EFFECT OF GEOGEBRA SOFTWARE ON SENIOR SECONDARY STUDENTS ACADEMIC ACHIEVEMENT IN ALGEBRA IN PANKSHIN LGA OF PLATEAU STATE

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Abstract
The study investigated the effect of GeoGebra software on the students' academic achievement in algebra among senior secondary school students two in Pankshin LGA of plateau state. The quasi – experimental non-equivalent research design was adopted using the intact – classes of the sampled schools. Each sampled school has both the experimental and control groups. The population of the study comprises of 5535 students of the 40 public and private secondary schools in Pankshin LGA in Plateau state. Four schools and 150 students were sampled for the study. The researchers used Algebra Achievement Test (ALAT) to collect the data. Three research questions and hypotheses were used. The research questions were answered using descriptive statistics (mean and standard deviation) while the hypotheses were tested using ANCOVA at 0.05 level of significance. The result obtained showed that those taught algebra using GeoGebra software performed better than those taught without GeoGebra software. Male and female students taught using GeoGebra showed no significant difference in their achievement in algebra. Meanwhile, private school students taught algebra using GeoGebra software performed better than their counter part in the public schools. Hence the study concluded that GeoGebra software has positive impact on student's achievement in algebra. It was recommended that teachers should be encourage to use CAI in teaching the students to increase their commitment in learning mathematics. Government and the private school proprietors should make provision of computers and the software to facilitate teaching of mathematics in our secondary schools.

Background to the study
Recent research on learning indicates that technology can play a critical role in changing classroom environment and restructuring schools to promote more meaningful and result oriented learning. Some of the widely used technologies in the classrooms are computers and their associated software, videos and projectors. According to Odili (2006) learning with the help of computers will lead not only to the development of skills but a sense of enjoyment in the process of learning. Odili further emphasized that the current software development like GeoGebra, Mathlab, Mathtype just to mention a few allows teachers and students to use computers without necessarily understanding the more technical hardware components. It is therefore within the preview of mathematics educators to develop instructional strategies that will attract students' interest in learning algebra in the secondary school, been one of the most dreadful topic in mathematics.

GeoGebra is an interactive mathematics software program for teaching and learning mathematics and sciences from primary school up to university level. Geometrical constructions can be made with points, vectors, segments, lines, polygons, conic sections, inequalities, implicit polynomials and functions. All of them can be changed dynamically afterwards. Elements can

be entered and modified directly via mouse and touch, or through the Input Bar. GeoGebra has the ability to use variables for numbers, vectors and points, find derivatives and integrals of functions and has a full complement of commands like Root or Extremum. Teachers and students can use GeoGebra to make conjectures and to understand how to prove geometric theorems (Wikipedia).

There is a widespread belief that technologies have an important role to play in changing and modernizing educational systems and ways of learning. When one looks at the current widespread diffusion and use of Information and Communication Technology (ICT) in modern societies, especially by the youth, it becomes clear that ICT will affect the complete learning process today and in the future.

Mathematics has importance in science and technological advancement of all nation. However, its study in Nigeria secondary school but has been bedeviled by incessant poor performance among students. The problems could be associated with the teaching and learning of mathematics topics have continued to attract topical issues which has gained the attention of researchers in mathematics education. The consistent low achievement in mathematics among secondary students is a clear manifestation of the problem of teaching and learning mathematics. West African Examination Council Chief Examiners' reports (2018-2019). Bot (2011) Imoke and Agwagah (2012) and Unodiaku (2012).

