and-practice applications; the computer is used to help the students memorize the appropriate response to some stimulus. The most common applications include drills on mathematics facts. Applying it to Algebra, the computer might display the problem 5x + 2x=? And the student would be asked to enter the correct response. The computer would evaluate the response and give the student appropriate feedback. If the student entered the incorrect response, the computer would display the correct answers on the screen and then present the next problem.

Several studies have been carried out to determine the achievement and retention of male and female students in mathematics and science using various teaching strategies. One of such studies is Obodo (1990) who conducted an experimental research on the effect of Target task, delayed formalization and expository methods of teaching on achievement, retention and interest of Junior Secondary School (JSS II) students in Algebra. The design was quasi-experimental, purposive and simple random sampling techniques were used in drawing the subject of the study. The study was conducted in Anambra State with a sample of 447 J.S.S. III Students. The findings of this study are as follows:

1. On the average; the target task and expository methods were equally effective.
2. For the urban students; the target task and expository methods were more effective in their algebraic retention.

Madu (2004), carried out a study on the effect of constructivist based instructional model in students' conceptual change and retention in physics. The study adopted the non-equivalent control group design using 204 SS II physics students in Nsukka urban of Enugu state for 2001/2002 session. Two secondary schools (one boys' and one girls') were used. The main purpose of this study was to determine empirically the effect of constructivist base instructional model PEDDA relative to students' conceptual change and retention in current electricity. His findings indicated that PEDDA model facilitated concept change and retention of physics concepts.

Ezeh, (2005), carried out a study on the effect of delayed formalization approach on senior secondary students' achievement in sequence and series. This study was carried out in Obollo Education Zone of Enugu State. The design was quasi-experimental. A sample of 240 senior secondary two (SS II) students of which 130 were males and 110 were females was used for the study. The findings among other things indicated that:

(i) Delayed formalization Approach, is effective in teaching and learning of mathematics and enhanced their achievement.
(ii) Also that, female student achieved more than their male counterparts with the delayed formalization approach.

Ogbonna (2007); also carried out a study on the effect of two constr5uctivist instructional models on students' achievement and retention in number and numeration. The study was carried out in Abia State. It was a quasi-experimental design with a sample of 290 JSS III Students. His findings revealed that students who were taught with the two constructivist instructional models (IEPT and TLC) achieved and retained higher than those taught with the conventional method. Also that, female students performed better than male students.

Emmanuel et al. (2009) carried out study on the effect of ethno-mathematics teaching approach on students' achievement and retention in locus. The study was carried out in zone B education of Benue State of Nigeria using a sample of 263 SS II students. It was a non-equivalent quasi-experimental design. Data collected using Locus Achievement Test (LAT). The results of this study indicated that students exposed to ethno-mathematics approach were superior in achievement and retention than those taught with conventional approach.

Onuka and Oshin (2015), carried out study on collegial school culture as determinant of students' achievement in mathematics in secondary schools. The study was carried out in 4 local government areas of Oyo State. This study was survey design. Data were collected using school culture scale (SCS) and Mathematics Achievement Test (MAT). The findings of this study revealed that school culture elements significantly predicted achievement in Mathematics, Equally there is no significant difference between males and females students' achievement.

All these studies reviewed used various techniques to find out the achievement of male and female students in mathematics and other sciences, but non of the studies tried to compare the effectiveness of using computer as tutor and tool in teaching. Mathematics and so calls for the need of this present study.

Another study by Ezeh (2009), on effect of using computer on students' achievement and retention in Quadratic equation was reviewed. The study was carried out in Nsukka Education zone of Enugu State. A sample of two hundred and seventy one (271) SS II students was involved in the study. The design of this study was quasi-experimental. The results of this study indicated that; students who were taught Quadratic equation with computer achieved and retained more than those taught without computer. The study equally revealed no significant different in the achievement and retention scores of male and female students.

Gunbas (2010), carried out a study on the students' mathematics word problem achievement in a computer based-story. The purpose of this study was to investigate the

effect of a computer based story, which was designed in anchored instruction framework, on sixth-grade students' mathematics word problem solving achievement. The problems were embedded in a story presented on a computer as computer story, and then compared with the paper-based version of the same story and to a condition that presented the problems as typi8cal, isolated word problems (i.e., a non-story condition include only problems). One hundred and twenty-eight (128) sixth-grade students from two middle schools in Turkey participated in this study. The design of the study was quasi-experimental. The results of the study indicated that students who solved the problems in the computer story treatment had significantly higher achievement scores than students who solved the problems in the paper story and isolated word problems treatments.

