

**EFFECTS OF COMPUTER ANIMATION PACKAGE ON SENIOR SECONDARY TWO STUDENTS' ACHIEVEMENT IN BIOLOGY IN JOS NORTH LOCAL GOVERNMENT AREA, PLATEAU STATE, NIGERIA**

**Obed Musa Yilshik  
Prof. Fellicia O. Agbo  
Dr. Friday John**

**Department of Science & Technology Education, Faculty of Education, University of Jos.**

*<sup>1</sup>[oyilshik.fukashere@gmail.com](mailto:oyilshik.fukashere@gmail.com), <sup>2</sup>[dronyemowo@gmail.com](mailto:dronyemowo@gmail.com), <sup>3</sup>[john@unijos.edu.ng](mailto:john@unijos.edu.ng)*

**ABSTRACT**

*The study investigated the effects of computer animation package on senior secondary two students' achievement in Biology in Jos North LGA, Plateau State. Two objectives were stated; two research questions and two hypotheses guided the study. The study adopted a quasi-experimental design, specifically the pre-test post-test non-equivalent control- group design. The population of the study consisted of all 731 SS 2 students (392 males and 339 females) who were offering Biology in the 22 public senior secondary schools in Jos North LGA, Plateau State in the 2024/2025 academic session. A sample of 52 students (21 males and 31 females) drawn from two intact classes from two schools selected from the 22 public senior secondary schools in Jos North Using stratified sampling technique participated in the study. Data were collected using Biology Achievement Test (BAT). It consisted of 40 multiple choice questions with options A-D. The questions were adapted from West Africa Senior School Certificate Examination and JAMB past question papers. The maximum marks obtainable was 100, while the minimum obtainable marks were 0. Three experts validated the instrument. The reliability of the BAT was established using Kuder-Richardson 20 (K-R20) method which yielded a reliability coefficient of 0.93. The descriptive statistics of mean and standard deviation were used to answer the research questions. While, Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. Findings show that CAP had significant positive effects on the achievement of students in Biology as the the experimental group had higher achievement mean gain than the respondents in the control group. The study also found that no significant difference existed between the achievement mean scores of male and female students in the experimental group hence the students did not differ significantly in their achievement based on gender. It was recommended that the Federal and state governments, school authorities including NGOs should devote more fund to providing information technology tools and reliable power sources to secondary schools, teachers' should be train on use of computer animation in schools and also be encouraged to integrate computer mediated teaching strategies like the use of computer animation package in the teaching and learning of their various subjects.*

**Key words: Biology, Computer Animation, Achievement, Gender**

**INTRODUCTION**

Science and Technology education form the core for major innovations which have led to cutting edge development globally. It enhances capacity building, societal maintenance, skill acquisition, and acquisition of relevant knowledge and the development of technology as well as habits for surviving in the changing world. Science as a vital component of education is defined by Nuru (2023) as the organized and systematic activity that constructs and organizes knowledge in the form of testable explanations and predictions about the universe. The application of scientific knowledge meets basic human needs and improves the standard of living for mankind. Such knowledge helps in finding sources of clean energy, provides a rational use of natural resources and its sustainability as well as guaranteeing the continuous existence of human race (Piwuna, 2024). In science generally, learners acquire practical and manipulative skills to interact with the

environment for better productivity in this ever-changing world. The core science subjects in the Nigeria senior secondary school curriculum are Biology, Chemistry and Physics. However, this study focused on Biology

Biology as a branch of science is the science of life. It is a natural science that studies living things in its entirety and things that once lived with all their vital processes. Biology studies life and living organisms, including their physical structure, chemical composition and processes, molecular interactions, physiological mechanisms, habits, development and evolution of species. It is offered in senior secondary schools in Nigeria to provide learners with the knowledge of living things and their interrelationship within the environment, most especially the activities of man that contribute to sustainable economic growth and productivity of nations. These human activities aim to solve the problems of food security, healthcare provision (such as the development of vaccines and biomedical equipment), hygiene, family life, poverty eradication, management and conservation of natural resources. More so, Biology is required for admission into science-based courses at the higher institutions such as Biological science, Microbiology, Agriculture, Veterinary Medicine, Biochemistry, Biotechnology, Medicine, Nursing, Pharmacy, Genetics, Ethnobotany among others (Yilshik, Ezekiel & Umar, 2020). From the foregoing, it is evident that the importance of Biology to life and in promoting sustainable economic and national development cannot be overemphasized. The need for meaningful teaching- and learning of Biology so as to foster high achievement in the subject is a necessity.

