

EFFECTS OF COMPUTER ANIMATION STRATEGY ON SENIOR SECONDARY ONE STUDENT'S ACHIEVEMENT IN CELL DIVISION IN JOS NORTH, NIGERIA

¹**Piwuna, Comfort Nanko**

Department of Science & Technology Education.
Faculty of Education, University of Jos.
+2348037037102 piwunacomfort@yahoo.com

²**Rawen, Yahweh Simon**

Plateau Baptist Academy, Katon Rikkos, Lamingo Road, Jos.
+2348184089132. rawenyahwehsimon@gmail.com

³**Raphael, Emmanuel**

Government Technical and Science College,
MadaStation, NasarawaEggon.
+2347039602611. raphaelemmanuel55@yahoo.com

⁴**Stephen, Joseph Usman**

Department of Science & Technology Education
Faculty of Education, University of Jos
+2348138899889. Stephen.joseph1991@gmail.com

Abstract

This study examined the Effects of computer animation strategy on senior secondary one student's achievement in cell division in Jos North. Three research questions and three corresponding hypotheses were formulated and tested at 0.05 level of significance. The quasi-experimental research design involving pre-test and post-test control group was employed on a population comprised all Senior Secondary one biology students in all senior secondary schools in Jos North Local Government Area. The sample for the research was 214 students (112 males and 102 females) in Senior Secondary one from intact classes drawn from four schools. Purposive sampling technique was used to select the four co-educational secondary schools that has computer. Cell Division Achievement Test tagged CDAT was used for data collection. The instrument was validated by three experts. The reliability coefficient of CDAT was 0.85 obtained using Kuder Richardson formula 21 (K-R-21). t-test of independent sample was used for data analysis. The Findings indicated that students taught cell division using computer animation strategy achieved better in the cell division concepts than those taught using lecture method of instruction. Also, the result of CAS strategy is gender friendly since both male and female subjects achieved equally. As a result of these findings, it was recommended among others that Biology teachers should use computer animation strategy to teach biology irrespective of gender and school type.

Keywords: Computer Animation Strategy, Achievement, Cell Division, Gender and School Type

Introduction

In Nigeria, a lot of emphasis is laid on the teaching and learning of science. This is with the major aim of achieving particular objectives of science education, as contained in the National Policy on Education, one of which is to equip the students to live effectively in this modern age of science and technology among others (FRN, 2014). These aims can be achieved by inculcating in the learners the necessary scientific knowledge, skills and attitudes through the effective teaching of the various science subjects. The outlined core science subjects in the senior secondary school curriculum which provide the foundation to science students for further studies in science and science-related courses at the tertiary level are Chemistry, Physics and Biology.

Biology is a natural science that deals with the living world and is concerned with how the world is structured, it functions, how living things came into existence and how they react and interact with one another as well as their environments (Owolabi, Olanike, Babatunde & Gambari, 2019). The importance of Biology cannot be over emphasized, it is a preparation for and a prerequisite for pursuing a number of careers in the sciences which include Medicine, Pharmacy, Biochemistry, Botany, Nursing, Microbiology, Food Technology and Zoology among others. This implies that the study of biology at the secondary school level, which is where the basics of biology are taught, should not be casual, because a decline in the understanding of biology concepts which buttresses the understanding of other fields will result in a gradual decline in the understanding of such fields as medicine, agriculture, biochemistry, and pharmaceutical sciences.

In spite of the plethora of contributions of Biology education to national development, students' achievement at senior secondary school Level Biology has not been impressive. According to the West Africa Examination Council (WAEC) subject analysis of Biology from 2011-2018, shows fluctuation and inconsistency in the achievement of Biology Students in Plateau state, Jos North local Government Area (LGA) inclusive. According to the report, some of the reasons for candidates under achievement in Biology include: teacher centered methods of teaching, lack of using technological gadgets in teaching among others. These under achievements affect the realization of the objectives of teaching biology and producing skilled manpower that can promote the technological advancement of the country. Biology is recognized as one of the science subjects that is voluminous in content, full of abstract concepts, contains technical words, intimidating facts, and has many themes in the secondary school curriculum identified as difficult to teach and learn by both teachers and learners (Akani, 2015). The identified concepts that are difficult and abstract in nature include: evolution, nervous system, photosynthesis, osmoregulation, genetics, sense organs and their structures, and cell division among others (Oyovwi 2021).

