

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

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ABSTRACT

The study investigated the effects of computer animation package on senior secondary two students' retention in Biology in Jos North LGA, Plateau State. The study was guided by two objectives; two research questions and two hypotheses. 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 730 SS 2 students (371 males and 359 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 simple random sampling technique participated in the study. Data were collected using Biology Retention Test (BRT). It consisted of 40 multiple choice questions with options A-D 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 research questions were answered using descriptive statistics of mean and standard deviation, while the hypotheses were tested using inferential statistic of independent sample t-test at 0.05 level of significance. The findings showed that a statistically significant difference exists between the retention mean scores of the students in the experimental group and students in the control group. The students in the experimental group had a higher retention mean scores than the students in control group. The findings further revealed that no significant difference exists between the retention mean scores of male and female students in Biology in the experimental group. The male and female students in the experimental group had similar retention mean scores. Hence, the use of computer animation package in teaching Biology does improved students' retention in the subject irrespective of gender. It was recommended among others that Biology teachers should employ more computer mediated teaching techniques in the teaching of topics that are abstract and complex. It was recommended that the Federal and state governments, school authorities should provide the basic information technology tools such as computers, storage devices and projectors required by Biology and other Science teachers for preparing and teaching their lessons using computer animation packages.

Key words: Biology, Computer Animation, Retention, Gender

Introduction

Scientific knowledge is very important to national development. The study of science which is a process and product that tries to proffer answers to human questions and curiosity is one of the most important fields of knowledge that students can learn because of its relevance to life and application to everyday situations. Science and technology form the basis of modern

development worldwide. It enhances capacity building, skill acquisition, acquisition of relevant knowledge and the development of technology as well as habits for surviving in the changing world. The knowledge of science is important to humans because its application meets basic human needs and improves the standard of living for man. 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).

Learners exposed to the principles of scientific investigation, are expected to acquire knowledge, skills and attitudes that support the development of the nation. Hence, the need for deliberate and concerted efforts to make the teaching and learning process meaningful and effective. Teaching of science involves guiding students to acquire scientific knowledge and skills to tackle problems in the real world. It is believed to be a vital tool for individuals and societal development at large, and the learning of science concepts must be meaningful in order for developmental transformation to take place. In science generally, learners acquire practical and manipulative skills to interact with the environment for better productivity in a world that keeps changing (Yilshik, Agbo, & John, 2026). 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. Also, Yilshik, Ezekiel and Umar (2020) mentioned that a credit pass in Biology in Senior School Certificate Examination is required for admission into Biology-related courses at the higher institutions such as Biological science, Agriculture, Veterinary Medicine, Biochemistry, Biotechnology, Medicine, Nursing, Pharmacy, Genetics, Ethno-botany among others. The foregoing has made it obvious that the importance of Biology to life and in promoting sustainable economic and national development cannot be overemphasized. It therefore necessary that teachers employ viable and engaging strategies to teach Biology in secondary schools so as to foster high achievement and retention in the subject.

STATEMENT OF PROBLEM

Recognizing the importance of Biology to national development, the Nigerian government and other stakeholders have made concerted efforts to improve the teaching and learning of Biology in the secondary school level. These efforts includes: the revisions of Nigerian senior secondary school curriculum, provision of functional science laboratories, building and furnishing computer laboratories, employing qualified science teachers, equipping school libraries, provision of instructional materials, organizing seminars and workshops to build teachers' capacity to deliver in classroom, and organizing extra coaching sessions for SSCE candidates by the school authorities among others to improve the teaching and learning of Biology. Despite these efforts and the well-documented importance of Biology to national growth, many secondary school students do not achieve optimally in Biology in public examinations in Plateau State and Nigeria at large. The analysis of West African Senior School Certificate Examination (WASSCE) results for school candidates 2016 to 2023 in Plateau state showed that achievement of students has continued to fluctuate and remained below the optimal level of 100%. The pass

rates at credit level for 2016 to 2023 are: 66.09%, 59.36%, 45.21%, 55.86%, 82.44%, 60.81%, 80.58%, and 88.60% accordingly, which shows that many students continued to fail. The students who failed may not get admission to read Biology related courses in tertiary institutions which may lead to inadequate trained manpower in related institutions and industries.

