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Effect of Algebrator Software Teaching Approach on Senior Secondary School Students' Interest and Achievement in Algebra in Kwande Local Government Area, Benue State Nigeria

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Abstract

This study examined the effect of Algebrator software teaching approach on senior secondary two students' interest and achievement in Algebra. The study was conducted in Kwande Local Government Area of Benue State. It adopted a quasi-experimental design of non-randomized pretest posttest control group with a population of 2,275 students in the 62 schools. A sample of 185 out of this population was used. The sample was selected using multi-stage sampling technique. Instruments for data collection were Algebra Interest Inventory (AII) and Algebra Achievement Test (AAT) which were validated by experts. AII and AAT were trial-tested and the reliability was calculated using Cronbach-Alpha and Kuder-Richardson 21(K-R21) and had reliability coefficient of 0.81 and 0.95

respectively. Means and standard deviations were used to answer all the research questions asked, while ANCOVA was used to test all the statement of hypotheses formulated at a = 0.05 level of significance. It was found that SS 2 students' interest and achievement in Algebra improved when taught using Algebrator software teaching approach, also there was no gender difference found in students' interest in Algebra. In addition, the use of Algbrator software teaching approach enhanced students' achievement in Algebra with respect to their gender. Recommendations based on the findings were equally made, that, in-service trainings given to mathematics teachers should include how to use Algebrator software teaching approach, and in the training, they should be encouraged to use this approach in their various classes among others.

Keywords: Mathematics, Algebra, Algebrator, Interest, Achievement, Software Teaching Approach

Introduction

The importance of Mathematics in our societies and to the development of any nation cannot be overemphasized. According to Kurumeh in Anyagh, Agbo-Egwu and Kalu (2017), the increasing importance and attention given to Mathematics stems from the fact that without Mathematics there is no science, without science there is no modern technology and without modern technology there is no modern society. Furthermore, Mathematics is the precursor, the queen of science and technology and the single indispensable element in modern societal development. The importance of Mathematics cannot be underestimated as the scientific and technological capability of any nation has become the social index and determining factor for assessing the economic progress, prosperity and power of nations.

Mathematics is the science that deals with the logic of shape, quantity and arrangement. It is also around us and in everything we do. Mathematics provides the structure and methodology for the study of virtually all the important modern disciplines, and also provides an important key to the understanding of the world in which we live (Olaifa, 2017). This implies that Mathematics is useful in domestic and business deals, scientific discoveries, technological breakthrough, problem-solving and decision making in different situations in life.

Emphasis on sound mathematical knowledge for pupils and students in primary and secondary schools is therefore for them to be able to reap the benefits of the acquisition of mathematical skills, live a better life and also be in a better position to directly or indirectly contribute to the development of the society and to the world's economy (Anaduaka, 2010).

The importance of Mathematics to the nation building has led to the Federal Government of Nigeria to make Mathematics a core subject to be offered by students at the basic, secondary and tertiary levels of education in Nigeria (National Policy on Education, 2014). Also, credit pass in Mathematics is a prerequisite for gaining admission into tertiary institutions for all science-based courses in Nigeria.

Despite the relevance of Mathematics in our societies and to the development of our nation, it is very disappointing to note that students' achievement in the subject is very low (Uche, 2011). The problem of Mathematics learning has been persistent, topical and attracts the attention of researchers (Pasha, Rao & Veerababu, 2012; Mensah, Okyere & Kuranchie, 2013). The low achievement in Mathematics examinations is linked to a number of factors which are responsible for this serious problem. In an attempt to proffer solution to this low achievement, researchers such as Akinoso (2010), Okeke (2012), Tshabalala and Ncube (2013), Iji, Ogbole and Uka (2014), Enu, Agyman and Nkum, (2015), Ajai and Imoko (2015), Abakpa and Anyagh (2015) have considered several factors ranging from inadequate teaching facilities, negative attitude of students and teachers towards the subject and inappropriate methods of teaching Mathematics among others.

Akinoso (2010) and Okeke (2012) identify poor teaching methods as the major factor contributing to low achievement of students in Mathematics. Iji, Ogbole and Uka (2014) identify lack of appropriate instructional materials for teaching Mathematics at all levels of education in Nigeria. Ajai and Imoko (2015) identify gender differences. Abakpa and Anyagh (2015) identify students' attitude and poor command of English language as well as disregard for the correct interpretation of questions before attempting them among others. Inappropriate approaches of teaching Mathematics seem to be the most prominent factor responsible for low achievement in Mathematics. It is possible that the approach of teaching this subject would contributes to students' low achievement in Algebra. This study focuses on whether the use of Algebrator software teaching approach can improve students' interest and achievement in Algebra at SS 2.