Adeneye (2011) carried out a research on effect of personalized, computer-Based Instruction on Students' Achievement in solving Two-Step word problems. The aims of this study was to investigate the effect of personalized, computer-base instruction using individual student interest and preferences on students' achievement in solving two-step word problem. 80 Junior Secondary school Students (JSS III) were grouped by ability level based on pre-test scores, then randomly assigned to a personalized or non-personalized version of the computer-base instruction on two-step word problems. The results of this study indicated that students on personalized treatment yielded a significant achievement over the non-personalized one.

Zahra et al (2012) carried out a study on the study of application of algebrator (CAAS) software for mathematical problems solving. The design of the study was quasi-experimental. 44 high school girl students in Iran were sample for this study. The aim of this study was to guage effects of using algebrator software on mathematics learning of the students. The results form Leven's test and independent samples clearly shows that the Algebrator software was positively effective on better math learning comparing with traditional methods of teaching.

Also Olga and Meral (2013), carried out a study on the effects of Computer-Assisted Instruction on the achievement attitudes and retention of fourth – grade mathematics students in North Cuprus. The purpose of this student was to examine the effects of the educational software Frizbi Mathematics 4 on 4^{th} grade students' mathematics achievement, attitude and retention toward computer-assisted instruction. 55 students were randomly selected for this study, 26 students was used as control group while 29 students was used as experimental group. The study included three units, multiplication of Natural numbers, Division of Natural numbers and Fractions. The scores on achievement tests were collecte3d three times, before intervention (pre-test), immediately after the intervention (post-test) and 4 months later (retention test). The results of this study revealed significant difference between the groups on the post achievement tests and attitude scales in favour of experimental group. However, statistically significant differences in favor of treatment group, on the retention tests were attained on the multiplication and division units but not on fractions.

Gambari et al. (2014), carried out a study on Effectiveness of Computer animation and geometrical instructional model on mathematics achievement and retention among Junior Secondary School Students. The design of this study was quasi-experimental. 40 Junior Secondary School Students were drawn from two secondary schools in Minna metropolis. 20 students are males and other 20 are females. The results of this study indicated that the students taught geometry using computer animation performed significantly better than their counterparts who were taught geometry using conventional methods in both post-test and retention test respectively. However, there was no significant difference reported in the post-test achievement scores of male and female students taught Geometry using computer animation and conventional model respectively. These findings indicated that geometry concept in mathematics could be taught and learnt meaningfully through the use of computer animation.

RESEARCH METHODS

Research Design

The design of this study is Non-randomized Pretest-Posttest research design (quasi-experimental Design). The quasi experimental design according to Kerlinger (1970) as cited in Cohen et al (2007) refers to quasi-experimental situations as 'compromise designs', an apt description when applied to much educational research where the random selection or random assignment of schools and classroom or subjects is quite impracticable. The quasi-experimental is chosen because it controls the interval validity threats of the initial group equivalence and researcher's selection bias, since there is no randomization of the subjects into groups. Intact classes, which were already organized in normal school setting was used. This will not disrupt the school setting in terms of classroom schedules, and so accommodated the study.

Area of the Study

The study was carried out in Jega Education zone of Kebbi State. The Zone is made up of four Local Government Areas; Jega, Aliero, Maiyama and Suru. In this education zone the total number of secondary schools is 65, thirty (30) out of these schools are Senior Secondary Schools while 35 are Junior Secondary Schools. The schools with computer facilities and electricity were purposively selected for this study.

Population of the Study

The population for the study is all the Senior Secondary Two (SS II) students in Jega Education zone. That is the entire Senior Secondary Two (SS II) students in 30 Senior Secondary Schools in the zone.

Sample and Sampling Technique

The sample for this study was drawn from six schools. The schools with computer and electricity facility were purposively selected for this study. There is going to be three schools for boys and three for girls. The researcher selected one class from each school making a total of 6 intact classes. Only SS II students will be select. The three boys' schools

and three girls' schools was assigned to experimental group I, II and the control group using simple random sampling technique.

