

Effects of Computer Assisted Instruction with Animation of Biology Students' Achievement in Niger State (Post Covid-19 Remedy for Teaching and Learning)

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Abstract

This study investigates the effects of Computer Assisted Instruction (CAI) with animation on biology students' achievement in Niger State, serving as a post-COVID-19 remedy for teaching and learning. The research employed an experimental design with Senior Secondary II (SSII) students as the target population. Schools and class groups were selected using random sampling, and each group (experimental and control) consisted of thirty students, equally distributed by gender (15 males and 15 females). A reliability coefficient of 0.75 was determined using the PPMC formula. Analysis of Variance (ANOVA) was employed to test hypotheses, leading to the rejection of the first null hypothesis and retention of the second. Results indicate that integrating teaching and learning aids, particularly CAI with animation, alongside conventional methods, significantly improves student achievement in biology. The study recommends widespread adoption of CAI with animation software in all Senior Secondary Schools to enhance academic performance in Biology. This approach addresses the challenges posed by traditional teaching methods, especially in the context of adapting to post-pandemic educational needs.

Keywords: Computer Assisted Instruction; Animation; Achievement; Covid-19.

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Introduction

Science and technology have served as vital tools in instructional delivery, establishing their dominant position in the contemporary world of the 21st century (Malik, 2018). The use of technology in education has revolutionized the way teaching and learning are conducted (Rakha, 2023). For instance, technology allows for broader and faster access to information through the Internet, the use of interactive educational software, and distance learning that connects students and teachers from various locations (Syvyi et al., 2022). Additionally, the development of digital tools such as projectors, computers, and simulation software has enriched teaching methods, making them more engaging and effective for students (Rehman et al., 2021).

The advancements in science and technology have also significantly impacted the curriculum and educational content (Campbell-Phillips, 2020). Lesson materials can now be presented more attractively through 3D visualizations, videos, and animations that explain complex concepts in an easy-to-understand manner (Ariesta & Movitaria, 2023). Teachers can use technology to evaluate students' progress in real time and adjust teaching methods according to individual student needs (Faucon et al., 2020). Furthermore, research in the field of education continues to innovate in finding new ways to leverage technology to enhance learning outcomes and prepare students for future workplace challenges (Portuguez Castro & Gomez Zermeno, 2020). Thus, science and technology have become the main pillars in shaping an adaptive and relevant education system in the modern era.

Century has been characterized by a lot of pandemic diseases such as Severe Acute Respiratory System Infection (SARS) like Bird flu, Ebola, and the recent COVID-19 viral infections. Computer Assisted Instruction (CAI) is an automatically facilitated instrument that simplifies the art of teaching and learning in Education (Chambers & Sprecher, 1980; Galvis, 2007; Ahmed & Abimbola, 2011; Zhang, 2021). Biology as one of the core science subjects could be best

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taught using animations (Hoban et al., 2011; Polk, 2013; Gambari et al., 2014). The objective of education in Secondary schools in Nigeria comprises; Meaningful and relevant knowledge provided to the students, the ability of students to apply scientific knowledge acquired in schools to everyday life in matters of personal and community health of Nigerian society, the acquisition of laboratory and field skills to cope at Nigerian tertiary institution, and also the agricultural and reasonable functional Scientific attitudes, Federal Republic of Nigeria in research (Olufunbi & Junior, 2009).

In the 21st century, most students choose Biology as the only available science subject to offer for both art and science students (Gambari, 2010; Juanda et al., 2021). To achieve the desired results, it became pertinent to note that the teaching and learning of Biology at this current status of covid-19 pandemic, requires that students learn through computer-assisted instruction which is characterized by learning individually and at one's pace, thus ensuring and maintaining covid-19 protocols such as distancing (Wicaksana, 2020; Tasyari et al., 2021; Kurniati et al., 2021). (Gana et al., 2013; Soe et al., 2000; Fuchs, 1988; Adekunle et al., 2020) in their research established that computer assisted instruction and computer managed instructions enhances students' achievement significantly. Consequent to the above, it was desirable to have a technology-mediated method of instruction that will supplement the teacher during the COVID-19 pandemic classroom instruction (Sarkar et al., 2017).