In addition, West African Examinations Council (WAEC) Chief Examiner's Report (2018) comments on candidates' weaknesses in Simultaneous Equation and Indices. Specifically, the report emphasizes on candidates' weaknesses in solving Simultaneous Equation involving Indices. Furthermore, the report indicates that most students avoid attempting questions in these areas while those who dare to attempt, score very low. Perhaps, the candidates' inability to answer questions on Indices and Simultaneous Equation could have been caused by the approach in which these concepts are taught.

Mathematics teachers are usually challenged to find the most effective approach of teaching students. Effective learning in Mathematics classroom involves teaching approaches that are innovative, interactive and students' activity-centred especially at the senior secondary school level. According to Pramila and Harsha (2012), classroom teaching of Mathematics should be engaging and intellectually stimulating to motivate students to learn Mathematics. Teachers of Mathematics are seriously finding other teaching approaches that can help students gain more knowledge and keep their interest in learning Mathematics. According to Mansil and Wiln in Sufiyanu, Sagir, Ibrahim and Aliyu (2017), learners are happier when they are engaged in Mathematics with a sense of personal accessibility, coalescence and application rather than just a body of knowledge and skills.

Pedagogical approaches that improve students' achievement ought to be used by Mathematics teachers. Okoyefi and Nzewi (2013) affirm that students achieved higher when they are exposed to approaches that interest them during the teaching and learning process. This has necessitates new search in Mathematics innovative teaching approaches, particularly the quest for suitable Mathematical software. There are many Mathematical software uses by secondary school students and teachers of Mathematics today. Some of them include GeoMatrix, Geometer sketchpad, Geogebra, Algebrator software among others. Research has shown that Algebrator software is a very authentic tool for effective teaching and learning Algebra (Yuliana, 2016; Ebhomien, 2016; Saleh, 2017; Ojaleye & Awofala, 2018).

Algebrator software is a Computer Algebra System Instruction (CASI) which enables students and Mathematics teachers to actively participate in constructing their Mathematical knowledge, practice what they have intended to learn, confront their misconceptions in Algebra and work with figures in realistic contexts on a computer screen. Algebrator software provides immediate feedback and engages students to acquire skills in learning Algebra. According to Noraini (2006), Algebrator software provides a flexible structured Mathematics laboratory that supports students' understanding of concepts at a realistic level, linking the concrete to the abstract. This could enhance the understanding of Indices and Simultaneous Equation as well.

From the National Curriculum for Senior Secondary Schools, Mathematics is divided into six themes which include: Number and Numeration, Algebraic Processes, Mensuration, Plane geometry, Trigonometry, Statistics and Probability. This study focuses on Algebraic processes which include the concepts of Simultaneous Equation and Indices which have been identified by WAEC Chief Examiner's Report (2018) as areas of students' difficulties in Algebra.

Algebraic process is an expression built up from constants, variables, and a finite number of operations (addition, subtraction, multiplication, division and exponentiation) by an exponent that is a rational number (Iji, Emaikwu & Utubaku, 2015). It is a generalization and extension of arithmetic in which symbols are employed to denote operations and letters to represent numbers or quantities. The researchers rightly state that Algebra serves as an opportunity gateway to higher level studies involving Mathematics. Russell (2014) affirms that Algebra develops one's thinking in specific areas like logic, patterns, problem-solving, deductive and inductive reasoning. Algebra as a gatekeeper of Mathematics is one of the areas of Mathematics in which students have major problems (Iji et al., 2015), and understanding Algebra is a prerequisite to the learning of many other mathematical concepts.

Students' interest in Algebra is also a factor relating to students' achievement in Mathematics. Despite the benefits of Mathematics to our daily activities and as an agent of nations' development and wealth creation, students' interest in learning Algebra has not been encouraging (Umoru & Ubom, 2013). If students do not have interest in Algebra even with the introduction of the Algebrator software teaching approach, the results of

their achievement might not be encouraging. Research on students' interest and achievement in Algebra should be considered as a continuous process until there is evidence of positive learning outcomes. This study therefore, investigates if using Algebrator software teaching approach would lead to students' higher interest and achievement in Algebra.