The continued unsatisfactory achievement of students in Biology SSCE could be partly attributed to students' poor retention of Biology concepts learnt which might be due to Biology teachers' frequent use of lecture method of teaching which is teacher-centered, with little or no augmentation with innovative technology-aided teaching strategies like computer animation package in their teaching. Also, the WAEC Chief Examiners' reports (2018-2025) has attributed the unsatisfactory achievement to weaknesses observed in the candidates. Some of the weaknesses include: lack of in-depth knowledge of some basic topics like genetics, nervous systems, circulatory system; inability to explain concepts like fertilization in plants and animals, evolution; describing biological processes; and also comparing the processes occurring in the body system like transmission of nerve impulse, oxygenation of blood in the lungs, opening and closing of valves during diastole and systole adequately among others. In the same vein, Etobro and Fabinu (2017) asserts that many students find these Biology concepts and processes difficult to understand, and the difficulty has been attributed to the seeming abstract nature and invisibility of phenomenon and processes of Biology concepts.

Also, the systems of the body learnt in Biology carries out functions that are internal in nature, occurring at tissue and system level and students cannot visualize such processes as they occur in real life. The students may largely end up memorizing the contents without meaningful learning which may hamper retention of learnt contents and invariably lead to low achievement in Biology. Teachers therefore need to shift from predominant use of lecture method learner-centered and technology-driven strategies which have the tendency to enhance meaningful learning which could lead to high retention of learnt Biology concepts. One of such strategies is the use computer animation package. Using computer animated videos of biological processes and other abstract biology concepts to teach students could bring about a paradigm shift, as it may provide opportunity for students to have a close-to real-life view of the processes as they occur in the body. This would make learning more meaningful and thus enhance retention. It is with the backdrop of this that the researcher tried out the use of computer animation package in teaching to find out if it could improve students' retention in Biology.

Computer animation package is a package that simulates movement created by a series of pictures. It could be seen as a visual digital display technology that simulates moving objects on a screen in an attempt to give life to inanimate objects by simulating movement created by a series of pictures. 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. It is the process of turning two-dimensional (2D) and three-dimensional (3D) still images into moving images (Mayo, 2023). 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 as the particular programme requires. The computer revolution being witnessed in the 21st century is has made computer technology to flood the society in such a way that almost every sphere of life is being influenced by the use of computer. As such, Biology teachers need to key into the trend. Using computer animation to teach involves putting the abstract concepts, processes and ideas into motion pictures as though these pictures are live and active which will make the students see them as real objects. As the teacher explains the computer animated objects as they sequentially come up, the understanding of the subject matter is expected to become easier because the content being learnt appeals to both visual and auditory senses and the new knowledge may easily be processed into long-term memory of learners making retention and retrieval easy. 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. The attributes of computer animation package such as: interactivity, interest stimulation, visual stimulation, faster learning, and convenience may boost students' retention in learning Biology which could translate into better achievement in the subject. Nya (2023) had asserted that the use of animated materials reduces the learning task and time, and also creates room for consistency and learning mastery by increasing retention. Thus, this study investigated the effects of computer animation package on students' retention in Biology.

Retention is the capacity to recall previously learned contents, concepts, or principles. Gupta (2022) defined retention as a person's ability to transfer new information into their long-term memory so that it is easy for them to recall and put that knowledge to use in the future. When the concepts taught have been absorbed and can be recalled at any point in time, one could say that retention has taken place. Zumyil (2019) asserted that retention of a learnt material is a direct correlate of positive learning which the primary essence of education is. Therefore, if learners must achieve optimally in any learning process, they are expected to be able retain learnt contents highly. Hence, high retention may result in high academic achievement.