Covid-19 viral disease has been traced to originate in Wuhan City, Hubel province in China. After several laboratory analyses; a severe Acute Respiratory Syndrome associated to coronavirus 2 or SARS-COV-2 was identified and named Coronavirus disease in 2019 by the World Health Organization (Biswas et al., 2020). It has been identified to cause illness ranging from common Cold to a more acute disease. In a bid to curtail the fast spread of the virus, measures have been adopted by both developing and developed nations, these include among others social distancing and other related measures such as temporary closure of schools (Courtemanche et al., 2020; Gupta et al., 2020; Loayza & Pennings, 2020). This closure of schools has drastically affected students' academic achievements. Achievement is a psychological construct that deals with the ability to reproduce what has been learned (Jaenudin & Sahroni, 2021; Afiati et al., 2022; Djaali, 2023). It is the end result of learning which is a relatively permanent change in the behavior of the learner as a result of experience and training.

Research findings revealed that students' achievement has been significantly improved when CAI was used (Gimba et al., 2014). Gender disparity in achievement has also been a major concern to educators, scholars, and researchers, many studies revealed no significant difference between males and females, while others observed a significant difference between the two sexes. Some of those researches include; (Yusuf & Afolabi, 2010; Ahmed & Abimbola, 2011), explored the effects of Computer Assisted Instructional Package on the academic performance of Biology students in Niger State before Covid-19 and found out that the experimental group outperformed the control group taught without CAI, but for the male and female students exposed to CAI in both settings, there was no significant difference between them.

Adams (2020), examined the comparative achievement scores of students learning through assisted instruction method for both genders in a post-test in a given rural area and also matched the attainment scores of students' knowledge via assisted instruction method for students of high and Low intelligence quotient in the selected rural area. The result revealed that science teaching through the CAI program was found to be more beneficial for the two genders in the rural areas. Nasiru (2023), likewise conducted a study on the effects of CAIP on Biology students' achievement in Generic concepts in Katagun Educational Zone, Bauchi State, Nigeria, and his work opened up that the control group did not achieve as much experimental group of the study. It also established that gender disparity was significant when the two genders were taught with CAIP. Aremu & Sangodoyin (2010), explored the computer animation package on the academic achievement of Nigerian Senior Secondary School Students in Biology. The finding established that there existed a significant main effect of treatment on students' achievement in Biology.

The outbreak of the Covid-19 pandemic has necessitated many countries of the world to fine-tune their strategies to salvage the problems associated with covid-19 pandemic, particularly in the area of instructions (Diedrich et al., 2021; Kasis et al., 2022; Ngcamu & Mantzaris, 2023). The viral strategies put in place to prevent the spread of the dreaded virus brought about the proliferation of diverse strategies by developed and developing nations for knowledge transplant to learners at various places such as the use of virtual classrooms and Zoom for most developed countries, which most developing nations dwell extensively on the use of Television, Radio, and other social media platforms for knowledge sharing among students at various levels of education in Niger and Nigeria at large. The poor performance of students in the West African Examination Council (WAEC), the National Examination Council of Nigeria (NECO), and the Joint

Admission and Matriculation Examination (JAMB) 2021 showed a geometric fall in the standard of performance in all the subjects particularly the science subjects (Lawal, 2022). Despite the use of above-mentioned strategies in Niger State, Nigeria, the poor performances in the above examination called for a more student-centered approach to learning Biology which could take into cognizance the Covid-19 protocols. The strategy believed to salvage that was the use of computer-assisted instruction with animation which was designed based on COVID-19 protocol of social distancing in the computer laboratories. Therefore, the study investigated the effects of CAI with animation on students' achievement in Biology during the Covid-19 pandemic in Niger State, Nigeria.

