

COMPARATIVE ANALYSIS OF COMPUTER ASSISTED INSTRUCTION VERSUS TRADITIONAL INSTRUCTION ON STUDENTS' ACADEMIC PERFORMANCE IN GEOMETRIC CONSTRUCTION IN SOKOTO METROPOLIS

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ABSTRACT

This study investigated the Effects of Computer Assisted Instructions on Students' Academic Performance in Geometric Constructions among Senior Secondary Schools in Sokoto States. Twelve (12) with a total of 292 SS 2 students were sampled for the study using stratified sampling technique. Three research questions and three null hypotheses were raised to guide the conduct of the study. One instrument SGCT with reliability index 0.86, was adapted and used for data collection. T-test and ANOVA statistical analysis at $\alpha = 0.05$ level of significance were used to test the hypotheses. Two null hypotheses were rejected and the last hypothesis was retained. Base on the findings, it was recommended that since the results of teaching through the use of Computer Assisted Instructional Method was proved to be better than traditional method, it is therefore recommended that Ministry of Educations (MOEs), Curriculum planners and Developers should review their policies to inculcate this strategy in teaching science and science related subjects designed in the Nigeria Curriculum System of Education. Parents were also recommended to use the benefits of the findings of this study to support both their children and the school with these computer electronic gadgets for better performance of students in science subjects.

Keywords: Computer Instructions, Geometric Constructions, Computer Electronic gadgets, Academic Performance.

INTRODUCTION

Geometric construction is branch of geometrical topics which refers to the problem solving technique that uses geometric tools such as a straightedge and pair of compasses to construct figures with certain properties (Ukaigwe, & Evelyn, 2022). The skills required in construction are to draw accurate figures based on the given information. This skills are essentials for many fields outside of mathematics such as Engineering, Architectural design, Technical and engineering drawings, Statistics, Geography, Science, Technology, etc. By learning

geometrical constructions, students are also developing skills like critical thinking and problem solving that will serve them well in any field they pursue (Rosali, 2020)

Computer Assisted Instruction (CAI) as cited by Likit & Mamuda, (2022), is the use of computers to teach students through drill-and-practice; tutorials or simulative activities as a supplement to traditional teacher directed instruction. The use of computer as a teaching and learning tool suggested opportunities for learner's control, improved enthusiasm, associations to the real world and enhance students' achievement as a measure in variety of ways, including, standardized achievement test (Anigbo & Ndukwe, 2016).

The traditional instruction refers to the use of conventional standard methods and tools in teaching mathematics in the classroom, such as the use of rulers, pencil and paper to carry out the content of the given subject (Agwagah, 2016). Learning takes place in this standard method in the classroom as well, work is presented on the board and the use of textbook is commonly practiced. The instruction is completely teacher oriented; question and answer method is mostly used by teachers during instructions.

In this study therefore, Computer Assisted Instruction (CAI), refers to the instructions carried out using educational mathematics software to facilitate learning and teaching through the direct interaction between students and the computer individually while the teacher facilitate, direct, guide and assist where necessary.

Statement of the Problem

Science, Technology and Mathematics nowadays are mostly the vibrant subjects this modern world is rowing in the area of developmental civilization. The distinguishing factor between the developing and developed nations of the world today can be viewed from their level of creation, mastery and utility of modern science, adequate knowledge of mathematics and technology, while geometry is the fundamental and ingredient to both (Yusha'u, 2016).

In Sokoto state there are many senior secondary schools and technical colleges teaching mathematics and technical subjects designed in Nigerian curriculum. In each of these schools, there are available technical and instructional materials and qualified teachers handling these subjects. However, despite all the qualified teachers and the materials available, the performance of students in geometric constructions, technical and engineering drawing, was poor.

According to Chief Examiner's Report of WASCE (2019 – 2023), the poor students' performance in those areas was because most teachers skipped this segment due of its difficulty and commitment required from both the teachers and students. The few teachers that teach the topics adapted traditional method of teaching where students were given some photocopies of constructed geometric figures from the texts to study and memorize during examinations. Also NABTEB chief examiners of (2021-2024) reported that many candidates avoided questions in technical drawing and geometric constructions. Those attempted them, recorded very low marks which resulted in massive students' failure in their general mathematics examinations.