According to Onah (2015), achievement means a thing that somebody has done successfully, especially using one's own efforts and skills. Achievement, simply put, is accomplishing whatever goals one sets for him/herself, not necessarily earning a lot of money. Furthermore, Rix in Nneji (2013) states that academic achievement is a result-oriented construct that summarizes the extent of performance of a desired task. Also, Rix in Iji, Abakpa and Age (2018) mention that academic achievement depicts students' achievement on a standard of measurement such as achievement test, skill test and analytical thinking test. Thus, academic achievement reflects the amount or depth of knowledge gained by students as a result of taking part in a learning activity or programme.

Furthermore, Alfmio in Akpan (2017) state that academic achievement shows students' performance on a standard of measurements such as performance test, skill test and analytical thinking test. Achievement is something important that one succeed in doing by one's on efforts. Therefore, will Algebrator software teaching approach improve SS2 students' interest and achievement in Algebra when taught using this approach?

Gender issues have been linked with students' academic achievement in several studies without any convinced conclusion. Gender is the property which differentiates organisms on the basis of their reproductive roles as male and female (Abubakar & Uboh, 2010). Concerning gender; Achor, Imoko and Jimin (2012) state that the extent to which knowledge is dependent on gender appears not to be resolved yet. Furthermore, Achor, Imoko and Ajai (2010) verify the influence of gender on students' achievement in Mathematics; thus, has led to series of divergent views on the influence of gender on students' interest and achievement in Mathematics generally and Algebra in particular. According to Iji, Ogbole and Uka (2014), it has been observed that there exists inconsistency on gender issues as it affects students' achievement in Mathematics generally. Omenka (2010) attributes the low achievement of students in Mathematics, particularly between male and female to instructional modality adopted by teachers.

However, Agwagah in Iji, Abakpa and Age (2018) report that female students perform significantly better than their male counterparts in Mathematics. Harbour-Peters in Iji et al. (2018) share the view that boys outperform girls in Mathematics while Abiam and Odok in Iji et al. (2018) find no significant relationship between gender and achievement in number and numeration, algebraic processes and statistics.

It appears that gender differences in Mathematics are inconclusive and need further enquiry in this study to justify the claims of other researchers. It is as a result of the mention unresolved arguments that this work is also aims at contributing its part in

resolving gender differences in students' low interest and achievement in Algebra among senior secondary school students using Algebrator software teaching approach.

Theoretical Framework

Realistic mathematics education (RME) theory (Freudenthal, 1973)

Realistic Mathematics Education Theory is a theory propounded by Hans Freudenthal of Netherland in 1973. The theory states that Mathematics is a human activity that must be connected to reality. The theory emphasizes the actual activity of doing Mathematics; an activity, which should predominantly consist of organizing or mathematizing subject matter taken from reality. Learners should therefore learn Mathematics by organizing subject matter from real contexts and their own mathematical activity rather than from the traditional view of presenting Mathematics to them as a ready-made system with general applications. These real situations can include contextual problems or mathematically authentic contexts for learners where they experience the problem presented as relevant and real. According to the theory, the verb mathematizing or the noun thereof mathematization implies activities in which one engages for the purposes of generality, certainty, exactness and brevity.

Through a process of progressive mathematization, learners are given the opportunity to reinvent mathematical insights, knowledge and procedures. In doing so learners go through stages referred to in RME as horizontal and then vertical mathematization

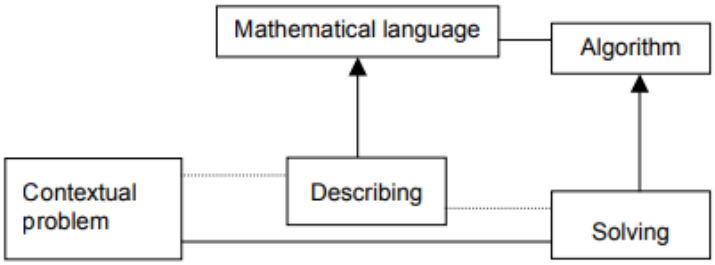

Figure 1: Representation of Horizontal and Vertical Mathematization

Horizontal mathematization is when learners use their informal strategies to describe and solve a contextual problem and vertical mathematization occurs when the learners' informal strategies lead them to solve the problem using mathematical language or to find a suitable algorithm. For example, in what we would typically refer to as a "word sum", the process of extracting the important information required and using an informal strategy such as trial and error to solve the problem, would be the horizontal mathematizing. Translating the problem into mathematical language through using symbols and later progressing to selecting an algorithm such as an equation could be considered vertical mathematization, as it involves working with the problem on different levels.