### **STATEMENT OF PROBLEM**

In spite of the importance of Biology to human existence, national development, and Biology students' career progression in Nigeria, the achievement of secondary school students in the subject has continued to fluctuate and remained below the optimal target. Stake holders in the education sector such as the federal and state governments, school administrators and NGOs are making concerted efforts to stem the tide through provision of science laboratory equipment, building and furnishing computer laboratories in secondary schools, organizing seminars and workshops to build teachers capacity to deliver in classroom. However, many students in Plateau state still fail Biology in Senior School Certificate Examination which can be seen in the analysis of WASSCE result for 2013-2023 which revealed the failure rate as: 50.00%, 56.77%, 51.09%, 30.19%, 35.03%, 51.21%, 33.44%, 13.59%, 7.79%, 10.51%, 9.44% accordingly. The WAEC Chief Examiners' reports (2013-2022) also revealed persistent students' unsatisfactory achievement in the West African Examination Certificate (WAEC). The students that failed may not get admission to read Biology related courses in tertiary institutions which may lead to inadequate trained manpower to man related institutions and industries.

The WAEC Chief Examiners' reports attributed the unsatisfactory achievement to weaknesses observed in the candidates which is seen in their lack of in-depth knowledge of some basic concepts like genetics, nervous systems, circulatory system; inability to explain concepts like fertilization in plants and animals, evolution; describe biological processes and also compare the processes occurring in the body system like endocrine system, respiratory system, digestive system, transmission of nerve impulse, oxygenation of blood in the lungs, opening and closing of valves during diastole and systole adequately among others. This points to the students' lack of in-depth understanding and low retention of the subject. This situation could be partly attributed to the teachers' poor method of lesson delivery, passivity of students in class, poor retention and low interest by the students in the subject (Chikendu, 2018). Hence the need to find more engaging teaching strategies to ensure optimal and consistency in students' achievement. The use of innovative and modern teaching strategies most of which are computer mediated such as flip classroom, use of virtual laboratory, computer simulation, computer animation among others to augment the conventional lecture method of teaching could be the game changer. This study intended to leverage on the interactivity, audio-visual stimulation, faster learning, and convenience

attributes of computer animation package to find out if students' achievement could be enhanced when they are taught using the such strategy.

Computer animation is the simulation of movement created by a series of pictures. It is a general term for a visual digital display technology that simulates moving objects on a screen. Computer animation package is defined by Thomas (2021) as the use of software to combine a series of still images to create motion frame-by-frame. Depending on the particular programme, users can animate some variation of two-dimensional (2D) and three-dimensional (3D), hand-drawn or computer generated graphics, often with the option to add music or additional effects. In modern societies of the 21<sup>st</sup> century, information technology whose primary medium of operation is the computer, has permeated the society in such a way that almost everything been done involves the use of computer. As such, Biology teachers need to key into the trend. Using computer animation in teaching involves putting the abstract concepts, processes and ideas into motion pictures as though these pictures are life and active which will make the students see them as real objects. As the teacher explains the computer animated concepts and processes as they sequentially come up, the understanding of the subject matter is expected to become easier because the contents being learnt appeal to both visual and auditory senses which might invariably enhance students' achievement. Creating videos that use animation to simplify complex and abstract concepts and make them interesting for learners could be a way to enhance teaching and learning. Thus, this study investigated the effects of computer animation package on students' achievement in Biology.

Achievement is an important variable in any academic system because it provides the basis for measuring academic progress. It is seen as outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments. In Biology, student achievement refers to the extent to which students demonstrate knowledge, understanding, and skills related to biological concepts and processes, often measured through assessments like tests, practical work, and projects. Suleiman (2023) defined achievement as performance outcomes that indicate how far a person has progressed in specific goals of activities in instructional settings, such as school, college, and university. Similarly, Umar, Manklibet and Dung (2019) viewed achievement as outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in schools, colleges, and universities. Achievement is being influenced by several factors operating within and outside the individual such as self-concept, learning style students' interest, retention level, among others.

Computer animation uses computer devices to create an illusion of moving images in sequential form. Hence, when effectively used in teaching abstract and complex concepts especially in Biology, better achievement could be obtained. Several studies have revealed divergent findings on the effects of computer animation on students' academic achievement. For example, Ibrahim and Gana (2019), Faruk, Faruku and Hassan (2022), Ala, Onojah, Isyaku and Adamu (2023) in their separate studies reported that revealed that instructional computer animation strategy had significant effects on students' achievement in Biology concepts. The authors revealed that CAP significantly improved students' achievement. In similar studies in other science subjects, Chikendu (2018), Omilani and Raji (2024) in their study on the effects of computer animation instructional package on Students' academic achievement in Chemistry revealed that CAIP highly impacted students' performance in the chemical concept of hybridization. The package thus had significant positive effects on the students' academic achievement.