In this light, the researchers compared the effectiveness of computer assisted instructional teaching method and traditional method to investigate whether there are significant differences in the academic performance of SS II students in geometric constructions in Sokoto Metropolis.

Objectives of the Study

This study has two objectives as follows:

- 1- To find out if computer assisted instruction has any effects on students' academic performance on geometric constructions among senior secondary school students in the Sokoto Metropolis.
- 2- To determine if gender difference exists in academic performance between senior secondary school students taught geometric constructions using Computer Assisted Instructional method in Sokoto Metropolis.
- 3- To find out if differences exist in academic performance between senior secondary school students taught geometric constructions using Computer Assisted Instructional method among the three Local Government Areas in Sokoto Metropolis.

Research Questions

The following research questions were raised to guide the conduct of this study:

- 1- Is there any difference in academic performance between students taught geometric constructions using Computer Assisted Instructions and those taught using traditional method in Sokoto Metropolis?
- 2- Is there any gender difference in academic performance between male and female senior secondary school students taught geometric constructions using Computer Assisted Instructional method in Sokoto Metropolis?
- 3- Is there any difference in academic performance between senior secondary school students taught geometric constructions using Computer Assisted Instructional method among the three Local Government Areas in Sokoto Metropolis?

Null Hypotheses

The following null hypotheses were also generated to guide the conduct of the study:

- 1- **H₀₁**: There is no significant difference in academic performance between students taught geometric constructions using Computer Assisted Instructions and those taught using traditional method in Sokoto Metropolis.
- 2- **H₀₂**: There is no significant gender difference in academic performance between male and female students taught geometric constructions using Computer Assisted Instructions in Sokoto Metropolis.
- 3- **H₀₃**: There is no significant difference in academic performance between senior secondary school students taught geometric constructions using Computer Assisted Instructional method among the three Local Government Areas in Sokoto Metropolis

Review of Related Empirical Studies

Some literatures related to the use of computer assisted instruction in teaching to assess the students' performance were reviewed in and outside Nigeria. Some of them include the study conducted by Leann (2020) conducted a study to determine the effect of implementing a Computer-Assisted Instruction on secondary physics students' academic performance in Philippines. Z test with a significance level of 0.05 was used in comparing the performance of

both groups to determine the effect of the CAI. The findings of the study show that both CAI and conventional methods of teaching improve the level of performance of students in physics significantly. However, when the effectiveness of the two methods is compared, there is no significant difference between their effects on academic achievement. Therefore, CAI could be used as an alternative teaching method.

Koni, Zephaniah, and Mercy (2019) carried out a study to investigate the effect of computer assisted instructional package on secondary school student's performance in arithmetic progression in Port Harcourt Local Government Area, Rivers State, Nigeria. Two research questions and two null hypotheses were formulated to guide the study. T-test was use in testing the hypotheses at 0.05 level of significant. The result from the study showed that there was a significant difference between the mean achievement scores of student who were taught with computer assisted instructional package and those who were taught by lecture method. There was also a significant difference between the mean achievement scores of male and female student who were taught with computer assisted instructional package in favour of male students.

Kofi, Nelly and Valentina (2019) carried out a study to investigate the effects of computer assisted instruction in integrated science on Distance Education students in Greater Accra, Western, Brong Ahafo and Ashanti Regions in Ghana. Two research questions and two hypotheses were formulated for the study. The experimental group was exposed to computer-assisted instruction package in integrated science while the control group was taught the same topics with the Lecture method. The data were analyzed using the Analysis of Variance (ANOVA. The findings of the study showed that students taught integrated science with computer-assisted instruction package in integrated science performed better than those taught with conventional teaching method and gender had an effect on their integrated science achievement scores.