Mathematics lessons are often presented in such a way that the learners are introduced to the mathematical language relevant to a particular section of work and then shown a few examples of using the correct algorithms to solve problems pertaining to the topic before being given an exercise or worksheet to complete. The exercises or worksheets are usually intended to allow learners to put the algorithms they have been taught into practice and may even contain some contextual problems that require the use of these algorithms.

According to the RME model depicted in Figure 1, this type of approach places learners immediately in the more formal vertical mathematization process. The danger in this is that when learners have entered that process without first having gone through a process of horizontal mathematization, a strong possibility exists that if they forget the algorithms they were taught, they do not have a strategy in place to assist them in solving the problem. This experience can be equated to someone being shown and told what is on the other side of a river and being expected to use what is there for their own benefit. However, they are not given or shown the bridge that assists one in crossing to the other side in order to make proper use of what is there. The horizontal mathematization process provides this bridge.

Kolb's Experiential Learning (KEL) Theory (Kolb, 1984)

Kolb's Experiential Learning Theory is a theory propounded by David Kolb in 1984. The theory states that experience is critical in the development of knowledge construction, as learning occurs through discovery and active participation. Kolb defines learning as "the process whereby knowledge is created through the transformation of experience". There are two parts of Kolb's experiential learning theory. The first part is that learning follows a four-stage cycle; Kolb believes that, ideally, learners progress through these stages to complete a cycle, and, as a result, transform their experiences into knowledge. The second part to Kolb's theory focuses on learning styles, or the cognitive processes that occur in order to acquire knowledge. Essentially, Kolb believes that individuals can demonstrate their knowledge, or the learning that occurs, when they are able to apply abstract concepts to new situations.

Statement of the Problem

In spite of the seeming improvement of candidates' achievement in other areas of Algebra, West African Examinations Council results still indicate that their level of achievement in Indices and Simultaneous Equation is still very low. Could this be that Mathematics teachers have paid little attention to how well Indices and Simultaneous Equation should be taught? Researchers have identified that how well students understand Algebra concepts taught can be traced back to teaching approaches used. Unfortunately, it seems that majority of the senior secondary school Mathematics teachers today are still sticking to the traditional method of teaching involving chalk and talk as well as students' speedy note-taking. This promotes rote memorization which prevents students from relating concepts learned to a real-life situation leading to their views that Algebra is abstract and difficult to comprehend.

Inappropriate teaching approaches employ by teachers of Mathematics may be responsible for students' low interest and achievement in Indices and Simultaneous Equation. Therefore, there is a need to explore more teaching approaches in the quest to enhance students' interest and achievement in Algebra. This study thus, intends using computer-assisted instruction as an alternative teaching approach to find out if this may enhance students' interest and achievement in Algebra. Algebrator software teaching approach is one of such approaches that researchers are exploring its efficacy. It is in line with this, that this study is examining the effect of Algebrator software teaching approach on students' interest and achievement in Algebra at SS 2. This study seeks whether Algebrator software teaching approach may increase students' interest and their achievement in Algebra? Also, the study concerned whether there would be gender gap in mean interest ratings of male and female students' taught Algebra using Algebrator software teaching approach? Would there be gender gap in mean achievement scores of male and female students taught Algebra using Algebrator software teaching approach?

Objectives of the Study

The purpose of this study was to determine the effect of Algebrator software teaching approach on Senior Secondary School Students' interest and achievement in Algebra. Specifically, the study seeks to:

i. Determine the effect of Algebrator software teaching approach on Senior Secondary School students' interest in Algebra.
ii. Determine the effect of Algebrator software teaching approach on Senior Secondary School students' achievement in Algebra.
iii. Determine the effect of Algebrator software teaching approach on male and female Senior Secondary School students' interest in Algebra.
iv. Determine the effect of Algebrator software teaching approach on male and female Senior Secondary School students' achievement in Algebra.

Research Questions

The following research questions were asked in this study:

i. What are the mean interest ratings of Senior Secondary School Students taught Algebra using Algebrator software teaching approach and those taught without it?
ii. What are the mean achievement scores of Senior Secondary School Students taught Algebra using Algebrator software teaching approach and those taught without it?
iii. What are the mean interest ratings of male and female Senior Secondary School Students taught Algebra using Algebrator software teaching approach?
iv. What are the mean achievement scores of male and female Senior Secondary School Students taught Algebra using Algebrator software teaching approach?