Instrument for Data Collection

The instrument used for data collection was Simultaneous Equation Achievement Test (SEAT). This instrument was development by researcher using the table of specification which can be seen in appendix A. There were 20 multiple choice items covering the four methods of solving simultaneous equation. Out of the 20 questions, 12 were of higher order while 8 were of lower order. One test will be use for pretest, post-test and retention test. For retention test, adjustment was made in the numbering and the options will equally interchange. This will reduce the effect of post-test on the retention test

Reliability of Instrument

There was a trial testing (Pilot testing) of simultaneous Equation Achievement Test (SEAT) to estimate the internal consistency and stability of the instrument. The researcher was administered the instrument to SS II students in a school in Birnin-Kebbi Education Zone which is outside the Education Zone selected for the study. The internal consistency was computed using Kuder-Richardson formula (K-R 20) which was 0.91.

3.8 Experimental Procedure

One class in each school will assign to experimental group I, II or control group; making a total of two classes for each of the groups.

Table 2: Classes used for the Study

Schools	EG. I	EG. II	Control
Boys	1	1	1
Girls	1	1	1
Total	**2**	**2**	**2**

Experimental Group I (Computer As Drill and Practice)

For this group, the teacher was given an overview of simultaneous Equation and what the students are expected to learn. Those in Experimental group I will be taken to computer room where they were given Computer Algebra Application software on simultaneous Equation. The software will allow students to practice how to solve simultaneous equation. It adopts a "learning-by-doing" approach where students will follow the step-by-step instructions; answer questions and will be assess by the computer. What students need to do is to use computer keyboard to insert the coefficient of the unknowns(x and y) and click solve, in few seconds computer will give solution to the problem.

Experimental Group II (Computer As Tutorial)

Those in experimental group II was taken to computer room where the teacher after teaching them demonstrate with the Intelligent Tutoring Application Software(ITAS)

software to show how computer can solve simultaneous equations. This software (ITAS) is capable of solving any simultaneous linear equation problems. It will give a tutorial to students just like human tutor.

Control Group (Not use Computer)

In this group, computer was not used to teach simultaneous equation to students, rather traditional method of teaching was used, by using talk and chalk method (conventional method).

In this case, those in experimental group I will use computer as tutor while those in the experimental group II will use computer as tool and those in control group will not use computer at all.

Reduction of Experimental Bias

The actual teaching of the experimental groups was not done by the researcher but by the research assistants. These research assistants are mathematics teachers in the schools selected for this study. This will remove teacher variability.

Control of the Effect of Pre-test on Post-test

The period between the pre-test and post-test was six weeks. This period is long enough to disallow the pre-test from affecting the post-test. The period between the post-test and retention test was 2 weeks. The researcher used Simultaneous Equation Achievement Test to produce Retention test, but the items was restructured, and interchanged to prevent the effect of post-test on retention test.

Variables of the Study

This study consists of two variables namely:

i) Dependent variables: the dependent variables are students' achievement and retention in simultaneous equation.

ii) Independent variables: these are two modes of computer assisted instruction(Drill and practice, and Tutorial)

Control of Hawthorne Effect

Hawthorne effect occurs when students are aware that they are being used for experiment. The term was coined in 1950 by Henry A. Landsberger when analyzing earlier experiments from 1924-32 at the Hawthorne works (a western electric factory outside Chicago, U.S.A.). Hawthorne Effect is a type of reactivity in which individuals modify or improve an aspect of their behavior in response to their awareness of being observed or study. To control this, the mathematics teachers in the schools selected for this study was used for teaching the classes. This reduced the suspicion that the teachers were using them for an experiment.

Method of Data Analysis

The research questions was answered using mean and standard deviation, while research hypotheses was tested using Analysis of covariance (ANCOVA) at $P < .05$. The pre-test scores will use as covariate to the post-test scores. Since there was no random selection of the subjects in this study, the intact groups (classes) was used as they are. In this case, ANCOVA is the appropriate test that can be use to determine whether there is significant difference between the means of the groups (Ogomaka, 2004).

RESULTS

Research Question 1

What are the mean achievement scores of students who were taught with computer and those who were taught without computer?