All living things are made up of a basic structural and functional unit of life called a cell (Michael, 2018). The cells divide to form new cells in order to repair worn-out or damaged tissues throughout an organism, and (in the gametes only) to enable the exchange of genetic material at the initial stage of the process of sexual reproduction. Cell division is the process by which parent cells divide into two or more daughter cells. It is in the process of cell division that genetic information is transferred from parents to offspring and expressed in the offspring. It is also the first stage in the stages of growth, development and reproduction. Cell division (mitosis and meiosis) are important and fundamental areas in biology education. It is the foundation of stem cell research, genetic engineering and potential treatments for cancer, diabetes, sickle cell anemia and an emerging model system in biology. The two types of cell division are generally called mitosis and meiosis. The processes in cell division cannot be presented convincingly with mere diagrams. Hence, it is considered abstract and difficult (Okolo & Oluwasegun (2020). This, according to some researchers is among the causes of under achievement in Biology. The teaching approach employed by teachers plays an important role toward improving the learning process. A technologically based and Learner-centered Instructional strategy such as computer animation strategy can enhance effective teaching and learning of Biology.

Computer animation refers to images in motion that could be accompanied by narration using an electronic device, with this done in ways that help the user to perceive a continuous change over time and develop a more appropriate mental model of the task. Muhammad, Ibrahim, and Gana, (2017) described animation as the presentation of learning media electronically using both pictorial and verbal forms such as spoken and printed text. The crop of students found in classrooms today and in the last few decades are technologically consumed and driven by their constant contact with the world of technology. They learn in new ways, and so need to be taught differently. This means that teachers must also rise to this challenge and work to provide quality teaching in line with their students' new realities. In spite of the global shift from teacher centered to learner centered approaches by educationists and many other researchers, some Biology teachers still employ the use of lecture methods.

The lecture method of teaching is a one-way process of teaching and learning with the teacher being active and the students' passive or mere listeners. In this case, the students are merely robot who regard the teacher as a repertoire of knowledge (Josiah & Larina, 2015). Research has been carried out on students centered and activity-based methods to promote self-reliance, improved performance and restructure gender differences in the science, Biology inclusive.

Gender refers to socially and culturally ascribed roles, responsibilities and opportunities associated with women and men, as well as the hidden power structures that govern relationships between them in any given society. Gender is one of the factors cited in various research studies to have significant effects on students' academic achievement especially, in science subjects. Some researchers found that male students achieve better than their female counterparts in sciences, others have found the opposite to be true (Agbo, 2019). Gender Issues in Biology are still controversial and inconclusive. This disagreement further necessitates the need for this study to include gender as an extraneous variable. Apart from gender another variable that has been found to influence students' achievement in sciences, is school type

School type refers to the categorization of secondary schools into public and private schools. The public schools are owned by the Federal, State, and Local Governments while the private schools are the ones owned by individuals, communities, associations or organizations. Private schools are usually financed by the individual owners and are usually expensive compared to the public schools. Parents pay for the cost of educating their children in private schools and therefore tend to be more involved in dictating what the schools offer than parents whose children are attending public schools (Olasahende & Olatoye, 2014). There have been inconsistent findings on the influence of school type on students' achievements. Some researchers found that public school students achieve better than their private school counterparts in sciences, others did not find any significant difference while some found that private schools are better. The review of literatures showed that there is a need to compare private and public-school students' achievement in cell division. The controversies so far, prompted the need to investigate the Effects of computer animation strategy on senior secondary one student's achievement and retention in cell division in Jos North, Nigeria.

STATEMENT OF THE PROBLEM

Despite the importance of Biology to national development, the situation of students' achievement in Biology examinations in Nigeria such as Senior School Certificate Examination (SSCE) organized by West African Examination Council (WAEC) and National Examination Council (NECO) in recent time is a matter of concern (WAEC, 2015-2019; Piwuna, Raphael, Rawen, & Peter, 2023). Chief Examiners' reports indicate that in such examination's students could not provide correct explanations of processes involving cell division. They could hardly state and correctly describe the behavior of chromosomes at each of the stages of mitosis and meiosis (WAEC, 2017, 2019). This dwindling achievement of students in Biology could be associated to the persistent

use of conventional strategies such as lecture method by the biology teachers, couple with the abstractness of certain biological concepts and terminologies such as cell glycolysis, Krebs's cycles, Cell Division, among others.

The implication of this failure in Biology education is that Nigeria may have shortages of manpower in science and technology-related disciplines such as: Medicine, Biochemistry, Pharmacy, Microbiology and Agriculture among others. This lamentable trend of students' achievement in Biology therefore, calls for an investigation of a functional strategy that could enhance the achievement of biology students in secondary schools. Hence this study intends to find out the effects of computer animation strategy on senior secondary one students' achievement in cell division in Jos North plateau state.