Hypotheses

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

i. There is no significant difference between the mean interest ratings of Senior Secondary School Students taught Algebra using Algebrator software teaching approach and those taught without it.
ii. There is no significant difference between the mean achievement scores of Senior Secondary School Students taught Algebra using Algebrator software teaching approach and those taught without it.
iii. There is no significant difference between the mean interest ratings of male and female Senior Secondary School Students taught Algebra using Algebrator software teaching approach.
iv. There is no significant difference between the mean achievement scores of male and female Senior Secondary School Students taught Algebra using Algebrator software teaching approach.

Methodology

The design that was adopted for the study was pretest, posttest quasi-experimental design of non-equivalent group. This design according to Ali in Emaikwu, Iji and Abari (2015) is considered appropriate because it establishes a cause-effect relationship between the independent and dependent variables. This design was selected because it was not possible for the researcher to have control of all variables under experimental condition and also have complete randomization of subjects as this will affect the normal classroom organization of the selected schools. Intact classes were assigned at random to the experimental and control group. In this design of the study, the experimental group was taught using Algebrator software teaching approach while the control group was taught without it.

The population of the study was 2,275 senior secondary two students in 62 government approved senior secondary schools in Kwande Local Government Area of Benue State. The sample size of this study was 185 SS 2 students from two senior secondary schools in Kwande Local Government Area. The sample consists of both male and female students in the experimental and control group. Multi-stage sampling technique was used for the study because different sampling techniques were used at different stages of the study. The sampling techniques used were purposive sampling technique and simple random sampling technique. Two instruments were used for data collection. These are; Algebra Achievement Test (AAT) and Algebra Interest Inventory (AII). AAT is a teacher-made test constructed by the researcher. It made up of objective questions with four options A to D. The items in the instrument were based on the selected topics for the study. AII is a test instrument constructed by the researcher to measure the level of students' interest in Algebra. It used 4-point rating scale anchored on Strongly Agree (SA) = 4; Agree (A) = 3, Disagree (D) = 2 and Strongly Disagree (SD) =1. The instruments contained the bio data of the respondents.

The instruments were validated by three validates. 40 multiple choice questions were initially prepared for AAT while 30 statement items were also constructed for AII which were given to one expert in Measurement and Evaluation, one Mathematics educator both in Joseph Sarwuan Tarka University, Makurdi and one Mathematics teacher in Kwande Local Government Area for face and content validation. The three experts were also given copies of SS 2 Mathematics Curriculum, lesson plans and table of specification for objective assessment of the test items. Some of the questions with poor options were deleted, and some options that were poorly framed were either deleted or modified. Also, some of the questions that were outside the SS 2 Mathematics Curriculum were deleted. The validates' recommendations on face and content validity and their suggestions led to final draft of AAT and AII from 40 items to 25 items and 30 items to 25 items respectively.

A trial testing was conducted on 40 SS 2 students of Christ the King College Adikpo in the study area which was not one of those schools chosen for the study. The trial testing was done to determine the reliability of the instruments for the study. The data collected was used to compute the reliability coefficients of AAT and AII. Kuder-Richardson formula 21 (k-R21) was used in finding the reliability co-efficient of AAT. This method is applicable where test items are scored dichotomously (right or wrong) (Adikwu, Aduloju & Emaikwu, 2013). A reliability coefficient of 0.95 was arrived at for the AAT and thus reliability of the instrument ascertained. The data collected using the AII was also computed using Cronbach-Alpha and a reliability coefficient of 0.81 was obtained; indicating good measure of internal consistency for the instrument.

The researchers with the help of the research assistants administered the pretests to the SS 2 students in the two schools selected before lessons were commenced. Eight (8) lessons covering the content scope were conducted for the study to the two groups. At the end of the lessons, posttests were administered to both groups. The results of the posttests were used for analysis. Data was collected and subjected to both descriptive and inferential statistics. Research questions were answered using descriptive statistics of means and standard deviations while statement hypotheses were tested at 0.05 level of significance using inferential statistics of analysis of covariance (ANCOVA). The pretest scores and pretest ratings were used to establish the differences between posttests scores and posttest ratings. The choice of ANCOVA was to control differences across the groups. ANCOVA was used in testing of the null hypotheses based on the following reasons: (a) It performs a type of regression analysis that controls variables when examining the relationship between two or more quantitative variables; (b) It removes differences on the dependent variables that may be due to differences in extraneous variables; and (c) It also removes bias that may result from using intact groups whose equivalence on certain measures has not been determined.

Results

Research Question One

What are the mean interest ratings of SS 2 students taught Algebra using Algebrator software teaching approach and those taught without it?