Significant researches (Imoko & Agwagah (2012); Abiam & Odok, 2016) have indicated the influence of gender on interest and academic achievement of students in mathematics. Therefore, the search for a good instructional delivery strategy that may stimulate the interest of students' in algebra and facilitate their overall achievement in Mathematics cannot be overemphasized. The process of learning algebra is a very complex cognitive task that can be very imposing on the students. It is therefore pertinent that Mathematics educators examine the opportunities of new technologies in other to enhance their teaching styles, capture the interest of students in the classroom and facilitate the subsequent achievement of students. Ahmed and Rohani (2010) conducted a research using GeoGebra software to test students' achievement and interest in algebra and found out that there was a significant difference in mathematical achievement between the GeoGebra group and the traditional teaching strategy group. His findings showed that the students in Geogebra group performed better than the students in the traditional group

Therefore, the use of Computer Aided Instruction (CAI) especially GeoGebra may serve as a great relief to secondary school teachers in search of instructional method for teaching the topics if properly researched into and integrated into the teaching pedagogy. Hence this study was designed to investigate the effect of computer Aided Instruction on students' achievement in algebra.

Hence the study investigated the influence of the aforementioned software (GeoGebra software) has on the academic achievement of senior secondary school student in Algebra in the study Area.

Statement of Problem

Mathematics has always been a prerequisite for gaining admission into Nigerian tertiary institutions, unfortunately, the consistent poor achievement of students in both internal and external examinations that students find mathematics difficult especially topics in school mathematics such as algebra. Difficulties observed in learning algebra has been associated with

poor teaching strategies mathematics teachers use in teaching the topics, which failed to arouse the interests of the students in learning the subject.

In review of the empirical studies on CAI, Computer assisted instruction has been found to enhance students' performance, especially mathematics than the conventional instructional method in counselor education. Based on a review of several studies and shortcoming on studies comparing CAI with conventional instruction, CAI can be considered as effective than the traditional instruction. Furthermore, how CAI is delivered can affect its effectiveness, and that new studies are needed to clarify the effect of CAI in contemporary students' environment. Therefore, the study intends to investigate the influence of GeoGebra software on the academic achievement in algebra among senior secondary school II students in Pankshin LGA, Plateau State.

Purpose of the study

This study aimed at investigating the effect of GeoGebra software on the academic achievement in Algebra among senior secondary school students II in Pankshin LGA, Plateau State. While the specific objectives are:

1. The effect of GeoGebra software on student academic achievement in algebra.
2. The effect of GeoGebra software on the mean achievement score of male and female student in algebra
3. The impact of GeoGebra software on the mean achievement score of public and private school students in algebra.

Research Question

In view of the above, the following research questions were formulated to guide the conduct of the study:

1. What is the difference in mean and standard deviation achievement test score of students taught algebra using GeoGebra software and the traditional method?
2. What is the difference in mean and standard deviation achievement test score of male and female student taught algebra using GeoGebra software?
3. What is the difference in mean and standard deviation achievement test score of public and private school students taught algebra using GeoGebra software?

Research Hypotheses

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

H_{01}: There is no significant difference in the mean achievement scores of student taught algebra using GeoGebra software and those taught using the traditional method.

H_{02}: There is no significant difference in the mean scores of male and female students taught algebra using GeoGebra software.

H_{03}: There is no significant difference in the mean scores of public and private school students taught algebra using GeoGebra software.

Method

The study employed the quasi-experimental non-equivalent (pre-test and post- test) control group design. There are 40 secondary schools in Pankshin LGA, and out of the 40 schools (25 public schools and 15 private schools). The total population of the students as revealed by the area inspectorate office in Pankshin LGA for the year 2019/2020 academic session is 5,535. Intact classes were used with the sample of 150 students. 70 males and 80 females were used. 4

schools were selected using the purposive sampling technique. (Two private and two public schools). Two schools were used as the experimental group and the other two were used as control group. The researchers used 6 weeks for the application of the treatment to both the experimental group and the control group.

The instrument used for this study was Algebra Achievement Test (ALAT) which comprises of twenty-five items; with options A to D and only one response is correct. The topics covered for the ALAT in the package are quadratic equation, factorization, simplification, simultaneous linear equation, and word problem.

The researcher ensured that, the instrument was of good quality and covered the areas in algebra. The bloom taxonomy table of specification was used during instrument development. The instrument passed through three experts from mathematics department to ensure its validity.

