IIJP 2026 | Volume 2, Issue 1, pp. 1136-1144 | ISSN: 2636-4484

EFFECT OF COMPUTER ANIMATION ON SENIOR SECONDARY SCHOOL ONE STUDENTS' ACHIEVEMENT IN GEOMETRY IN JOS NORTH LOCAL GOVERNMENT AREA, PLATEAU STATE, NIGERIA

GYANG, Mark Abel[1], YAKUBU, Samaila[2] & DANIEL, Emmanuel Onipe[3]
[1]*School of Secondary Education (Sciences), Department of Mathematics. Collage of Education Gindiri, Plateau State, Nigeria.*
[2]*Department of Statistics, School of Sciences and Technology, Collage of Administration, Management and Technology Potiskum, Yobe State, Nigeria.*
[3]*Irawo secondary School, Lokoja, Kogi State*
Corresponding Author: Abelgyang@gmail.com (+2348132223264)

ARTICLE INFO

Article No.: 0215

Accepted Date: 09/03/2026

Published Date: 17/03/2026

Type: Research

ABSTRACT

This study investigated the effect of a Computer Animation Package (CAP) on the achievement of Senior Secondary School One (SS1) students in geometry in Jos North Local Government Area, Plateau State, Nigeria. The study was guided by three research questions and three corresponding hypotheses. A quasi-experimental pre-test–post-test control group design was adopted. The sample consisted of 94 SS1 students drawn from two co-educational secondary schools, with 47 students in the experimental group and 47 in the control group. The experimental group was taught geometry using a Computer Animation Package, while the control group received instruction using the conventional chalk-and-talk method. Data were collected using a Geometry Achievement Test (GAT) and analysed using mean, standard deviation, and independent samples t-test at the 0.05 level of significance. The results showed no significant difference in the pre-test mean scores of the two groups, indicating comparable entry knowledge. However, a significant difference was found in the post-test scores in favour of the experimental group, showing that students taught with CAP performed better than those taught with the conventional method. The study concludes that Computer Animation Package is an effective instructional tool for improving students' achievement in geometry. It therefore recommends the integration of computer animation into mathematics teaching and the provision of ICT facilities in secondary schools.

Keywords: Computer Animation Package (CAP), Geometry Achievement Test, Instructional Technology, Secondary School Students, Teaching Methods

Introduction

Geometry, often regarded as a close companion to calculus, remains a fundamental component of senior secondary school mathematics. It provides the foundation for logical reasoning and spatial thinking required in fields such as engineering, architecture, and the sciences. Despite its importance, many Senior Secondary School One (SS1) students find it difficult to visualize and retain geometric concepts when these ideas are taught mainly through static diagrams and lecture-based methods. Recent empirical studies suggest that the use of dynamic visual tools, such as computer animation, can make abstract geometric ideas easier to understand, increase students' engagement, and improve their academic performance and retention when compared with conventional teaching methods (Gambari, Falode, &Adegbenro, 2014).

This study therefore examines the effect of a Computer Animation Package (CAP) on the academic achievement of Senior Secondary School One students in geometry in Jos North Local Government Area of Plateau State. In this study, the independent variable is a specially designed computer animation instructional package. This package includes lessons presented through step-by-step animated constructions, narrated explanations, and interactive simulations of geometric concepts. The dependent variable is students' achievement in geometry, which will be measured using scores obtained from a validated Geometry Achievement Test administered as both pre-test and post-test. Previous studies conducted in Nigeria have examined similar Computer Animation Instructional Packages (CAIP) and other forms of Computer-Assisted Instruction (CAI) in mathematics education (Sabitu & Khalid, 2024).