Table 1: Mean Interest Ratings and Standard Deviations of SS 2 Students in the Algebrator Software Teaching Approach and Conventional Method

Group	N	Pre-Interest		Post-Interest		Mean Gain
		$\bar{x}$	SD	$\bar{x}$	SD	
Algebrator Software Teaching Approach	113	2.36	0.16	3.53	0.12	1.17
Conventional Method	72	2.35	0.10	2.97	0.17	0.62
Mean Difference		0.01		0.56		0.55
Total	185					

Results in Table 1 shows that, the mean pre-interest ratings of SS 2 students taught Algebra using Algebrator Software Teaching Approach is 2.36 with standard deviation of 0.16 while that of the students taught Algebra using the conventional teaching method is 2.35 with a standard deviation of 0.10. However, the mean post-interest rating for the experimental group is 3.53 with standard deviation of 0.12 while the mean post-interest rating for the control group is 2.97 with standard deviation of 0.17. The mean gain for the experimental and control group is 1.17 and 0.62 respectively. The mean difference between the interest ratings of SS 2 students taught Algebra using Algebrator Software Teaching Approach and those taught using the conventional teaching method is 0.56 in favour of the experimental group.

Research Question Two

What are the mean achievement scores of SS 2 students taught Algebra using Algebrator software teaching approach and those taught without it?

Table 2: Mean Achievement Scores and Standard Deviations of SS 2 Students in the Algebrator Software Teaching Approach and Conventional Method

Group	N	Pre-Interest		Post-Interest		Mean Gain
		$\bar{x}$	SD	$\bar{x}$	SD	
Algebrator Software Teaching Approach	113	37.81	5.24	55.33	10.55	17.52
Conventional Method	72	36.56	4.26	53.61	10.65	17.05
Mean Difference		1.25		1.72		0.47
Total	185					

Results in Table 2 shows that the mean pretest scores of SS 2 students for the experimental group which was exposed to Algebrator Software in the teaching and learning of Algebra is 37.81 with standard deviation of 5.24 and the mean pretest scores for the control group which was taught Algebra using the conventional teaching method is 36.56 with a standard deviation of 4.26. However, the mean posttest scores for the experimental and control group are 55.33 and 53.61 with standard deviation of 10.55 and 10.65 respectively. The mean gain for the experimental group was found to be 17.52 while the mean gain for the control was found to be 17.05.

The mean difference between the achievement scores of students taught Algebra using Algebrator Software Teaching Approach and those taught using the conventional teaching method is 0.47 in favour of the experimental group.

Research Question Three

What are the mean interest ratings of male and female SS 2 students taught Algebra using Algebrator software teaching approach?

Table 3: Mean Interest Ratings and Standard Deviations of Male and Female SS 2 Students in the Algebrator Software Teaching Approach Group

Gender	N	Pre-Interest		Post-Interest		Mean Gain
		$\bar{x}$	SD	$\bar{x}$	SD	
Male	52	2.38	0.17	3.54	0.13	1.16
Female	61	2.35	0.16	3.52	0.12	1.17
Mean Difference		0.03		0.02		-0.01
Total	113					

Results in Table 3 shows that the mean pre-interest ratings of the male and female SS 2 students in the Algebrator Software Teaching Approach group are 2.38 and 2.35 with standard deviation 0.17 and 0.16 respectively. The post-interest ratings for the male and female SS 2 students are 3.54 and 3.52 with standard deviation of 0.13 and 0.12 respectively. However, the mean gains for the male and female SS 2 students are 1.16 and 1.17. The mean difference between the male and female SS 2 students taught Algebra using Algebrator Software Teaching Approach is 0.02 in favour of the male students.

Research Question Four

What are the mean achievement scores of male and female SS 2 students taught Algebra using Algebrator software teaching approach?

Table 4: Mean Achievement Scores and Standard Deviations of Male and Female SS 2 Students in Algebrator Software Teaching Approach Group

Gender	N	Pre-Interest		Post-Interest		Mean Gain
		$\bar{x}$	SD	$\bar{x}$	SD	
Male	52	38.08	5.16	55.62	10.12	17.54
Female	61	37.57	5.33	55.08	10.99	17.51
Mean Difference		0.51		0.54		0.03
Total	113					

Results in Table 4 shows that the mean achievement pretest scores for the male and female SS 2 students in the experimental group is 38.08 and 37.57 with standard deviation of 5.16 and 5.33 respectively, while the mean of posttest scores for the male and female SS 2 students is 55.62 and 55.08 with standard deviation of 10.12 and 10.99. The mean gain for the male and female SS 2 students is 17.54 and 17.51 respectively. The mean difference between the achievement scores of the male and female SS 2 students that were exposed

to the usage of Algebrator Software in the teaching Algebra however was 0.03 in favour of the male students.