Alhassan, Ezenwa and Wushishi (2015) conducted a study to determine the effectiveness of Computer- Assisted Instructional package (CAIP) on performance and retention in geometry among junior secondary schools in Minna Metropolis, Niger state, Nigeria. Two research questions were raised and two null hypotheses were tested. Eighty (80) students were randomly drawn from four junior secondary schools in Minna Metropolis. The t-test statistics was used to analyze the hypotheses. The findings revealed that there is significant difference between the mean achievement score of junior secondary school students taught geometry with CAI and those taught with lecture method. Also there is significant difference between the mean retention score of junior secondary school students taught geometry with CAI and those taught using lecture method. In another study, Harbor-Peter (2002) investigation on the effect of computer-assisted instruction on gender and performance of junior secondary school students in mathematics also reported that male students exposed to computer-assisted instruction attained significantly higher mean scores than the female students exposed to same instructional strategy.

However, in most of the related empirical studies reviewed, it was found that research in geometric constructions which is very vital topic in the field of architectural designing, technical and engineering drawing was not conducted using any electronic means such as computer assisted instructional package in Sokoto state. In this study therefore the researchers

used computer assisted instructional package to teach the sampled students how to construct some geometric figures using computer system and projectors, in Sokoto central educational zone.

Research Methodology

Sokoto metropolis has three Local Government Areas (Sokoto South, Sokoto North and Wamakko). The target population of for study therefore is the whole SS II students in Sokoto metropolis. 12 senior secondary schools were purposefully sampled for the study. Six (6) male and six (6) female schools with a total of 327 SS II students were sampled using stratified sampling techniques to participate in the study as shown in the table below

Table 1: Summary of Sampled Schools, Category, Gender and Number of students

LGA	School	Group	Gender	No. of SS 2 Students	No. Students in Intact Class
S. North	GDSS Kofar Marke	Experimental	M	115	22
	GGDSS Kafar Marke	Experimental	F	108	30
	GDSS Kofar Rini	Control	M	110	26
	GGDSS Runjin Sambo	Control	F	113	32
S. South	Sokoto Science College	Experimental	M	104	23
	G.G.C. Sokoto	Experimental	F	208	27
	Sultan Abubakar Coll.	Control	M	108	31
	Nana Girls' College	Control	F	216	33
WMK	G. Tech. C. Farfaru	Experimental	M	165	16
	GGDSS Badon Barade	Experimental	F	109	32
	SDUSS Sokoto	Control	M	110	23
	GGDSS Arikilla	Control	F	122	32
TOTAL				1,588	327

Source: Examination Units of the sampled schools (2024/2025)

Table 1 shows the twelve sampled schools in the three sampled Local Government Areas with total of 1,588 students. Two hundred and ninety two (327) students in twelve intact classrooms to participate in the study. One hundred and forty one (141) were male while one hundred and eighty six (186) were female students.

Instrumentation

Instrument named Geometric Construction Test (GCT) was adapted by the researchers for the purpose of collecting data for this study. The instrument EGCT has two sections. Section A

contained twenty objective questions and section B contained 5 theory questions. Students were required to attempt all questions in section A and any three questions in section B.

Validity of Geometric Construction Test (EGCT)

Geometric Construction Test (GCT) was submitted to experts for their assessments, comments and suggestions. On the basis of their advice some test items were modified and some were reduced. Section A which has twenty objective questions was reduce to ten objective questions. Section B which has 5 theory questions was modified but number of questions was maintained. Marking schemes was also adjusted to 4 marks for each question answered correctly in section A, and a total of 20 marks for each theory question answered correctly in section B. This give a total of 100 marks if the required questions were answered correctly.

Reliability of Geometric Construction Test (GCT)

Test and re-test method was conducted. This was done by administering GCT to a sample of twenty (20) students from SSCOE Staff secondary school, Sokoto. After an interval of two weeks the same GCT was again re-administered to the same sample of twenty (20) students. Marks scored by each student from the two tests were recorded. Pearson's Product Moment Correlation was used to calculate the reliability index of GCT and it was found to be 0.861

Administration of the instruments

A pre-test was administered to all the sampled students in each sampled school using SGCT. All scripts were marked and students' scores were recorded. The Experimental Groups were taught geometric construction using CAI for six weeks and with 80 minutes per a double period as allocated in the school time-table. The controls Group (CG) were also taught geometric constructions using normal traditional methods of using chalkboard mathematical sets for the same equal period of time. Post-test was then administered using the same EGCT instrument to both the groups (EG) and (CG)

Data Presentation and Analysis

T-test and ANOVA were used to analyze the performance of students at $\alpha = 0.05$ level of significance. The pre-test conducted for both the (CG) and (EG) show that their performance before giving the treatment was homogeneous.