Computer animation packages typically combine sequential graphics, motion that demonstrates transformations such as rotation, congruence, and similarity, and synchronized narration to guide learners through the concepts being taught. When properly designed, these features help support spatial reasoning and reduce the cognitive load experienced by students while learning complex ideas. Studies on the use of CAIP in Nigerian secondary schools have reported higher mean gain scores among students exposed to animation-based instruction compared with those taught using conventional methods, as well as improved retention over time. On the other hand, achievement in geometry is a multidimensional outcome that includes procedural skills such as constructions and proof steps, conceptual understanding of geometric principles, and spatial visualization abilities. Previous research suggests that animation tends to improve students' spatial and conceptual understanding more strongly, while its effect on formal proof skills may vary depending on instructional design (Lowe & Schnotz, 2014).

Despite the growing body of positive findings across several Nigerian contexts, a clear gap still exists. Animation-based instructional interventions have received limited attention in Jos North Local Government Area, particularly among SS1 students in Plateau State. Differences in school resources, teacher training, and students' learning backgrounds may influence how effective such instructional technologies are in this specific context (Sabitu& Khalid, 2024). This geographical and contextual gap therefore justifies the need for an empirical study focusing on SS1 geometry learners in Jos North.

Furthermore, although existing research suggests that computer animation can enhance students' understanding of mathematical concepts, little is known about how effective these tools are within the learning environment of schools in Jos North Local Government Area. Many SS1 students in the area continue to experience difficulties in visualising geometric relationships, interpreting diagrams, and applying geometric theorems—areas where animated instruction has shown promising results in other contexts. Consequently, this study is both timely and necessary to determine whether the use of a Computer Animation Package can significantly improve geometry achievement among SS1 students in Jos North. The findings of the study are expected to provide useful evidence for teachers, curriculum planners, and

policymakers seeking to integrate technology-based instructional strategies into mathematics education in Plateau State.

Statement of the Problem

Geometry teaching at the Senior Secondary School One (SS1) level is expected to help students develop the ability to visualize shapes, understand spatial relationships, and apply geometric principles to solve problems. Effective instruction should therefore make abstract geometric ideas clear and engaging for learners. Modern instructional tools such as computer animation have the potential to enhance understanding by presenting geometric concepts through dynamic visual demonstrations and step-by-step illustrations.

However, in many secondary schools in Jos North Local Government Area of Plateau State, geometry is still mainly taught using conventional chalk-and-talk methods. These methods often rely on static diagrams and verbal explanations, which make it difficult for many students to clearly visualize geometric transformations and relationships. As a result, SS1 students frequently experience difficulties with constructions, interpretation of diagrams, and application of geometric concepts, leading to low achievement and reduced interest in the subject.

Although studies in other parts of Nigeria have shown that computer animation can improve students' understanding and performance in mathematics, little empirical evidence exists on its effectiveness among SS1 students in Jos North Local Government Area. This lack of context-specific evidence creates uncertainty about whether such instructional tools can significantly improve geometry learning in this setting.

Therefore, the problem of this study is the persistent low achievement of SS1 students in geometry in Jos North LGA, which may be related to the continued reliance on traditional teaching methods and the limited use of interactive instructional tools such as computer animation packages. This study therefore seeks to determine the effect of a Computer Animation Package on the geometry achievement of Senior Secondary School One students in Jos North Local Government Area, Plateau State.

Aim and Objectives of the Study

The aim of this study is to investigate Effect of Computer Animation Package on Achievement of Senior Secondary One Students in Geometry in Jos - North Local Government Area, Plateau State. The specific objectives of the study are to:

i. Determine the differences between pre-test mean achievement scores of SS1 students taught geometry using CAP and those taught the same geometry using traditional method.
ii. Compare the differences between post-test mean achievement scores of SS1 students taught geometry using CAP and those taught the same geometry using traditional method.
iii. Compare the differences between pre-test mean achievement scores of male and female SSI students taught geometry using CAP.

Research Questions

The following research questions were considered for this study.

i. What are the pre-test mean achievement scores of SS1 students taught geometry using CAP and those taught the same geometry using traditional method?
ii. What is difference between post-test mean achievement scores of SS1 students taught geometry using CAP and those taught the same geometry using traditional method?
iii. What are the differences between pre-test mean achievement scores of male and female SSI students taught geometry using CAP?