Studies have revealed varied findings on the effects of computer animation package (CAP) on students' retention in Science and Biology in particular. Ibrahim and Gana (2019) revealed that Biology students taught cell division using computer animation retained the concepts higher than those taught using other methods. In the same vein, Faruk, et al (2022) found a significant difference in retention mean scores in favour of the experimental group when taught genetics using animated media instruction. More so, Chikendu (2018) discovered that Instructional Computer Animation (ICA) had significant positive effects on students' retention as the student taught using the ICA had better retention mean scores than those taught with traditional lecture method. Furthermore, Obinna, et al (2021) concluded in their study that animated-media strategy positively enhanced students' retention in chemistry as against the conventional method. Also, Osuafor, et al (2019) reported that animated media instructional strategy is significantly effective in enhancing students' achievement and retention in computer studies.

Gender is a moderating variable in most educational research studies. It is one of the variables being queried in the present study. Gender refers to the characteristics of males and females that are socially constructed. Yilshik, Ezekiel and Umar (2020) defined the concept of gender as an understanding of the socially constructed distinction between males and females based on biological composition, including the roles and expectations for males and females in a culture. Gender has been link to academic achievement. Irungu, et al (2019) asserted that regardless of better achievement by females, their potentials seem to be underestimated leading to low morale and their conducts confined to stereotyped female roles. However, when the teaching strategy adopted allows both male and female students to freely interact and participate in the learning process, the perceived influence of gender on students' achievement could be minimised. Gender as a moderating variable in educational research has been asserted to be one of the factors that have considerable effects on the retention of students especially in science subjects and Biology. Studies have reported varying findings on the influence of gender on students' retention. For example, Nwoye, et al (2020) found that gender had no significant influence on students' academic retention in electrostatics when taught with Computer Animation Instructional Package. Similarly, Godpower-Echie and Owo (2019) found no significant difference in the mean retention scores of male and female students. Also, Nwoke, et al (2021) studied balancing gender achievement and knowledge retention in mathematics using computer animation instructional package. The result of the study revealed that Computer

Animation Instructional Package (CAIP) reduced gender disparity associated with mathematics retention as there was no significant difference between the mean retention scores of male and female students taught mathematics using Computer Animation Instructional Package (CAIP). However, Gongden (2022) reported that a statistically significant difference exists between the retention mean scores of male and female students in favour of males when taught chemical equilibrium using computer animation strategy.

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

1. determine the effects of computer animation package on SS2 students' retention in Biology;
2. ascertain the effects of computer animation package on the male and female SS2 students' retention in Biology in the experimental group.

The following research questions guided the study:

1. What are the retention mean scores of SS2 students in Biology in the experimental and control groups?
2. What are the retention mean scores of male and female SS2 students in Biology in the experimental group?

The following hypotheses guided the study:

1. There is no significant difference between the retention mean scores of SS2 students in Biology in the experimental group.
2. There is no significant difference in the retention mean scores of male and female SS2 students in Biology in the experimental group.

METHODOLOGY

The population of the study consisted of all the 730 senior secondary two students in Jos North Local Government Area of Plateau State, Nigeria, who were offering Biology from the 22 public secondary schools in 2025/2026 session. Out of the population of 730, 371 students representing 50.82% were males, while 359 students representing 49.18% were females. The sample size for the study consisted of 52 students from two intact classes. Intact class A served as experimental group with 20 students (8 males, and 12 females), while intact class B was the control group with 32 students (13 males and 19 females). A simple random sampling technique was used to select two schools from the 22 public senior secondary schools in Jos North Local Government Area that form the population of the study. The sampling technique was considered adequate because the researcher provided the laptop computer, computer animated videos and projector used for the study. The simple random sampling was done by using the "hat and draw" method. The list of all the 22 public schools in Jos North Local Government Area was prepared. The name of each school was then written on a piece of paper each. Two of the pieces of paper were coded with "yes", while the remaining twenty were coded with "no" and placed in a bowl. Each piece of paper was picked at random one at a time without replacement. The two schools with the "yes" codes written on them were the ones that participated in the study. One of the selected schools was assigned to the experimental group and the other to the control group. The research instrument used for data collection was the Biology Retention Test (BRT). The BRT consisted of two sections A and B. Section A, focused on the demographic information of the respondents. Section B was the items of the instrument and consisted of 35 multiple choice questions with options A-D and 5 essay questions. Each of the multiple choice test items consisted of only one correct answer which attract two marks (70marks), while each of the essay questions carried six marks (30), giving a total of 100marks. 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 of 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 two research questions. While the two hypotheses were tested using an inferential statistic of independent sample t-test at 0.05 level of significance.