Null Hypothesis One (H_{01})

There is no significance difference in academic performance between students taught geometric constructions using Computer Assisted Instructions and those taught using traditional method in Sokoto Metropolis

Table 2: Summary of T-test analysis of null hypothesis one (H_{01})

Groups	No. of Students	Mean ($\bar{x}$)	SD (σ)	SD Error ($\bar{x}$)	Mean Difference	df	t_{cal}	P	Decision
EG	150	51.993	13.25	1.082	14.507	325	10.45	0.000	H_{01} Rejected
CG	177	37.485	11.84	0.889					

Source: Field work, 2025

$\alpha = 0.05$

Table 2 shows the t-test summary analysis for the difference in performance between students taught geometric constructions using CAI and those taught using traditional method in Sokoto metropolis. The results showed that the $P - value = 0.000$ is less than the $\alpha - value = 0.05$. From the rule, when the P-value is less than the alpha value, the null hypothesis is rejected. This implies that null-hypothesis which says there is no significant difference in academic performance between students taught geometric constructions using Computer Assisted Instructions and those taught using traditional method in Sokoto Metropolis was rejected. This reveals that students taught geometric constructions using computer assisted instructions performed significantly better than those taught using traditional method in Sokoto Metropolis with mean difference performance of $\bar{x} = 14.507$ between them.

Null Hypothesis Two (H_{02})

There is no significant gender difference in academic performance between male and female students taught geometric constructions using Computer Assisted Instructions in Sokoto metropolis.

Table 3: Summary of T-test analysis of null hypothesis one (H_{02})

Gender	No. of Students	Mean ($\bar{x}$)	SD (σ)	SD Error ($\bar{x}$)	Mean Difference	df	t_{cal}	P	Decision
Male	61	51.065	13.64	1.74	1.563	148	0.709	0.480	H_{01} Retained
Female	89	52.629	13.01	1.37					

Source: Field work, 2025

$\alpha = 0.05$

Table 3 shows the summary of the t-test analysis for the difference in performance between male and female students taught geometric constructions using computer assisted instructional method in Sokoto metropolis. The results showed that the $P - value = 0.480$ is greater than the $\alpha - value = 0.05$. From the rule, when the P-value is greater than the alpha value, the null hypothesis is not rejected. This implies that null-hypothesis which says there is no significant difference in academic performance between male and female students taught geometric constructions using Computer Assisted Instructions in Sokoto metropolis was retained.

Null Hypothesis Two (H_{02})

There is no significant difference in academic performance between senior secondary school students taught geometric constructions using Computer Assisted Instructional method among the three Local Government Areas in Sokoto Metropolis

Table 4: Summary of One Way ANOVA Analysis of Null Hypothesis Three (H_{03})

Source	Sum of Squares	df	Mean Square	F_{cal}	P	Decision
Between Groups	464.008	2	232.004	1.327	0.268	H_{03} Retained
Within Groups	25702.986	147	174.850			
Total	26166.993	149				

Source: Field work, 2025

$\alpha = 0.05$

Table 4 shows the summary of the ANOVA analysis for the difference in performance between students taught geometric constructions using computer assisted instructional method in the three Local Government Areas in Sokoto metropolis. The results shows that the $P - value = 0.268$ is greater than the $\alpha - value = 0.05$. From the rule, when the P-value is greater than the alpha value, the null hypothesis is not rejected. This implies that null-hypothesis which says there is no significant difference in academic performance between senior secondary school students taught geometric constructions using Computer Assisted Instructional method among the three Local Government Areas in Sokoto Metropolis was retained. This reveals that the selected students in the three Local Government Areas performed equally the same.