Table 3: Mean Achievement Scores and Standard Deviation of Students who were taught with computer and without Computer.

		Pre-Test	Post-Test	Mean Gain
Drill & Practice Group	N	90	90	
	Mean	18.422	37.80	19.37
	S.D.	6.32	9.4	
Control	N	87	87	
	Mean	18.84	27.10	8.26
	Std. Deviation	6.90	8.72	
Tutorial	N	94	94	
	Mean	18.23	50.62	
	Std. Deviation	6.64	1.09	
Total	N	271	271	
	Mean	18.49	38.81	
	Std. Deviation	6.60	1.37	

Table 3 shows the mean achievement scores of students who were taught with Drill and Practice and Tutorial and those who were taught without computers students who were taught with as Drill and Practice had a mean of 37.8 in the post-test and standard deviation of 9.4 in the post-test and standard deviation of 9.4. Students who were taught with computer as Tutorial had a mean of 50.62 and standard deviation of 1.09 while students who were taught without computer had a mean of 27.10 and standard deviation of 8.72. The mean achievement scores of students taught with computer both as Drill and Practice and tutorial were higher than the mean achievement score of students taught without computer, for the pre-test the mean achievement scores of students taught with computer as Drill and Practice, Tutorial and control were 18.42, 18.23 and 18.84. This indicates that the students were at the same level before the experiment.

Research Question 2

What are the mean achievement scores of students who were taught with computer as Drill and Practice and those who were taught with computer as Tutorial?

Table 4: Mean Achievement Scores and Standard Deviation of Students Taught with computer as Drill/Practiced and Tutorial.

Modes/Groups		Pre-Test	Post-Test	Mean Gain
Drill & Practice Group	N	90	90	
	Mean	18.42	37.8	19.37
	S.D.	6.32	9.4	
Tutorial	N	94	9.4	
	Mean	18.23	50.62	32.39
	Std. Deviation	6.64	1.09	

Table 4 reveals that the mean achievement score of students taught with computer as Drill and Practice was 37.8 in the post-test with standard deviation of 9.4 while the mean achievement score of students taught with computer as tutorial was 50.62 with standard deviation of 1.09. This indicates that student who was taught with computer as Tutorial achieved higher than students taught with computer as Drill/Practice.

Research Question 3

What are the mean achievement scores of male and female students who were taught with computer and those who were taught without computer?

Table 5: Mean Achievement Scores and Standard Deviation of Male and Female Students who were taught with Computer and without Computer?

Groups	Sex		Pre-Test	Post-Test
Drill & Practice Group	Male	N	40	40
		Mean	16.90	40.05
		Std. Deviation	6.56	1.03
	Female	N	50	50
		Mean	19.64	36.0
		Std. Deviation	5.91	8.39
	Total	N	90	90
		Mean	18.42	37.80
		Std. Deviation	6.32	9.4
Control	Male	N	42	42
		Mean	18.40	27.83
		Std. Deviation	7.84	9.00
	Female	N	45	45
		Mean	19.24	26.42
		Std. Deviation	5.94	8.48
	Total	N	87	87
		Mean	18.84	27.10
		Std. Deviation	6.90	8.72
Tutorial	Male	N	50	50
		Mean	17.84	51.34
		Std. Deviation	7.15	9.78
	Female	N	44	44
		Mean	18.68	49.79
		Std. Deviation	6.06	1.22
	Total	N	94	94
		Mean	18.23	50.62
		Std. Deviation	6.64	1.09

Table 5 shows the mean achievement scores and standard deviation of male and female students who were taught with computer both as Drill and Practice and as Tutorial and also those that were taught without computer. For Drill and Practice group, male students had a mean of 40.05 with standard deviation of 1.03 while female students had a mean of 36.0 with standard deviation of 8.39 in the post-test. For Tutorial group, male students had a mean of 51.34 with standard deviation of 9.78 while female students had a mean of 26.42 with standard deviation of 8.48. This indicated that male students taught with computer both as Drill and Practice and tutorial achieved higher than male students who were taught without computer.

Research Question 4

What are the mean retention scores of students who were taught with computer and those who were taught without computer?

Table 6: Mean Retention Scores of Students taught with Computer and without Computer.