Research Questions

The following research questions were raised to guide the study:

1. What is the difference in the achievement mean score of students taught cell division using computer animation strategy and those taught using lecture method?
2. What is the difference in the achievement mean score of male and female students taught cell division using computer animation strategy and those taught using lecture method?
3. What is the effect of Computer Animation Strategy (CAS) on Senior Secondary one student's achievement mean score in Cell division based on school type?

Hypotheses: The following hypotheses were formulated and tested at 0.05 level of significance:

- H₀₁:** There is no significant difference in the achievement mean score of students taught cell division using computer animation strategy and those taught using lecture method
- H₀₂:** There is no significant difference in the mean achievement score of male and female Students taught cell division using computer animation strategy and those taught using lecture method
- H₀₃:** There is no significant difference in the mean achievement score of private and public-school Students taught cell division using computer animation strategy.

Methodology

The study adopted the quasi-experimental design, where intact classes were used. The population of this study includes all the Senior secondary one student studying Biology as a subject in Jos North Local Government Area of Plateau State. The sample comprised 204 (109 female and 105 male) SSI Biology students drawn from four co-educational public senior secondary schools during the 2022/2023 academic session. Purposive sampling technique was employed to select two private and two public senior secondary schools that offer Biology as a subject and have computers. Two school were assigned to experimental group and the other two to control group randomly. After which a simple random sampling technique was used to select one arm of the class from each school as sample for the study.

The researchers used Cell Division Achievement Test (CDAT) to collect data. The CDAT was used to measure students' achievement in Cell Division (mitosis and meiosis) topic taught during the period of study. The test consisted of 25 objective items and was adopted from West African Examination Council (WAEC 1993-2022). The test items covered the concept of Cell Division with four options (A-D) in which students are expected to choose a correct option in line with West African Examinations Council (WAEC) standard. The mark allotted to each correct option is 4, and the total mark obtainable is 100.

This instrument was subjected to scrutiny by two experts in Biology Education and one expert from Measurement and Evaluation unit all in the University of Jos. They scrutinized the instrument in terms of clarity, appropriateness and comprehensiveness. CDAT was trial tested on a group of 20 (SSI) Biology students from a co-educational senior secondary school in Jos South Local Government Area and the scores were subjected to Kuder Richardson formula 21 (K-R-21) which yielded a reliability index of 0.85.

The pre-test was administered to both the experimental and control groups before the commencement of the four weeks treatment in order to determine the equivalence of the groups in knowledge and ability. The topic Cell Division was taught for four weeks using the computer animation strategy in the experimental group, while that of the control group was lecture method. The post-test was administered after the four weeks teaching exercise to both the groups to determine the effectiveness of the computer animation strategy. The scores obtained were analyzed, the research questions and hypotheses were answered using mean and standard deviation, while t-test was used to test all hypotheses at 0.05 level of significance

Results and Discussion.

Research Question One: What is the difference in the mean achievement score of students taught Cell Division using computer animation strategy and those taught using lecture method?

To answer research question one, the post-test scores of students for BAT in the experimental and control groups were subjected to descriptive statistics in the form of Means and Standard Deviations. This is presented in Table 1

Table 1: Posttest Mean Scores of SSI Students in Control and Experimental Groups

	GROUP	N	Mean	Std. Deviation	Std. Error Mean	Mean Difference
Post-test	Experimental	109	54.495	16.357	1.671	11.924
	Control	105	42.571	12.974	1.397	

Table 1 reveal that the post-test means and standard deviations of students for CDAT in the experimental Group were 54.495 and 16.853 and that of control group were 42.571 and 12.974. The posttest mean difference was 11.90 in favor of experimental group.

Research Question Two: What is the difference in the mean achievement score of male and female Students taught Cell Division using computer animation strategy?

To answer research question two, the post-test scores of male and female students for CDAT in the experimental group is presented in Table 2

Table 2: Posttest Mean Achievement Scores of SSI Students in Experimental Group

Group	Gender	N	Mean	Std. Dev.	Mean Difference
Experimental	Male	64	55.859	17.651	3.081
	Female	45	52.778	14.164	

Table 2 reveal that the CDAT post-test means and standard deviations of male and female students in the experimental group was 55.859 and 17.651 for male students and that of female students was 52.778 and 14.164. The posttest mean difference was 3.081.

Research Question Three: What is the effect of Computer Animation Strategy (CAS) on Senior Secondary one student's achievement mean score in Cell division based on school type?

To answer research question five, the post-test scores of students for CDAT in the experimental group for public and private school is presented in Table 6.