The reliability of the items was computed using the Cronbach alpha formula. The test was administered once on pilot samples of twenty students. Reliability test using the Kuder Richardson formula revealed a reliability coefficient of 0.82 was obtained which was considered adequate for the study. Pre test was administered to both experiment and control groups before the treatment, and after the treatment, a post test was administered to both groups. The result was collated and analysed using descriptive statistics consisting of mean, standard deviation in answering the research questions while Analysis of covariance (ANCOVA) was used to test the hypotheses using SPSS statistical package version 21.

Result

The data obtained was used to the research questions and the hypotheses.

Research Question 1: What is the difference in mean achievement scores of students taught algebra using GeoGebra software and those taught using the traditional method of teaching?

Table 1: Mean and Standard deviation of Experimental (GeoGebra software) and control (lecture) group in Algebra Achievement Test (ALAT)

Variable	N Mean (pre)	Mean (post)	SD	MD
Experimental	77 45.06	52.73	12.58	6.96
Control	73 43.98	45.77	13.32	

Table 1 shows that the experimental group (EG) had a higher mean score of 45.06 and 52.73 for pre and post test against that of control group (CG) of 43.98 and 45.77 for pre and post test respectively. Theses result indicated that, there is a difference in mean achievement scores between the two groups in favour of the experimental group.

Research Question 2: What is the difference in mean scores of male and female students taught algebra using GeoGebra software?

Table 2: Post test Mean and Standard deviation of Male and Female Students of the Experimental group (GoeGebra software) in Algebra Achievement Test (ALAT)

Variable	N	Mean	SD	MD
Male	32	62.83	10.79	5.7
Female	38	68.53	11.08	

Table 1 shows that the female students had a higher mean score of 62.83 against that of their male counterpart with 68.53. Theses result indicated that, there is a difference in mean achievement scores between the two groups in favour of the female students.

Research Question 3: What is the difference in mean achievement scores of public and private school students taught algebra using Geogebra software?

Table 3: Mean and Standard deviation of Public and Private school Students of the Experimental group (GoeGebra software) in Algebra Achievement Test (ALAT)

Variable	**N Pre test mean**	**Post test Mean**	**SD**	**MD**
Private	30 60.45	68.76	13.27	6.66
Public	40 56.89	61.10	13.53	

Table 3 shows that the private school students had a higher mean score of 60.45 and 68.76 for pre and post test against that of their public schools counterpart with 56.89 and 61.10 for pre and post test respectively. Theses result indicated that, there is a difference in mean achievement scores between the two groups in favour of the private school students.

H_{01}: There is no significant difference in the mean achievement score of student taught algebra using GeoGebra software and the traditional method.

Table 4: ANCOVA Result of Mean Academic Achievement score of student Taught Algebra using GeoGebra Software and Conventional Method

Dependent Variable: Post Test						
Source	Type I Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	13032.137[a]	3	4344.0454	239.923	.000	.922
Intercept	165954.391	1	165954.391	9165.662	.000	.993
Pre Test	8244.033	1	8244.033	455.318	.020	.882
Method	4788.105	1	4788.105	264.447	.000	.813
Error	1104.472	61	18.106			
Total	180091.000	64				
Corrected Total	14136.609	63				
a. R Squared = .922 (Adjusted R Squared = .919)						

The result in Table 4 showed that the p-value (0.00) < α(0.05) hence, the null hypothesis is rejected. Hence it was concluded that there is difference in the mean achievement scores of students taught algebra using GeoGebra software and those taught with the traditional method. The result is in favour of the experimental group.

H_{02}: There is no significant difference in the mean achievement scores of male and female students taught and algebra using GeoGebra software.