Gender issues have been linked with achievement of students in academic task. It has been held as one of the attributes that influence students' achievement in science subjects at senior secondary schools. Hence, Awobodu (2016) posited that gender as a moderating variable has an influence in students' achievement in science in general. The influence of gender on students' level of achievement has been a matter of concern to teachers, researchers and other stakeholders in education. In view of that, concerted efforts are being made by researchers to ascertain the extent

of gender influence and to also devise ways that will ensure both male and female students achieve optimally in their academic pursuit and other life endeavours.

Scholars have revealed divergent findings on the influence of gender on students' academic achievement. For example, Yilshik, Ezekiel and Umar (2020) asserted that gender is one of the factors that have considerable effects on the academic achievement of students especially in science subjects and Biology in particular. The authors revealed gender differences in academic achievement among students in Biology with the males scoring higher than the females. Similarly, Musa, Christopher and Samuel (2019) revealed that male students achieved better than female students when taught algebra using individualized algebra blocks strategy. More so, Gongden (2022) found that a significant difference exists between the mean achievement scores of male and female students in favour of males when taught using computer animation strategy. On the other hand, Kakudi and Salisu (2019) found no significant difference between mean scores of male and female students in Biology when taught using animated media instructional strategy). Similarly, Dajal and Dada (2020); Nguuma, Ityavzua, and Onyia (2020) in their separate studies have reported that computer animation- based instructional strategies do not significantly affect students' academic achievement based on gender. The separate studies revealed no significant difference between the mean achievement scores of male and female students.

The present study is therefore seeking to answer the broad question: what effects does Computer Animation Package have on SS2 students' achievement in Biology in Jos North Plateau state, Nigeria?

### **Objectives of the Study**

The aim of the study was to investigate the effects of computer animation package on interest of senior secondary two students in Biology in Jos North Local Government Area, Plateau State, Nigeria. Specifically, the objectives of the study were to:

1. Determine the effects of computer animation package on senior secondary two students' achievement in Biology in Jos North Local Government Area;
2. Ascertain the effects of computer animation package on senior secondary two male and female students' achievement in Biology in the experimental group.

### **Research Questions**

The following research questions guided the study:

1. What are the pre-test and post-test achievement mean scores of SS2 students in Biology in the experimental and control groups?
2. What are the pre-test and post-test achievement mean scores of SS2 male and female students in Biology in the experimental group?

### **Hypotheses**

The following hypotheses guided the study

1. There is no significant difference in the pre-test and post-test achievement mean scores of SS2 students in Biology in the experimental and control groups?
2. There is no significant difference in the pre-test and post-test achievement mean scores of male and female SS2 students in Biology in the experimental group.

### **METHODOLOGY**

The study adopted a quasi-experimental design, specifically the pre-test post-test non-equivalent control- group design where intact classes were used. The population of the study consisted of all the 731 SS 2 students (392 males and 339 females) who were offering Biology in the 22 public senior secondary schools in Jos North Local Government Area, Plateau State. The sample of the study consisted of 52 students (21 males and 31 females) drawn from two intact classes from two schools selected from the 22 public senior secondary schools in Jos North using

stratified sampling technique. The schools were placed into two strata (stratum A and stratum B). Stratum "A" had 8 schools which had functional computer laboratory with adequate power supply (solar panel), while stratum "B" had 14 schools which lack functional computer laboratory and other information technology tools. One school chosen from stratum "A" served as the experimental, and one school sampled from stratum "B" served as the control group. The research instrument used for data collection was the Biology Achievement Test (BAT). It consisted of two sections A and B. Section A focused on the background information of the respondents. These information were the students' code, school code and gender. Section B was the items of the instrument and consisted of 40 multiple choice questions with options A-D. The multiple choice questions were adapted from West Africa Senior School Certificate Examination, JAMB past question papers from 1978-2023 booklet. The maximum marks obtainable was 100, while the minimum obtainable marks were 0. The validity of the BAT was ascertained by three experts who established its face, content and construct validity. One of the experts was a lecturer from Biology Education Unit of the Federal University of Kashere. The second expert was a lecturer from Research, Measurement and Evaluation Unit in the Department of Educational Foundations of the University of Jos, and the third expert was an experienced secondary school Biology teacher from the Department of Science in Industrial Training Fund (ITF) Staff School Jos, Plateau State. The reliability of the Biology Achievement Test instrument was established using Kuder-Richardson 20 (K-R20) method which yielded a reliability coefficient of 0.93. The descriptive statistics of mean and standard deviation were used to answer the research questions. While, Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance.