Table 3: Posttest Mean Achievement Scores of SSI Students Based on School Type

Group	School Type	N	Mean	Std. Dev.	Mean Difference
Experimental	Public	57	55.175	16.146	1.136
	Private	52	54.039	16.717	

The results of analysis of Table 3 established that public school students in the experimental group had a mean achievement score of 55.175 and standard deviation of 16.146, while their counterpart in private school had a mean of 54.039 and standard deviation of 16.717. The findings also reveal a mean difference of 1.136. This implies that public school students who were exposed to the treatment had slightly higher mean achievement score than private school students who were also exposed to the treatment.

Hypothesis One

Ho₁: There is no significant difference in the mean achievement score of students taught cell division using computer animation strategy and those taught using lecture method.

In order to test hypothesis one, the post-test scores in the experimental and control groups for CDAT were subjected to t-test of independent sample. Summary of the analysis is presented in Table 4

Table 4: Results of Posttest Independent t-Test of SSI Students in Control and Experimental Groups

Group	Group	N	Mean	Std. Dev.	Df	t-Cal	P	Decision
Posttest	Control	105	42.571	12.974	2.12	-5.894	.000	Rejected
	Experimental	109	54.495	16.357				

The post-test results in Table 4 reveal that $t(2.12 = -5.894, p = .000)$, which implies that $p < 0.05$. Based on this, the null hypothesis that stated that there is no significant difference in the mean achievement score of students taught cell division using computer animation strategy and those taught using lecture method is rejected. The decision implies that, there is a significant difference in the mean achievement score of students taught cell division using computer animation strategy and those taught using lecture method. It can be stated that the treatment using computer animation strategy has significant effect on students' achievement in cell division

Ho₂: There is no significant difference in the achievement mean scores of male and female students taught Cell division using Computer Animation Strategy (CAS).

In order to test hypothesis two (2), the post-test scores in the experimental of male and female students for CDAT were subjected to t-test of independent sample. Summary of the analysis was presented in table 5.

Table 5: Independent t-Test of Difference in the Posttest Mean Achievement Scores of Male and Female SSI Students in Experimental Group

Group	Gender	Mean	Std. Dev.	Df.	t-cal.	P	Decision
Experimental	Male	55.859	17.651	107	0.974	.334	Accepted
	Female	52.778	14.164				

The results of analysis in Table 5 reveal that $t(107=0.974, p=.334)$, which means $p>0.05$; hence the study retained the null hypothesis. It was concluded that there is no significant difference between the posttest mean achievement score of male and female students in the experimental group. This is due to the fact that both male and female students were exposed to the same treatment of teaching using the CAS method. It can be stated that the treatment, using computer animation strategy has no significant effect on students' achievement in cell division across gender $T(107=0.974, p=.334)$, which means $p>0.05$.

Ho₃: There is no significant difference in the achievement mean score of public and private school students taught cell division using Computer Animation Strategy (CAS) and those who are not.

In order to test hypothesis five (5), the post-test achievement scores of public and private schools in the experimental group for CDAT were subjected to t-test of independent sample. Summary of the analysis was presented in table 6

Table6: Difference in Independent t-test of Posttest Mean Achievement Scores of SSI Students Based on School Type

Group	School Type	Mean	Std. Dev.	Df.	t-cal.	P	Decision
Experimental	Public	55.175	16.146	107	0.361	.719	Accepted
	Private	54.039	16.717				

$p>0.05$

The results of analysis of Table 6 established that public school students in the experimental group had a mean achievement score of 55.175 and standard deviation of 16.146, while their counterpart in private school had a mean of 54.039 and standard deviation of 16.717. The findings also reveal a mean difference of 1.136. This implies that public school students who were exposed to the treatment had slightly higher mean achievement score than private school students who were also exposed to the treatment.

Discussion

The results of these findings reveal that, there is a significant improvement in the mean achievement score of students taught Cell division using Computer Animation Strategy (CAS). This finding agrees with that of Jovita, Ugwuanyi, Okeke and Nwoye (2020) who maintained that animated media instruction was significantly effective in enhancing students' achievement in mathematical aspect of economics in Enugu metropolis, Enugu State. Also, Hamzat, Bello, and Abimbola (2017) found out that computer animation instructional package significantly improved secondary school students' achievement in practical biology.

Moreover, the findings on gender revealed that there is no significant difference between the posttest mean achievement score of male and female students in the experimental group. This is in line with the results of Owolabi, Olanike, Babatunde & Gambari (2019) who found no gender difference in the achievement of male and female Biology Students exposed to Computer animation instructional package in Niger state, Nigeria. Conversely, Otuturu, (2022) in her studies on the effect of Computer Animation Instructional Package on Students Performance in Environmental Concepts in Biology among secondary school students in Obio/Akpor Local Government Area in Rivers State, observed that the female biology students achieved more than male biology students.