Statement of Hypothesis One

There is no significant difference between the mean interest ratings of SS 2 students taught Algebra using Algebrator software teaching approach and those taught without it.

Table 5: Summary of ANCOVA Results of SS 2 Students' Mean Interest Ratings in Algebrator Software Teaching Approach and Conventional Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	13.788[a]	2	6.899	347.387	0.000
Intercept	6.714	1	6.714	338.101	0.000
Pre-Interest	0-008	1	0.008	0.398	0.529
Group	13.760	1	13.760	692.887	0.000
Error	3.614	1	0.020		
Total	2045.416	185			
Corrected Total	17.412	184			

a: R Squared = 0.792 (Adjusted R Squared = 0.790)

From Table 5, the p-value for groups is 0.000. Since $p < 0.05$, the null hypothesis is rejected. This implies that, there is a significant difference between the mean interest ratings of SS 2 students taught Algebra using Algebrator software teaching approach and those taught without it. This means that the SS 2 students who were exposed to the Algebrator software in the teaching and learning of Algebra showed more interest in learning Algebra than their counterparts who were taught using the conventional teaching method.

Statement of Hypothesis Two

There is no significant difference between the mean achievement scores of SS 2 students taught Algebra using Algebrator software teaching approach and those taught without it.

Table 6: Summary of ANCOVA Results of SS 2 Students' Mean Achievement Scores in Algebrator Software Teaching Approach and Conventional Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	140.322[a]	2	70.161	0.622	0.538
Intercept	8582.468	1	8582.468	76.124	0.000
PreTest	10.773	1	10.773	0.096	0.758
Group	118.477	1	118.477	1.051	0.307
Error	20519.223	182	112.743		
Total	573376.000	185			
Corrected Total	20659.546	184			

a: R Squared= .007 (Adjusted R Squared= -.004)

From Table 6, the p-value for group is 0.307. Hence $p>0.05$, the null hypothesis is accepted. This implies that, there is no significant difference between the mean

achievement scores of Senior Secondary School Students taught Algebra using Algebrator software teaching approach and those taught without it. This means that, the students who were taught Algebra using Algebrator software and those that were taught using the conventional teaching method had a similar achievement in the Algebra taught during this period.

Statement of Hypothesis Three

There is no significant difference between the mean interest ratings of male and female SS 2 students taught Algebra using Algebrator software teaching approach.

Table 7: Summary of ANCOVA Results for Mean Interest Ratings of Male and Female SS 2 Students in Algebrator Software Teaching Approach Group.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	0.011[a]	2	0.005	0.354	0.703
Intercept	6.593	1	6.593	443.139	0.000
Pre-Interest	0.000	1	0.000	0.010	0.919
Gender	0.010	1	0.010	0.674	0.413
Error	1.637	110	0.15		
Total	1408.811	113			
Corrected Total	1.647	112			

a: R Squared = .006 (Adjusted R Squared = .012)

From Table 7, the p-value for gender is 0.413. Hence $p > 0.05$, the null hypothesis is accepted. This implies that there is no significant difference between the mean interest ratings of male and female SS 2 students taught Algebra using Algebrator software teaching approach. This means that, both the male and the female SS 2 students that were exposed to the Algebrator Software during teaching and learning of algebra demonstrated a similar level of interest in learning algebra.

Statement of Hypothesis Four

There is no significant difference between the mean achievement scores of male and female SS 2 students taught Algebra using Algebrator software teaching approach.

Table 8: ANCOVA Results for the Mean Achievement Scores of Male and Female SS 2 Students in the Algebrator Software Teaching Approach Group

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	52.579[a]	2	26.289	0.233	0.793
Intercept	5421.137	1	5421.137	47.997	0.000
PreTest	44.592	1	44.592	0.395	0.531
Gender	6.258	1	6.258	0.055	0.814
Error	12424.306	110	112.948		
Total	358384.000	113			
Corrected Total	12476.885	112			

a: R Squared = .004 (Adjusted R Squared = .014)

From Table 8, the p-value for gender is 0.814. Hence p>0.05, the null hypothesis is accepted. This implies that, there is no significant difference between the mean achievement scores of male and female SS 2 students taught Algebra using Algebrator software teaching approach; hence both the male and female SS 2 students that were exposed to the Algebrator Software improved equally and greatly on their achievement in Algebra.