Summary of the Major Findings

The summary of the major findings shows that:

- 1- Students taught geometric constructions using computer assisted instructional method performed significantly better than those students taught geometrical constructions using traditional method in Sokoto Metropolis.
- 2- There was no gender significant difference between the academic performance of male and female students taught geometric constructions using computer assisted instructions in Sokoto metropolis.
- 3- There was no significant difference in academic performance between students taught geometric constructions using Computer Assisted Instructions among the three Local Government Areas of Sokoto Metropolis.

Discussion

The first finding reveals that, there was significant difference between the academic performance of students taught geometric constructions using computer assisted instructions and those taught using traditional method in Sokoto metropolis. This finding was in line with the findings of Ukaigwe and Evelyn (2022), Lawal (2020), Muhanna (2015), Ndanwu and Ezejiofor (2021), Likita & Mamuda (2022) Ullaskar (2019). However, the finding was in total disagreed with the finding of Leann (2020)

The second finding of this study reveals that, there was no significant difference between the academic performance of male and female students taught geometric constructions using computer assisted instructions in Sokoto metropolis. This finding agreed with the findings of Ukaigwe and Evelyn (2022), Kofi, Nelly and Valentina (2019). However, the finding disagreed with finding of Harbor-Peter (2002), Ndanwu and Ezejiofor (2021). Likita and Mamuda (2022), and Ullaskar (2019)

The third finding shows that there was no significant difference in academic performance between students taught geometric constructions using Computer Assisted Instructions among the three Local Government Areas of Sokoto metropolis. This finding agreed with the finding of Leann (2020), Ukaigwe & Evelyn (2022), Lawal (2020) and Muhanna (2015), Ndanwu & Ezejiofor (2021), Likita & Mamuda (2022), Koni, Zephaniah, & Mercy (2019) and Alhassan, Ezenwa & Wushishi (2015). They carried out their studies to investigate the effect of computer assisted instructional package on secondary school student's performance in different states of Nigeria. The result from the study showed that there was no significant

difference between the mean achievement scores of students when compared with the students' performance among their different states.

However, the finding was not in conformity with the finding of the study conducted in Ghana by Kofi, Nelly and Valentina (2019) in Greater Accra, Western, BrongAhafo and Ashanti Regions in Ghana. Their results showed that region has significant effects students' performance among their different geographical locations in integrated science under the use of computer-assisted instructional methods

The finding also disagree with the finding of Alhassan, Ezenwa & Wushishi (2015) and Ullaskar (2019) whom conducted their studies to determine the effects of teaching mathematics through computer assisted instruction and traditional method in Niger state and Murshidabad District of West Bengali Area in Kenya. Their findings revealed that significant differences in students' performance have been found among their different regions and locations.

Conclusion

Based on the findings of this study, the following conclusion was proffered:

- 1- The use of Computer Assisted Instructions in teaching geometric constructions resulted in higher performance of students over traditional methods in the three sampled educational zones in Sokoto metropolis.
- 2- Male and Female students performed equally the same in geometric constructions under the use of computer assisted instructions in Sokoto metropolis.
- 3- Students' geographical locations or Local Government Area have no any effects on their academic performance in geometrical constructions under the use of computer assisted instructional method.

Recommendations

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

- 1- Since the use of CAI method in teaching geometric constructions was proved to be better than traditional teaching method, it was recommended that Government, Stakeholders of Science and Technology, should use the findings of this study to give more support towards teaching of mathematics, sciences, technology subjects through CAI method.
- 2- It was also, recommended that stakeholders, educational agencies, and None Governmental Organizations (NGOs) should mobilized and support government, teachers and students by providing such computer software for teaching mathematics, science and technical subjects. This will encourage greater females' participation in mathematics and would also discourage the idea of taking the subjects to be for masculine only.
- 3- Parents should use the benefits of this finding to encourage their children with those electronic gadgets that support and make learning permanents for a better change of Nigerian society.

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