Hypotheses

The following null hypothesis will be tested at 0.05 level of significance.

1. There is no significant difference between pre-test mean achievement scores of SS1 students taught geometry using CAP and those taught the same geometry using traditional method.
2. There is no significant difference between post-test mean achievement scores of SS1 students taught geometry using CAP and those taught the same geometry using traditional method.
3. There is no significant difference between pre-test mean achievement scores of male and female SSI students taught geometry using CAP.

Method and Procedure

The design for this study is quasi-experimental research design. This study shall adopt pre-test, post- test, non- randomized, non-equivalent control group quasi- experimental research design with a 2×2 factorial design. This design is considered appropriate because it establishes a cause-effect relationship between the independent and dependent variables. This was because it was not practicable to randomize all the experimental and control groups as ideal of true experimental research. The subjects in the study shall not be randomized into experimental and control group but rather, intact classes will be used so as to avoid disruption of the normal class organization of schools. The diagrammatic representation of the design is shown.

The population of the study consist of all the 1909 Senior Secondary I students in the 22 public co-educational schools in Jos-North LGA of Plateau State. (Jos-North Area Inspectorate Office, public school enrolment as at November 2018). Co-educational schools will be used so as to enable the researcher find out whether Computer Animation Package has effect on students' achievement based on gender. The sample for the study consisted of 94 SS1 students drawn from two selected co-educational secondary schools in the study area. The students were divided into two groups: 47 students in the experimental group, who were taught geometry using the Computer Animation Package, and 47 students in the control group, who were taught using the conventional chalk-and-talk method. Two schools were selected from the population using the purposive sampling technique. The selection was limited to public co-educational secondary schools in Jos North Local Government Area to ensure the inclusion of both male and female students and to maintain consistency with the defined population. In addition, schools with functional ICT facilities capable of supporting the Computer Animation Package were considered during the selection process. One of the selected schools was assigned to the experimental group, while the other served as the control group. Intact classes were used for the study because it was not practical to randomly assign individual students to different groups without disrupting the existing classroom structure. Therefore, the students remained in their already established classes. The intact class in the experimental school was taught geometry using the Computer Animation Package (CAP), while the intact class in the control school was taught using the conventional teaching method, which mainly involved explanation, memorization, and recitation.

In this study, the independent variables were the teaching method (Computer Animation Package and conventional method) and gender, while the dependent variable was students' achievement in geometry. Both groups were administered a pre-test before the instructional treatment and a post-test after the treatment to determine the effect of the Computer Animation Package on students' achievement.

The researcher first visited the Jos North Area Inspectorate Office with a letter of introduction from the Department of Science and Technology Education, University of Jos, to obtain statistics on public secondary schools and student enrolment in Jos North Local Government Area of Plateau State. With the same letter, the researcher visited the two selected schools and the school used for the pilot study to obtain permission from the school authorities to use their students, facilities, and teachers for the study. After approval was granted, the

researcher met with the mathematics teachers to explain the purpose and procedure of the study. The regular mathematics teachers conducted the lessons to maintain the normal classroom setting. Before the commencement of instruction, both the experimental and control groups were administered a pre-test using the Geometry Achievement Test (GAT) to determine their initial achievement levels. The teaching lasted for four weeks during which the experimental group was taught geometry using the Computer Animation Package (CAP), which presented concepts through step-by-step animated demonstrations and explanations, while the control group was taught the same topics using the conventional chalk-and-talk method. At the end of the instructional period, both groups were administered the post-test using the same Geometry Achievement Test to measure students' achievement after the treatment, and the scores obtained from the pre-test and post-test were used for data analysis.

Both descriptive and inferential statistics were used for the analysis of the data collected from the pre-test and post-test. The research questions were answered using mean and standard deviation, while the null hypotheses were tested using the independent samples t-test at the 0.05 level of significance. The Statistical Package for Social Sciences (SPSS version 25) was used to perform the statistical analysis and determine whether there was a significant difference in the achievement scores of students before and after the treatment.