Discussion of Findings

Results from Table 5 indicates that there is a significant difference between the mean interest ratings of SS 2 students taught Algebra using Algebrator software teaching approach and those taught without it with $p < 0.05$. This means that the SS 2 students who were exposed to the Algebrator software in the teaching and learning of Algebra showed more interest in learning Algebra than their counterparts who were taught using the conventional teaching method. This result is in agreement with the study of Ojaleye and Awofala (2018) who found that the use of Algebrator software teaching approach enhanced students' interest in Algebra. Again, it is in line with the study of Iji, Abakpa and Age (2018) who found that students taught geometry using Geometer's Sketchpad approach showed greater interest in learning geometry than those taught with traditional approach. It also confirms the findings of Emaikwu, Iji and Abari (2015) who revealed that students taught statistics using geogebra teaching method showed greater interest in learning statistics than those taught with conventional teaching approach.

Results from Table 6 shows that there is no significant difference between the mean achievement scores of SS 2 students taught Algebra using Algebrator software teaching approach and those taught without it with $P > 0.05$. This means that, the SS 2 students who were taught Algebra using Algebrator software and those that were taught using the conventional teaching method had a similar achievement in the Algebra taught during this period. This result is in support of Rosali (2020) who found that both Computer-assisted instruction and conventional method of teaching improve the level of performance/achievement of students in physics significantly. This result also agrees with the findings of Orifah (2022) who revealed that computer-assisted instruction improved students' achievement in Chemistry.

Furthermore, results from Table 7 indicates that there is no significant difference between the mean interest ratings of male and female SS 2 students taught Algebra using Algebrator software teaching approach with $P > 0.05$. This means that, both the male and female SS 2 students that were exposed to the Algebrator Software during teaching and learning of Algebra demonstrated a similar level of interest in learning Algebra. This result is in agreement with the findings of Emaikwu, Iji and Abari (2015) who revealed that both male and female students that were taught statistics using the geogebra teaching method showed similar interest in statistics.

Similarly, results from Table 8 shows that there is no significant difference between the mean achievement scores of male and female SS 2 students taught Algebra using Algebrator software teaching approach with $P > 0.05$; hence both the male and female SS 2 students that were exposed to the Algebrator Software improved equally and greatly on

their achievement in Algebra. This agreed with the findings of Emaikwu, Iji and Abari (2015) who revealed that both male and female students taught statistics using geogebra have the same level of achievement.

Summary

The study was conducted in Kwande Local Government Area of Benue State, Nigeria in order to improved senior secondary school students' interest and achievement in Algebra. This became important since low achievement of students in Algebra is recorded in external examinations, and that most of them do have low interest in Algebra. Mathematics is an important subject; therefore, a pass in it is compulsory for students to gain admission into tertiary institution. This study investigated the effect of using Algebrator software teaching approach on students' interest and achievement in Algebra. It equally determined the efficacy of the Algebrator software teaching approach on gender with respect to interest and achievement. Four research questions were asked and four statements of hypotheses were formulated and tested at 0.05 level of significance for the study.

Quasi-experimental of non-randomized pretest-posttest control group design was adopted and multistage sampling was used to obtain the sample of the study. However, intact classes were used for the selection of the students. Research questions were answered using mean and standard deviation, while statements of hypotheses were tested using ANCOVA at 0.05 level of significance.

The results of the study showed that students taught Algebra using Algebrator software teaching approach improved statistically upon their interest and achievement, and that, male and female students taught Algebra using Algebrator software teaching approach improved equally upon their interest and achievement. The study has its contribution to knowledge for it had brought into attention that the use of Algebrator software teaching approach is capable of reducing low Algebra interest and achievement among students irrespective of gender.

Conclusion

In conclusion, the utilization of Algebrator software teaching approach in the teaching and learning of Algebra gave significant improvement both in students' interest and achievement. Also, students taught Algebra using Algebrator software teaching approach improved in their interest in Algebra more than the students taught Algebra using conventional method. In addition,the use of Algebrator software teaching approach in teaching and learning Algebra enhanced students' interest as well as their achievement in Algebra irrespective of their gender.

Recommendations

Recommendations based on the findings of this study were made as follows:

i. In-service training giving to mathematics teachers should include how to use Algebrator software teaching approach, and in the training, they should be encouraged to use this approach in their various Algebra classes.

ii. Mathematics teachers should employ Algebrator software teaching approach in their Algebra classes which could make the students to be active participants in the teaching and learning process to improve their level of achievement in Algebra.

iii. Stakeholders such as Mathematical Association of Nigeria (MAN) and Science Teachers Association of Nigeria (STAN) should promote this approach through workshop, conferences and publications.

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