## RESULTS

### Research Question One

What are the pre-test and post-test achievement mean scores of SS2 students in Biology in the experimental and control groups?

**Table 1**

**Pre-test and Post-Test Achievement Mean Scores of Students in the Experimental and Control Groups**

Group	Pre-test			Post-test		Mean Gain	Mean Gain Difference
	N	Mean	SD	Mean	SD		
Experimental	20	23.50	7.80	52.10	15.38	28.6	22.38
Control	32	22.19	7.28	28.41	9.90	6.22	

Table 1 shows the pre-test and post-test achievement mean scores of students in Biology for experimental and control groups. The respondents in the experimental group had an achievement mean score of 23.50 with a standard deviation of 7.80 in the pre-test, a mean score of 52.10 with a standard deviation of 15.38, and a mean gain of 28.6 in the post-test. The control group had an achievement mean score of 22.19 with a standard deviation of 7.28 in pre-test, a mean score of 28.41, standard deviation of 9.90 and a mean score gain of 6.22 in the post-test. An achievement mean gain difference of 22.38 existed in favour of experimental group, implying that the use of computer animation package in teaching Biology does improve students' achievement in the subject.

### Hypothesis One

There is no significant difference in the pre-test and post-test achievement mean scores of SS2 students in Biology in the experimental and control groups.

**Table 2**  
**ANCOVA Result on the Pre-test and Posttest Achievement Mean Scores of SS2 students in Biology in Experimental and Control Groups**

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	7586.251 <sup>a</sup>	2	3793.125	27.107	.000	.525
Intercept	4075.038	1	4075.038	29.121	.000	.373
BATPREALL	676.789	1	676.789	4.837	.033	.090
GROUP	6489.094	1	6489.094	46.373	.000	.486
Error	6856.730	49	139.933			
Total	87643.000	52				
Corrected Total	14442.981	51				

a. R Squared = .525 (Adjusted R Squared = .506)

Table 2 reveals that  $F(1, 49) = 46.37, p < 0.05$ . Since the p-value of 0.000 is less than 0.05 level of significance, the null hypothesis which states that there is no significant difference in the pre-test and post-test achievement mean scores of students in the experimental group and control group was rejected. The table further showed an adjusted R squared value of 0.506 which means that 50.6% of variation in the students' achievement in Biology was explained by the treatment administered to the experimental group, while the remaining 49.4% could be as a result of other factors. This results is indicative that the treatment had significant positive effects on the achievement of secondary two students in Biology.

### Research Question Two

What are the pre-test and post-test achievement mean scores of male and female students in Biology in the experimental group?

**Table 3**

### Pre-test and Post-Test Achievement Mean Scores of Male and Female Students in the Experimental Group

Group	N	Pre-Test		Post-Test		Mean Gain	Mean Gain Dif
		Mean	SD	Mean	SD		
Male	8	18.86	7.57	44.75	14.38	25.89	4.53
Female	12	26.58	6.54	57.00	14.54	30.42	

Table 3 revealed that male students had a pre-test achievement mean score of 18.86, standard deviation of 7.57, post-test achievement mean score of 44.75, standard deviation of 25.89 and a mean gain of 25.89 in the experimental group. While the female students had a pre-test achievement mean score of 26.58, standard deviation of 6.54, post-test achievement mean score of 57.00, standard deviation of 14.54 and achievement mean gain of 30.42. The table also showed that a small achievement mean gain difference of 4.53 existed between the groups in favour of the female students. The small achievement mean difference implies that the computer animation package had similar effects on the achievement of both male and female students in Biology.

### Hypothesis Two

There is no significant difference in the pre-test and post-test achievement mean scores of male and female SS2 students in Biology in the experimental group.