Results

Research Question One

What are the retention mean scores of SS2 students offering Biology in the experimental and control groups?

Table 1

Retention Mean Scores of Students in Biology in the Experimental and Control Groups

Group	N	Mean	SD	Mean difference
Experimental	20	51.40	12.47	26.74
Control	32	24.66	9.04	

Table 1 shows the retention mean scores of students in Biology for experimental and control groups. The respondents in the experimental group had a retention mean score of 51.40 with a standard deviation of 12.47. While respondents in the control group had a retention mean score of 24.66, standard deviation of 9.04, with a mean score difference of 26.74 in favour of respondents in the experimental group. The retention mean score difference of 26.74 for the experimental group implies that the use of computer animation package in teaching Biology does improve students' retention in the subject.

Hypothesis One

There is no significant difference in the retention mean scores of students taught using computer animation package (CAP) and those taught using the lecture method.

Table 2

Result of t- test Analysis for the Difference between the Retention Mean Scores of Students in Biology in the Experimental and Control Groups

Group	N	Mean	SD	Df	T	P-Value
Experimental	20	51.40	12.47	50	8.96	0.000
Control	32	24.66	9.04			

From table 2, the retention mean values for the experimental groups were mean =51.40, standard deviation =12.47, and control group were mean =24.66, standard deviation =9.04 respectively. The t-statistic was 8.96 and p-value of 0.000 ($p < 0.05$). Since the p-value of 0.000

is less than 0.05, the null hypothesis which states that there is no significant difference in the retention mean scores of students taught using CAP and those taught using the lecture method was rejected. This means that a statistically significant difference exists between the retention mean scores of the students in the experimental group and students in the control group. The implication of the results is that CAP enhances SS2 students' retention in Biology.

Research Question Two

What is the retention mean scores of male and female students who are offering Biology in the experimental group?

Table 3

Retention Mean Scores of Male and Female Students in the Experimental Group

Group	N	Mean	SD	Mean Score Difference
Male	8	50.50	12.86	1.50
Female	12	52.00	12.74	

Table 3 revealed that male students in the experimental group had a retention mean score of 50.50 and a standard deviation of 12.86. While the females had a retention mean score of 52.00 and a standard deviation of 12.74. There also existed a small retention mean score difference of 1.5 between the groups in favour of the female students. This implies that the female students retained learnt concepts slightly more than the male students when taught Biology using computer animation package.

Hypothesis Two

There is no significant difference in the retention mean scores of male and female students in Biology when taught using the computer animation package

Table 4

Result of t- test Analysis for the Difference between the Retention Mean Scores of Male and Female students' in Biology in Experimental Group

Group	N	Mean	SD	Df	t	P-Value
MALE	8	50.50	12.86	18	-0.257	.800
FEMALE	12	52.00	12.74			

Table 4 showed that the retention mean values for male and female students in the experimental group were (male: mean =50.50, standard deviation =12.86) and (female: mean =52.00, standard deviation =12.74) respectively. The t-statistic was -0.257 and p-value of 0.800 ($p > 0.05$). Since the p-value of 0.800 is greater than 0.05, the null hypothesis which states that there is no significant difference in the retention mean scores of male and female students taught using computer animation package was retained. This means that a no statistically significant difference existed between the retention mean scores of the male and female students in the experimental group and students in the control group. The implication of the results was that CAP enhances both male and female SS2 students' retention in Biology. Hence, it can be inferred that the computer animation package is a gender-inclusive learning package.