Groups		Post-Test	Retention Test	Mean Gain
Drill & Practice Group	N	90	90	
	Mean	37.80	40.61	3.81
	S.D.	9.4	8.67	
Control	N	87	87	
	Mean	27.10	28.05	0.95
	Std. Deviation	8.72	9.35	
Tutorial	N	94	94	
	Mean	50.62	51.70	1.08
	Std. Deviation	1.09	1.06	
Total	N	271	271	
	Mean	38.81	40.42	1.61
	Std. Deviation	1.37	1.36	

Table 6 indicated that the mean retention score of students taught with computer both as Drill and Practice and Tutorial were 40.61 and 51.70 respectively with standard deviations of 8.67 and 1.06. Students that were taught without computer had a mean of 28.05 with standard deviation of 9.35. This indicated that students taught with computer both as Drill and Practice and as Tutorial retained higher than those taught without computer.

Research Question 5

What are the mean retention of students who were taught with computer as Drill and Practice and those who were taught with computer as Tutorial?

Table 7: Mean Retention Score of Students taught with computer as Drill and Practice and Tutorial.

Groups		Post-Test	Retention-Test	Mean Gain
Drill & Practice Group	N	90	90	
	Mean	37.80	37.80	3.81
	S.D.	9.4	8.64	
Tutorial	N	94	94	
	Mean	50.62	51.70	1.08
	Std. Deviation	1.09	1.06	

Table 7 indicates that students that were taught with computer as Drill and Practice had a mean retention score of 40.61 with standard deviation of 1.06 while students that were taught with computer as Tutorial had a mean retention score of 51.70 with standard deviation of 1.06. This indicated that students who were taught with computer as Tutorial retained higher than students taught with computer as Drill and practice.

Research Question 6

What are the mean retention scores of male and female students who were taught with computer as Drill and Practice and those who were taught with computer as Tutorial?

Table 8: Mean Retention Scores and Standard Deviation of Male and Female Students who were taught with computer as Drill and Practice and as Tutorial.

Groups	Sex		Post-Test	Retention-Test
Drill & Practice Group	Male	N	40	40
		Mean	40.05	40.15
		Std. Deviation	1.03	1.04
	Female	N	50	50
		Mean	36.00	40.98
		Std. Deviation	8.37	7.02
	Total	N	90	90
		Mean	37.80	40.61
		Std. Deviation	9.4	8.67
Tutorial	Male	N	50	50
		Mean	51.34	51.08
		Std. Deviation	9.78	9.40
	Female	N	44	44
		Mean	49.79	52.41
		Std. Deviation	1.22	1.19
	Total	N	94	94
		Mean	50.62	51.70
		Std. Deviation	1.09	1.06

Table 8 revealed that male students who were taught with computer as Drill and practice had a mean retention score of 40.15 and Standard Deviation of 1.05 while female students who were taught with computer as Drill and Practice had a mean retention score of 40.98 and standard deviation of 7.02. Male students who were taught with computer as Tutorial had a mean retention score of 51.08 and standard deviation of 9.40 while female students who were taught with computer as Tutorial had a mean retention score of 52.41with standard deviation of 1.19. This result indicated that female students who were taught with computer both as Drill and Practice and as Tutorial retained more than their male counterpart who were taught with computer as Drill and Practice and as Tutorial.

Research Hypothesis 1

HO_1: There is no significant difference between the mean achievement scores of students who were taught with computer and those who were taught without computer.

Table 9: ANCOVA Table of Students' Scores in the Simultaneous Equation Achievement Test (SEAT)

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Result
Corrected Model	26021.050[a]	6	4336.84	46.21	.000	S
Intercept	36894.217	1	36894.21	393.18	.000	S
Pretest	438.738	1	438.73	4.67	.031	S
Group	25051.040	2	12525.52	133.48	.000	S
Sex	456.915	1	456.91	4.86	.028	S
Group *Sex	128.280	2	128.28	.68	.506	NS
Error	24772.352	264	93.83			
Total	459016.000	271				
Corrected Total	50793.402	270				

S = Significant at 0.05 Probability level.
NS = Not Significant at 0.05 probability level.