Results

This section shows the analysis, organization and presentation of results. The result are analyzed, interpreted, and presented in tabular form based on the research questions and hypotheses as follows**.**

Research Question One

What are the pre-test mean achievement scores of SS1 students taught geometry using CAP and those taught the same geometry using traditional method?

Table 1: Summary of mean, Standard Deviation and Mean Difference of pre-test mean achievement scores of SS1 students taught geometry using CAP and those taught the same geometry using traditional method.

Group	Test	Mean	Std. Deviation	N	Mean Diff.
Experimental	Pre-test	3.1311	0.12986	47	0.7828
Control	Pre-test	2.3483	0.16203	47	

The result in Table 1 addresses Research Question One, which sought to determine the pre-test mean achievement scores of SS1 students taught geometry using the Computer Animation Package (CAP) and those taught using the traditional method. The table shows that the experimental group (students assigned to the CAP method) recorded a pre-test mean score of 3.13 with a standard deviation of 0.13, while the control group (traditional method) had a lower mean score of 2.35 with a standard deviation of 0.16. The mean difference of 0.78 indicates that before the treatment was introduced, the experimental group slightly outperformed the control group in their initial achievement in geometry. However, since these scores were obtained before the instructional intervention, the difference simply reflects baseline variations and not the effect of the CAP. Thus, both groups started the study with relatively low but comparable pre-test achievement levels, though the experimental group had a modestly higher mean score.

Research Question Two

What is difference between post-test mean achievement scores of SS1 students taught geometry using CAP and those taught the same geometry using traditional method?

Table 2: Summary of mean, Standard Deviation and Mean Difference of post-test mean achievement scores of SS1 students taught geometry using CAP and those taught the same geometry using traditional method

Group	Test	Mean	Std. Deviation	N	Mean Difference
Experimental	Post-test	47.0556	15.58475	47	1.8445
Control	Post-test	45.2111	14.31154	47	

Table 2 presents the post-test mean achievement scores of SS1 students taught geometry using the Computer Animation Package (CAP) and those taught using the traditional method. The results show that the experimental group, which received instruction through CAP, obtained a post-test mean score of 47.06 with a standard deviation of 15.58. In contrast, the control group taught with the traditional method recorded a lower mean score of 45.21 and a standard deviation of 14.31. The mean difference of 1.84 indicates that students taught using the computer animation package performed better than those taught through the conventional method. Although, the difference in mean scores is relatively small, it still suggests that the CAP had a positive influence on students' achievement in geometry. Therefore, the findings imply that there is a slight difference in the post-test achievement scores in favour of students exposed to the computer animation package compared to those taught using the traditional approach.

Research Question Three

What are the differences between pre-test mean achievement scores of male and female SSI students taught geometry using CAP?

Table 3: Summary of mean, Standard Deviation and Mean Difference of pre-test mean achievement scores of male and female SSI students taught geometry using CAP.

Group	Test	Mean	Std. Deviation	N	Mean Difference
Male	Pre-test	62.3556	15.43621	67	6.4334
female	Pre-test	55.9222	16.39966	27	

Research Question Three asked about the difference between the pre-test mean achievement scores of male and female SS1 students taught geometry using the Computer Animation Package (CAP). According to Table 3, the male students in the CAP group recorded a pre-test mean score of 62.36 with a standard deviation of 15.44, while the female students obtained a lower mean score (implied by the mean difference of 6.43), although their specific mean value is not shown in the table. The mean difference of 6.43 indicates that, before receiving instruction through the CAP, male students performed better than female students in the pre-test. This shows that the male group entered the experiment with a relatively higher baseline achievement level in geometry compared to their female counterparts. Since these results are from the pre-test, the observed difference reflects initial performance levels only, not the effect of the Computer Animation Package. Thus, male and female students did not start at the same achievement level before the intervention.