Table 5: ANCOVA Result of Mean Academic Achievement scores of Male and Female students Taught Algebra using GeoGebra Software

Dependent Variable: Post Test						
Source	Type I Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	5378.231[a]	2	2689.115	97.691	.000	.863
Intercept	113565.441	1	113565.441	4125.646	.000	.993
Pre Test	5331.563	1	5331.563	193.687	.000	.862
Sex	46.668	1	46.668	1.695	.202	.052
Error	853.328	31	27.527			
Total	119797.000	34				
Corrected Total	6231.559	33				

a. R Squared = .863 (Adjusted R Squared = .854)

The result in Table 5 showed that the p-value (0.202) > α (0.05), this implies that we fail to reject the null hypothesis of no significance differences in the mean achievement score of male and female students taught algebra using GeoGebra Software. Hence, we conclude that there is no significance differences in the mean achievement score of male and female students taught algebra using GeoGebra software.

H_{03}: There is no significant difference in the achievement mean scores of public and private school student taught algebra using GeoGebra software.

Table 6: ANCOVA Result of Mean Academic Achievement scores of Private and Public Schools students Taught Algebra using GeoGebra Software

Dependent Variable: Post Test						
Source	Type I Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	23256.069[a]	3	7752.0229	216.4765	.000	.914
Intercept	202612.516	1	202612.516	5657.974	.000	.989
Pre Test	19565.557	1	19565.557	546.370	.001	.900
Schools	3690.512	1	3690.512	103.058	.000	.628
Error	2184.415	61	35.810			
Total	228053.000	64				
Corrected Total	25440.484	63				

a. R Squared = .914 (Adjusted R Squared = .911)

The result in Table 6 showed that the p-value (0.00) < α(0.05) hence, the null hypothesis is rejected. Hence it was concluded that there is difference in the mean achievement scores of public and private schools' students taught algebra using GeoGebra software in favour of the private schools students.

Discussion of the Findings

The research was aimed at assessing the effect of GeoGebra software on student's achievement in algebra among SSII students. The result in table 4 indicated that students taught algebra using

computer aided instruction (Geogebra Software) has higher achievement scores than those taught using the traditional method of teaching. This result further reinforces the efficacy of CAI (Computer Assisted Instruction) on academic achievement of students' in algebra. Similar study was conducted by Kausar, Chouldhry and Gujjar (2008) and it was observed that there was increase in cognitive achievement of students taught through CAI (Computer Assisted Instruction). The authors also observed that total gain in cognitive domain by CAI (Computer Assisted Instruction) was significantly superior to the total gain in cognitive domain by conventional teaching method.

According to the result in Table 5 indicated that there is no significant difference in the mean achievement scores between male and female students. The null hypothesis was not rejected. The findings coincided with the findings of Abiam and Odok (2006) who found no significant relationship between gender and achievement in number and numeration, algebraic processes and statistics. Yusuf and Afolabi (2010) observed that gender had no influence on the performance of students in science subjects whether they were taught with CAI (Computer Assisted Instruction) in individualized or cooperative setting.

The result on table 6 indicated that the achievement of students taught algebra using GeoGebra teaching method base on school type (private and public) reveals significant difference in the mean achievement score of students in private schools and public schools taught algebra using GeoGebra software. the result from the mean achievement score between private and public schools shows that students from the private schools performed better than that of their counterpart in public schools. This agree with the general believe about private school been well equipped than the public schools.

Summary

The study "Effect of GeoGebra software on the academic achievement in algebra among senior secondary school students in Pankshin LGA, Plateau State" was aimed at examining the academic achievement of students taught algebra using GeoGebra software among secondary school students in the study area. The findings of the study showed that GeoGebra software used improve students achievement in algebra. Gender has no significant effect on the academic achievement of SSII students when they were taught algebra using GeoGebra software. Schools type (private and public) has significant effect on the academic achievement of SSII students when algebra is taught using GeoGebra software.

Contribution to knowledge

1. CAI (GeoGebra software) has been proven to be a catalyst to rid learning disability.
2. Students develop interest in learning algebra using CAI.

Recommendations

Based on the finding emanating from this study, the following recommendations are suggested:

1. Teachers should be encouraged to use CAI in teaching their students to increase their interest in mathematics.
2. Government should make provision for computers in the public schools to enable their teachers to teach their students using CAI.

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