Table 9 indicated that the use of computer in teaching simultaneous equation is a significant factor in the mean achievement scores of students who were taught with computer and without computer. This is because with the 95% confidence interval of different, the value of F, its degree of freedom and its p-value significant, the value of F is 46.2 and the result of the test is significant beyond the 0.05 level of significant as .000 is less than 0.05. Therefore the null hypothesis of no significant difference is hereby rejected. This means that there is a significant difference in the mean achievement scores of students taught with computer and those taught without computer.

Hypothesis 2

HO_2: There is no significant difference between the mean achievement scores of students who were taught with computer as Drill and Practice and those who were taught with computer as Tutorial.

Table 10: ANCOVA Table of Students who were taught with computer as Drill and Practice and as Tutorial on Achievement.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Result
Corrected Model	7994.960[a]	4	1998.740	19.136	.000	S
Intercept	37469.739	1	37469.739	358.729	.000	S
Pretest	21.500	1	21.500	.206	.651	NS
Group	7173.694	1	7173.694	68.680	.000	S
Sex	374.368	1	374.368	3.584	.060	NS
Group *Sex	77.062	1	77.062	.738	.392.	NS
Error	18696.780	179	104.451			
Total	388570.0	184				
Corrected Total	26691.739	183				

S = Significant at 0.05 Probability Level.
NS = Not Significant at 0.05 probability Level.

Table 10 indicated that the mode of computer usage is a significant factor in the mean achievement scores of students in the simultaneous Equation Achievement Test (SEAT). This is because with the 95% confidence interval of difference, the value of f, it degree of freedom and its p-value significant, the value of F is 19.136 and the result of the test is significant beyond the 0.05 level of significant as 0.000 is less than 0.05. This hypothesis 2 of no significant difference in the mean achievement scores is therefore rejected. This means that there is a significant difference in the mean achievement scores of students taught with computer as Drill and Practice and those who were taught with computer as Tutorial. The Experimental Group II (Tutorial0 achieved significantly higher than the experimental group I (Drill and Practice) in the simultaneous Equation Achievement Test (SEAT). Hence the use of computer as Tutorial influenced achievement more than the use of computer as Drill and Practice.

Hypothesis 3

HO_3: There is no significant difference between the mean achievement scores of male students' who were taught with computer as Drill and Practice and those who were taught with computer as Tutorial.

Table 10 also indicated that sex is not a significant factor in the mean achievement scores of students who were taught with computer as Drill and practice and as Tutorial. This is because with the 95% confidence interval of difference, the value of F, its degree of freedom and its P-value significant, the value of F is .738 and the result of the test is not significant beyond the 0.05 level as 0.392 is greater than 0.05. This hypothesis 3 of no significant difference in the mean achievement score4s is therefore accepted. This means that there is no significant difference in the mean achievement scores of male and female students taught with computer as Drill and Practice and as Tutorial.

Hypothesis 4:

HO_4: There is no significant difference between the mean retention scores of students who were taught with computer and those who were taught with computer.

Table 11: ANCOVA Table of Students' Scores on Retention Test

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Result
Corrected Model	40416.233[a]	6	6736.039	186.326	0.000	S
Intercept	1700.515	1	1700.515	47.038	.000	S
Pretest	15030.561	1	15030.56	415.761	.000	S
Group	827.403	2	413.701	11.443	.000	S
Sex	636.048	1	636.048	17.594	.000	S
Group *Sex	25.855	2	12.927	358	.700	NS
Error	9544.114	264	36.152			
Total	492890.0	271				
Corrected Total	49960.347	270				

S = Significant at 0.05 Probability Level.
NS = Not Significant at 0.05 probability Level.

Table 11 indicated that, there is a significant difference between the mean retentions cores of students who were taught with computer and those who were taught without computer. This is because with the 95% confidence interval of difference, the value of F, its degree of freedom and its P-value significant; the value of F is 186.326 and the result of F-test is significant beyond 0.05 level as .000 is less than 0.05, hypothesis 4 of no significant difference in the mean retention scores is therefore rejected. Which means that, there is significant difference in the mean retention scores of students who were taught with computer and those who were taught without computer? Therefore students who were taught with computer retained significantly higher than students who were taught without computer.

Hypothesis 5:

HO_5: There is no significant difference between the mean retention scores of students who were taught with computer as Drill and Practice and those who were taught with computer as Tutorial.