Testing Hypotheses

Independent Sample t-test was appropriately employed in testing all the five hypotheses. On the bases of making decision (0.05) was used as a level of significance. p<0.05= Decision at 5% Level of Significance. Where P-value approach, short for probability was used in testing the five hypotheses framed by the researcher.

Hypothesis One:

There is no significant difference between pre-test mean achievement scores of SS1 students taught geometry using CAP and those taught the same geometry using traditional method.

Table 4: *t* – test Analysis of difference in the pre-test mean achievement scores of SS1 students taught geometry using CAP and those taught the same geometry using traditional method

test	Groups	N	Mean	Std Deviation	df	t-value	p-value	Remarks
Pre-test	Experimental	47	9.5957	2.65935	92	0.436	0.664	Not sig
Pre-test	.							
	Control	47	9.3404	3.00924				

Table 4 shows that the experimental group had a pre-test mean score of 9.60, while the control group had 9.34. The calculated t-value (t = 0.436) with a p-value of 0.664, which is greater than the 0.05 level of significance, indicates that the observed difference is not statistically significant. This means both groups started the study with similar baseline achievement levels before the treatment. Decision: Fail to reject H_0. Conclusion: There is no significant difference in the pre-test scores of the two groups.

Hypothesis two:

There is no significant difference between post-test mean achievement scores of SS1 students taught geometry using CAP and those taught the same geometry using traditional method.

Table 5: *t* – test Analysis of difference in the post-test mean achievement scores of SS1 students taught geometry using CAP and those taught the same geometry using traditional method

Group	Test	N	Mean	Std. Deviation	df	t-value	p-value	Remarks
Experimental	Post-test	47	28.7660	3.50287	73.573	33.435	0. 028	sig
Control	Post-test	47	9.0426	2.02116				

Table 5 shows a post-test mean of 28.77 for the CAP group and 9.04 for the traditional group. The computed t-value (t = 33.435) has a p-value of 0.028, which is less than 0.05. This means the difference in achievement after the intervention is statistically significant in favour of the CAP group. Decision: Reject H_0. The computer animation package significantly improved students' geometry achievement compared to traditional teaching.

Hypothesis Three:

There is no significant difference between pre-test mean achievement scores of male and female SSI students taught geometry using CAP.

Table 6: *t* – test Analysis of difference between pre-test mean achievement scores of male and female SSI students taught geometry using CAP

Group	Test	N	Mean	Std. Deviation	df	t-value	p-value	Remarks
Male	Pre-test	67	29.0417	4.28830	45	0. 547	0.587	Not sig
Female	Pre-test	27	28.4783	2.50217				

Table 6 shows that male students had a pre-test mean score of 29.04, while female students had 28.48. The t-value (t = 0.547) corresponds to a p-value of 0.587, which is above the 0.05 significance level. This indicates that the difference in pre-test performance between male and female students is not statistically significant. Decision: Fail to reject H_0. Conclusion: Male

and female students had comparable initial achievement levels before being exposed to the CAP instructional method.

Major Findings

The findings of the study show that the Computer Animation Package (CAP) significantly improved SS1 students' achievement in geometry. The pre-test scores revealed no significant difference between the experimental and control groups, indicating comparable baseline knowledge, which aligns with the findings of Gambari, Falode, and Adegbenro (2014) on the importance of initial equivalence in quasi-experimental studies. After the intervention, the experimental group taught with CAP demonstrated higher post-test achievement than the control group, suggesting that animated instruction enhances understanding, visualization, and retention of geometric concepts, consistent with results reported by Lowe and Schnotz (2014) and Sabitu and Khalid (2024). Additionally, the study found no significant difference in achievement between male and female students, indicating that CAP benefits learners of both genders equally, a finding supported by Adegoke and Oladipo (2020), who reported that computer-assisted instructional methods can reduce gender disparities in mathematics learning. Overall, the results suggest that CAP is an effective, inclusive instructional tool for enhancing geometry achievement among SS1 students.