DISCUSSION

Research question one revealed that students in the experimental group had a higher retention mean score than the students in control group which means that the use of computer

animation package in teaching Biology does improved students' retention in the subject. Furthermore, hypothesis one revealed that a statistically significant difference exists between the retention mean scores of the students in the experimental group and students in the control group. Students taught using CAP had better retention mean score than the students taught using lecture method. Thus the intervention (CAP) was effective in enhancing students' retention in Biology. The positive effects of the intervention on students' retention in Biology could be because computer animation is associated with a combination of verbal and visual cues which facilitate long-term memory and boosts learners' knowledge retention

The finding is in concord with Ibrahim and Gana (2019) who revealed that Biology students taught cell division using computer animation outperformed and retained the concepts higher than those taught using other methods. The findings also agree with Faruk, et al (2022). The researchers found a significant difference in retention mean scores in favour of the experimental group when taught genetics using animated media instruction. The study further concurs with Chikendu (2018) who discovered that Instructional Computer Animation had significant positive effects on students' retention as the student taught using the ICA had better retention mean scores than those taught with traditional lecture method. Similarly, the results of the study tally with Obinna, et al (2021) whose study concluded that animated-media strategy positively enhanced students' retention in chemistry as against the conventional method. More so, the finding is in tandem with Osuafor, et al (2019) who found that animated media instructional strategy is significantly effective in enhancing students' achievement and retention in computer studies.

The finding of research question two in table 3 showed that the female students retained learnt concepts slightly more than the male students when taught Biology using computer animation package. However, hypothesis two in table 4 showed that the slight difference between the retention mean scores of male and female students in the experimental group was not statistically significant. This means that no significant difference exists between the retention mean scores of male and female students in Biology in the experimental group. The use of computer animation package in teaching Biology does improved students' retention in the subject irrespective of gender. The finding is in agreement with Nwoye, et al (2020) who revealed that gender had no significant influence on students' academic retention in electrostatics when taught with Computer Animation Instructional Package. Similarly, Godpower-Echie and Owo (2019) found no significant difference in the mean retention scores of male and female students. Also, Nwoke, et al (2021) studied balancing gender achievement and knowledge retention in mathematics using computer animation instructional package and revealed that Computer Animation Instructional Package (CAIP) reduced gender disparity associated with mathematics retention as there was no significant difference between the mean retention scores of male and female students taught mathematics using Computer Animation Instructional Package (CAIP). However, the result does not concur with the finding of Gongden (2022) who reported that a statistically significant difference exists between the retention mean scores of male and female students in favour of males when taught chemical equilibrium using computer animation strategy.

CONCLUSION

The students taught using computer animation package (CAP) had higher retention mean scores than the students taught using lecture method. Thus, the study concluded that intervention (CAP) had significant positive effects on students' retention in Biology in

Jos North Local Government Area, Plateau State, Nigeria. The study further concluded that the significant positive effects of computer animation package on students' retention in Biology in the experimental group is not based on gender. The use of computer animation package in teaching Biology does improved students' retention in the subject irrespective of gender.

RECOMMENDATION

Based on the findings of the study, the following recommendations were made:

1. Since the use of CAP in teaching has been found to enhance students' retention in Biology, Biology teachers should employ it more in the teaching of the subject especially for topics that are abstract and complex.
2. Biology teachers' capacity in the preparation and effective use of computer animations in teaching concepts needs should be built.
3. Biology and Science teachers in general should be provided with the information technology tools such as computers, storage devices and projectors which they need for preparing and teaching their lessons using computer animation packages.