However, the t-test analysis on the difference in the mean achievement score of public and private school students in the experimental group revealed that there is no significant difference in the posttest mean achievement score of public and private school students in the experimental group in the study Area. The finding is in tandem with the *study conducted by* Yakubu, Danja and Farouk (2019) which revealed that there is no significant difference in the academic achievement of Biology students in public and private senior secondary schools in Zaria Education zone. The conclusion drawn is that computer animation strategy is school friendly.

Conclusion and Recommendations

Based on the outcome of this research, it is concluded that computer animation strategy improves the achievement of students in cell division better than the conventional lecture method regardless of gender and school type. The combination of verbal, visual and motion images in the computer animation of cell division processes, the flexibility, captivation and active engagement of students improves their confidence and enhance deep understanding of cell division concepts. It is therefore recommended that Biology teachers in secondary schools should use computer animation to teach cell division and other Biology topics in biology classrooms so as to meet the demands of today's generation of science students and the demands of new technologies.

References

- Agbo, F.O. (2019). The teaching profession and the achievement of the educational sustainable development goal in Nigeria. 6th induction lecture for graduating teachers, university of Jos. Page 15. Date of presentation 17th May, 2019.
- Akani, O. (2015). An investigation of difficult topics in the senior secondary school mathematics curriculum as perceived by student teachers. *American Journal of Educational Research*, 3(7), 178- 184.
- Chibabi, A. A., Umoru, S. E., Onah, D. O., &Itodo, E. E. (2018). Effect of laboratory method on students'achievementandretentioninsenior secondary schools Biology in Kogi East Senatorial Zone. *Journal of Research & Method in Education (IOSR-JRME)*, 8(6), 31-39.
- Federal Republic of Nigeria. (2014). *National policy on education* (4th edition). Abuja: Federal Ministry of Education.
- Hamzat, A., Bello, G. & Abimbola, I. O. (2017). Effects of computer animation instructional package on students' achievement in practical biology. *Cypriot Journal of Educational Science*. 12(4), 218–227.
- Josiah, M. M., &Larina, E. P. (2015). Physics education in Nigerian secondary schools: problems and prospects. *International Journal of Research in Science, Technology and Mathematics Education*, 3(2), 115-123.
- Michael, M.C. (2018). *Essential biology for senior secondary school*. Ikeja: Tonad Publishers Limited.
- Muhammad, R., Ibrahim, R. U., & Gana, B.K. (2017). Appraising animation as an instructional strategy for enhancing quality education in Biology. *Sokoto Educational Review*, 17(1&2), 3-11.
- Owolabi, O. A., Babatunde, A. E., & Gambari, A. I. (2019) Effects of computer animation instructional package on secondary school students' achievement in biology in Niger State, Nigeria. *Journal of Science, Technology, Mathematics and Education (JOSTMED)*, 15(1), 3-11.
- Olasehinde, K. J., &Olatoye, R. A. (2014). Comparative study of public and private senior secondary school students' science achievement in Katsina State, Nigeria. *Journal of Educational and Social Research* 3(4), 1-2.
- Okolo, M. A., & Oluwasegun, O. G. (2020). Effect of computer- simulation on achievement and interest in cell division among male and female secondary school students in Abuja, Nigeria. *International Journal of Innovative Science and Research Technology*, 8(5), 809-812.
- Otuturu, F.G. (2022). Effect of Computer Animation Instructional Package on Students Performance in Environmental Concepts in Biology among secondary school students in Obio/Akpor Local Government Area in Rivers State. *Rivers State University Journal of Education (RSUJOE)*, 25 (2):29-37
- Oyovwi, E.O.(2022).Effects of concept-mapping and inquiry strategies in teaching difficult curriculum concepts in biology on students' academic achievement and retention. *International journal of bioscience*. 18(6), 258-267.
- Piwuna, C.N, Raphael, E., Rawen, Y.S.& Peter, N. M. (2023). Effect of Model-Lead-Test on Achievement of Senior Secondary one Student in skeletalsystem, Nasarawa Eggon. Nasarawa state, Nigeria. *SAHARA International journal ofteacher education (SIJTE)*6(1)1-9.
- Yakubu, I. A; Danja, M. I. & Farouk, Y. U. (2019).School Type and Academic Achievement in Biology among Senior Secondary School Students in Zaria, Nigeria: Analysis of Difference and relationship. *Journal of science technology and education* 7(4), 1-12.