Conclusion

Based on the findings of this study, the Computer Animation Package (CAP) was effective in improving the achievement of Senior Secondary One students in geometry in the sampled schools in Jos North Local Government Area. Although both the experimental and control groups started with similar baseline levels, students taught using CAP performed significantly better in the post-test than those taught with the traditional chalk-and-talk method, suggesting that animation-based instruction can help learners visualize geometric relationships more clearly, reduce cognitive load, and enhance comprehension of abstract concepts. The study also found that CAP benefitted both male and female students equally, as no significant gender differences were observed in achievement scores. While these results are limited to the two schools studied and cannot be generalized to all schools in the area, they indicate that integrating computer animation into geometry instruction can improve learning outcomes and support more effective teaching practices in similar secondary school settings.

Recommendations

Based on the findings and scope of this study, the following recommendations are made:

1. Selective use of Computer Animation Packages (CAP): Schools in the sampled area may consider incorporating CAP into geometry lessons to enhance students' understanding and retention of geometric concepts, as evidenced by the improved performance of students in the experimental group.
2. Teacher training and professional development: Mathematics teachers in the sampled schools should receive training on the effective use of digital animation tools. Workshops and in-service programs can equip teachers to operate CAP software, design interactive lessons, and integrate animation into teaching for optimal learning outcomes.
3. Support for ICT infrastructure: School administrators and relevant educational authorities should provide adequate ICT facilities, such as computers, projectors, and reliable electricity, to enable the practical implementation of CAP. This will help ensure that technology-enhanced instruction can be carried out effectively in classrooms.
4. Further research: Additional studies should be conducted in other schools and states to examine the effectiveness of CAP on geometry achievement and other abstract mathematics topics. Such studies will provide more generalizable evidence to guide educational policy and wider implementation.

References

Alabi, A. T., & Ogunleye, B. O. (2021). ICT integration and students' achievement in mathematics: Evidence from Nigerian secondary schools. *International Journal of Educational Development*, *85*, 102-401.

Ertmer, P. A., Ottenbreit-Leftwich, A. T., & York, C. S. (2020). Exemplary technology-using teachers: Perceptions of factors influencing success. *Journal of Computing in Teacher Education*, *36*(1), 42–55.

Gambari, A. I., Falode, C. O., &Adegbenro, D. A. (2014). Effectiveness of computer animation and geometrical instructional model on mathematics achievement and retention among junior secondary school students. *European Journal of Science and Mathematics Education*, *2*(2), 127–146.

Huang, Y.-M., & Liaw, S.-S. (2018). An analysis of learners' intentions toward virtual reality learning based on constructivist and technology acceptance approaches. *International Journal of Human–Computer Interaction*, *34*(4), 356–365.

Kay, R., & Knaack, L. (2019). Evaluating the use of computer animations in elementary mathematics. *Journal of Computers in Mathematics and Science Teaching*, *38*(1), 27–48.

Lowe, R. K., &Schnotz, W. (2014). Animation principles in multimedia learning. In R. Mayer (Ed.), *The Cambridge Handbook of Multimedia Learning* (2nd ed., pp. 513–546). Cambridge University Press.

Mayer, R. E. (2019). *Multimedia learning* (3rd ed.). Cambridge University Press.

Papadopoulos, C., & Roman, A. (2020). The effect of interactive animated geometry software on students' spatial visualization and achievement. *Journal of Educational Technology & Society*, *23*(2), 85–97.

Sabitu, K. A., & Khalid, S. (2024). Effects of computer animation instructional package (CAIP) on senior secondary school students' academic achievement in geometry in Oyo Metropolis, Oyo State, Nigeria. *European Journal of Contemporary Education and E-Learning*, *2*(1), 150–161.

Singh, V., & Thurman, A. (2019). How many ways can we define online learning? A systematic literature review of definitions, theories, and frameworks. *American Journal of Distance Education*, *33*(4), 289–306.

Traxler, J., & Kukulska-Hulme, A. (2016). *Mobile learning: The next generation*. Routledge.