**Table 4**  
**ANCOVA Result on the Pre-test and Posttest Achievement Mean Scores of Male and Female students in Biology in Experimental Group**

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	877.970a	2	438.985	2.064	.158	.195
Intercept	2634.159	1	2634.159	12.385	.003	.421
BATPREEXPTL	157.670	1	157.670	.741	.401	.042
GENDEREXPTL	291.128	1	291.128	1.369	.258	.075
Error	3615.830	17	212.696			
Total	58782.000	20				
Corrected Total	4493.800	19				

a. R Squared = .195 (Adjusted R Squared = .101)

Table 4 showed that  $F(1, 17) = 1.369, P > 0.05$ . Since the P-value of .258 is greater than 0.05, the null hypothesis was retained. It was concluded that no significant difference existed between the pre-test and post-test achievement mean scores of male and female students in the experimental group. The students did not differ significantly in their achievement based on gender. The result further revealed an adjusted R squared value of 0.101 which means that only 10.1% of the variation in the students' achievement in Biology was explained by gender, while the remaining 89.9% was due to other factors. This implies that the computer animation package is gender friendly in influencing students' achievement in Biology.

## DISCUSSION

Results of research question one showed that the respondents in the experimental group had an achievement mean gain difference of 22.38 over their counterparts in the control group. The higher achievement mean gain in favour of the respondents in the experimental group implies that the use of computer animation package (CAP) in teaching Biology does improve students' achievement in the subject. In the same vein, hypothesis one revealed that the null hypothesis was rejected which means that a significant difference existed between the pre-test and post-test achievement mean scores of students in the experimental group and control group. Students taught using CAP achieved better than the group taught using lecture method. This is indicative that the treatment had significant positive effects on the achievement of students in Biology. The significant positive effects the CAP had on the achievement of students in the experimental group could be as a result of the interactivity, faster learning, and convenience attributes of CAP which could promote conceptual clarity and also improve conceptual understanding, increase attention, increase curiosity, increase retention and invariably place the learners on a pedestal for better achievement as recorded in this study. The results corroborated the findings of Ibrahim and Gana (2019), Faruk, Faruku and Hassan (2022), Ala, Onojah, Isyaku and Adamu (2023), Kakudi and Salisu (2019) who in their separate studies reported that instructional computer animation strategy had significant effects on students' achievement in Biology concepts. The authors revealed that CAP significantly improved students' achievement. The findings also lend credence to Omilani and Raji (2024) who found that computer animation instructional package (CAIP) had significant positive effects on the students' academic achievement in Chemistry (chemical concept of hybridization).

The results of research question two showed that a small achievement mean gain difference existed between male and female students in the experimental group in favour of the female students. The small mean difference implies that the computer animation package had similar effects on the achievement of both male and female students in Biology. Similarly, hypothesis two concluded that no significant difference existed between the pre-test and post-test achievement mean scores of male and female students in the experimental group. The students did not differ significantly in their achievement based on gender. This presupposes that the computer animation package is gender friendly in influencing students' achievement in Biology. The interactivity, audio-

visual stimulation attributes which characterise the CAP probably captivated both male and female students in similar fashion leading to insignificant difference in the achievement when taught using the intervention. The findings tally with Kakudi and Salisu (2019) who found no significant difference between mean achievement scores of male and female students in Biology when taught using animated media instructional strategy. The findings also agree with Dajal and Dada (2020); Nguuma, Ityavzua, and Onyia (2020) who reported in their separate studies that computer animation- based instructional strategies do not significantly affect students' academic achievement based on gender. The separate studies revealed no significant difference between the mean achievement scores of male and female students.

On the other hand, the findings differ from Yilshik, Ezekiel and Umar (2020) who reported gender differences in academic achievement among students in Biology with the males scoring higher than the females. In the same vein, Irungu, Nyagah and Mugambi (2019) reported that gender biases exist between boys and girls in many African communities and the gender bias tends to make boys more active in the classroom during the teaching and learning process. Furthermore, the findings are at variance with Musa, Christopher and Samuel (2019) who revealed that male students achieved better than female students when taught algebra using individualized algebra blocks strategy. Also, Gongden (2022) found that a significant difference exists between the mean achievement scores of male and female students in favour of males when taught using computer animation strategy.

## **CONCLUSION**

The study concluded that the use of computer animation package enhances secondary students' achievement in Biology. The study also concluded that the computer animation package is gender friendly in influencing students' achievement in Biology, since the male and female students did not differ significantly in their achievement.

## **RECOMMENDATIONS**

1. The Federal and State Governments, school authorities including NGOs should devote more fund to providing information technology tools such as computers, projectors, internet connectivity and reliable power sources to secondary schools for easy integration of computer mediated teaching strategies like the use of computer animation package in teaching their subjects.
2. Principals should encouraged subject teachers to integrate computer mediated teaching strategies like the use of computer animation package in the teaching and learning of their subjects.
3. Teachers should be properly trained to acquire the requisite skills to effectively be use of computer animation package in their schools since the strategy was effective in improving both male and female students' achievement.

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