Table 12: ANCOVA Table of Students' who were taught with computer as Drill and Practice and as Tutorial on Retention

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Result
Corrected Model	15505.308[a]	4	3876.327	94.744	.000	S
Intercept	1806.133	1	1806.133	44.145	.000	S
Pretest	9792.840	1	9792.840	239.358	.000	S
Group	146.386	1	146.386	3.578	.060	S
Sex	430.765	1	430.765	10.529	.001	S
Group *Sex	19.580	1	19.580	.479	.490	NS
Error	7323.556	179	40.914			
Total	416879.00	184				
Corrected Total	22828.864	183				

S = Significant at 0.05 Probability Level.
NS = Not Significant at 0.05 probability Level.

Table 12 shows that there is a significant difference between the mean retention scores of students who were taught with computer as Drill and Practice and those who were taught with computer as Tutorial. This is because with 95% confidence interval of differenced, the value of f, its degree of freedom and its P-value significant, the value of F is 94.744, and the result of F-Test is significant beyond the 0.05 level as 0.000 is less than 0.05. Therefore hypothesis 5 of no significant difference is hereby rejected. The result indicated that students who were taught with computer as Tutorial retained significantly higher than those who were taught with computer as Drill and Practice.

Hypothesis 6:

HO_4: There is no significant difference between the mean retention scores of male and female students who were taught with computer as Drill and Practice and those who were taught with computer as Tutorial.

In table 12, it was indicated that sex is not significant among the groups (Drill and Practice and Tutorial). The table 12 shows the value of F to be .479 and the result of F-test is not significant beyond the 0.05 level of significant as .490 is bigger than 0.05. Therefore hypothesis 6 of no significant difference is retained (Accepted). This indicates that there is no significant difference between the mean retention scores of male and female students taught with computer as Drill and Practice and as Tutorial in the Simultaneous Equation Achievement Test (SEAT).

Suggestions for Further Studies

Similar investigations should be carried out to determine the effect of use of computer in other areas of mathematics and sciences equally compare other modes of Computer

Assisted Instructions (CAI) like problem solving, Game Simulation, Logo, BASIC, MATLAB and so on.

Secondly, similar studies can be replicated in other Education Zones, States of the Federation; with larger samples. Finally, the researcher equally suggests that students and teachers in the rural areas should be remembered, so that they will be part of this technology.

Recommendations

The following recommendations were made based on the findings of this study:

1. Since the use of computer as Tutorial enhanced achievement and retention in Mathematics, the Mathematics teachers should use it as one of the strategies to be employed in teaching Mathematics in our schools.
2. Workshops/seminars should be organized by Government for Mathematics teachers to enable teachers learn how to use computer in teaching Mathematics.
3. Government and Non-Governmental Organizations (NGOs) should provide computers to schools so that every student will have access to computer.
4. Parents should equally encourage to buy computers for students to use at home after school hours. This will help students to practice what they have learnt in the school and equally discourage them from engaging in unnecessary activities after school.
5. Computer programmers and software producers should be encouraged to mathematics curriculum in the production of software and equally arranged them according classes.

Suggestions for Further Studies

Similar investigations should be carried out to determine the effect of use of computer in other areas of mathematics and sciences equally compare other modes of Computer Assisted Instructions (CAI) like problem solving, Game Simulation, Logo, BASIC, MATLAB and so on.

Secondly, similar studies can be replicated in other Education Zones, States of the Federation; with larger samples. Finally, the researcher equally suggests that students and teachers in the rural areas should be remembered, so that they will be part of this technology.

Conclusion

The following conclusions are made based on the findings of this study. The results of this study provided the empirical evidence that the use of computer as Tutorial enhanced students' achievement in Simultaneous Equation more than the use of computer as Drill and practice. Thus the effectiveness of computer in teaching Mathematics depends on the mode of usage. More so, that the use of computer in teaching simultaneous equation is better than teaching simultaneous equation without computer.

Also, there was no significant difference between the mean achievement scores of male and female students that were taught with computer as Drill and Practice and as Tutorial in Simultaneous. Thus the computer did not recognize whether a male or a female student was using it. This implies that gender has no significant effect on achievement of students in the Simultaneous Equation Achievement Test (SEAT).

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