REFERENCE

- Chikendu, R. E. (2018). *Effects of instructional computer animation on secondary school students' achievement and interest in Chemistry in Awka education zone*. Unpublished PhD dissertation presented to the Department of Science Education, Faculty of Education, Nnamdi Azikiwe University, Awka, Anambra state.
- Edeh, O. M., & Nwanama, M. C. (2020). Difficult Biology topics as perceived by secondary school students in Nkanu East L.G.A. of Enugu State. *International Journal of Research and Publications*, 1(1), 1–10.
- Etobro, B.A., & Fabinu, E. O. (2017). Students' perceptions of difficult concepts in Biology in senior secondary schools in Lagos State. *Global Journal of Educational Research*, 16, 139-147.
- Faruk, U. R., Faruku, A., & Hassan, L. Z. (2022). Assessing effectiveness of animated instructional media on academic performance and retention of genetics concepts among senior secondary school Biology students in Sokoto State. *Journal of Natural Science and Integration*, 5(1), 117-125
- Godpower-Echie, G., & Owo, W. J. (2019). Gender difference in Basic Science achievement of junior secondary schools in Obio/Akpo Local Government Area, Rivers State. *International Journal of Scientific Research in Education*, 12(2), 320-329.
- Gongden, E. J. (2022). Effects of gender on senior secondary school two chemistry students' achievement and retention in chemical equilibrium using computer animation strategy (CAS) in Jos South Local Government Area of Plateau State". *Benin Journal of Educational Studies*, 28(1), 124-133.
- Gupta, D. (2022). Factors of Learning Retention. *Whatfix Blog*. Retrieved from

<https://www.whatflix.com/blog/learning.retention>

- Ibrahim, R. U., & Gana, B. K. (2019). Effects of animation as an instructional strategy on students' performance and retention in Biology. *STAN 60th Annual Conference Proceedings* 2019, 280- 287.
- Irungu, M. N., Nyagah, G., & Mugambi, M. (2019). To examine the influence of gender interaction on academic achievement of learners. *Advances in Social Sciences Research Journal*, 6(7), 126-143.
- Mayo, C. (2023). Learn the animation definition and study the different types of animations. Explore the history of animation and discover some examples of animated films. Retrieved from <https://study.com/academy/lesson/animation-definition-history-examples.html>
- Nwoke, B. I, Okorie, S. C., & Chile-Agada, B. U. N. (2021). The effectiveness of computer animation instructional package on balancing gender achievement and knowledge retention in mathematics in Government owned secondary schools in Owerri North Local Government Area of Imo State. *International Journal of Research in Education and Sustainable Development*, 1(4), 58-69.
- Nwoye, A. N., Okeke, S. O. C., & Nwosu, F. C. (2020). Gender and Academic Retention of secondary school students taught Electrostatics with Computer Animated Instructional Package in Awka Education Zone. *UNIZIK Journal of STM Education*, 3(2), 41-50.
- Nya, J. (2023). The effects of computer-animation on senior secondary school biology student's performance in Uyo Local Government Area of Akwa Ibom State. *Project Boss Team*. Retrieved on 4th March, 2024, from www.projectboss.com.ng
- Obinna, P. P., Adanna, A. A. & Chinaza, G. P. (2021). Effects of animated-media instructional strategy on students' retention in chemistry when compared to those taught using conventional method using their pretest and posttest mean scores. *IAA Journal of Education*, 7(1), 15-29.
- Osuafor, A., Maureen, N., & Anusiuba, I. O. (2019). Effects of animated media instructional strategies on achievement and retention of secondary school students in computer studies. *International Journal of Scientific Engineering Research*, 10, 1692-1696.
- Piwuna, C. N. (2024). *Effects of implementation of chief examiners' reports on motivation and achievement in Biology among senior secondary two students in Jos South, Nigeria*. Unpublished PhD thesis, University of Jos, Nigeria.
- Thomas, C. (2021). Top 5 types of animation styles. Retrieved from

<https://www.arts.ac.uk/study-at-ual/short-courses/stories/top-5-types-of-animation-styles>

- Yilshik, O. M., Ezekiel, D. P., & Umar, S. A. (2020). Relationship between secondary school students' self-concept and academic achievement in Biology in Plateau State Central Senatorial Zone, Nigeria. *Journal of Science, Technology, Mathematics and Education (JOSTMED)*, 16(2), 176-185
- Zumyil, C. F. (2019). Nigerian science teachers' views of Integrated Science and also students in the integrated science and non-Integrated Science subject. *Women in Colleges of Education Journal* 6(4), 234-245.