Method

The research adopted an experimental design involving the use of a randomized pretest boost test equivalent design. The design was used based on compliance to the COVID-19 protocols, especially the social distancing protocol. The population of the students were Senior Secondary II students who were stable in school. The target population was two randomly sampled school students in Minna. A sample random sampling technique was exploited in the selection of the schools, the arms of the classes, and the participants of the study. An equivalent sample of thirty (30) students for both the experimental and control group was drawn in equal ration of Masculine and Feminine ratios (Masculine =15 and Feminine =15). The randomization of the subjects was based on the carrying capacity of the computer laboratory considering the Covid-19 protocols. The instruments for data gathering were a treatment tool and a test instrument tool.

The treatment instrument was developed by researchers based on research and development (R&D) guidelines. The R&D guidelines are a guide that includes steps, principles, and methodologies used to carry out R&D activities systematically and efficiently (Schumann Jr et al., 1995; Kerssens-van Drongelen et al., 2000; Gustiani, 2019). This process begins with planning, which involves identifying problems or opportunities, conducting literature reviews, and setting objectives and budgets. This model collaborates with computer programmers. The test tool was identified as covid-19 Biology Achievement Test (C-19BAT). It was designed and constructed based on the lower levels of Bloom's Cognitive domain levels of knowledge, Comprehension, and Application using the test blueprint. The test instrument (Tool) and the treatment tool were validated by experts in the field of computer animation, and graphics, based on the principles of design (Aremu & Sangodoyin, 2010a). While the test tool was validated by specialists in Biology and test and measurement experts in the WAEC Board (Minna Niger State) for both face and content validity. The former focused on the logical sequencing of the items while the latter focused on the subject matter content of the topic. To derive the reliability of the test tool, the 20-item tool was administered to Twenty (20) randomly selected SSII students from the population of the study, test-retest method was used with an interval of one week between the two administrations.

The results collated were analyzed using the PPMC formula and a reliability index of 0.75. During the data collection, the experimental subjects were distributed in the computer laboratory with two computer tables in between according to distancing protocol. The animation package was uploaded to the computers for individualized learning. The teacher of the school was trained on the operational guidelines of the package and served as a facilitator. Embedded in the package were evaluation test questions that the students went through after successfully learning the contents.

A mechanism was developed into it with only two chance trials. For instance, a wrong option is choosing the mechanism that takes the student back to the content where the answer emanated, if, on the second attempt, the student fails again the mechanism provides the answer and then moves the student to the next content. If, however, a rightful answer is choosing the mechanism automatically moves the student to the next content. The control group was also taught by their teacher in the classroom strictly under COVID-19 protocols. The lesson note was prepared by the researcher to avoid the effect of teacher quality variable and ensures homogeneity of standard with the package. The teachers were used to avoid the experimental effect of the researcher. Before the above processes began the two groups were pretested to determine the entry knowledge of the two groups before the treatment. After the treatment achievement test was administered, but the questions were reshuffled before being administered as a posttest, to create an impression to the students as different from the one they answered during the pretest administration. The data collected on the pretest was analyzed using analysis of variance ANOVA statistics since there was no significant difference between the two groups at the pretest. The study lasted for four weeks.

The following declarative hypotheses were formulated and analyzed at 0.05 alpha benchmark of significance.

HO₁: There is no significant disparity between the achievement scores of students taught Biology via Computer Assisted Instruction (CAI) with Animation and those via Traditional Lecture Method (TLM).

HO₂: There is no significant disparity between the achievement scores of masculine and feminine achievement taught Biology via CAI with Animation.

Results and Discussion

Result

The results derived from the analysis of the data collected have been presented in the table below:

1. Pretest Result

The Analysis of Variance (ANOVA) was used to evaluate the pretest scores to determine the students' equilibria knowledge of the subject matter before the treatment was administered. This was carried out also to prevent the initial pre-experimental effect of the two groups after the treatment and to determine the statistical tool to be adopted if significant differences exist between the groups.

Table 1. ANOVA Summary of Pretest Analysis between the Experimental and the Control Group

Groups	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.350	1	1.350	0.339	0.563
Within Groups	231.233	58	3.987		
Total	232.583	59			

*Not Significant at P<0.05

Looking at the results Table 1 on the summary of the pretest computed between the two groups shows that the two groups were at equivalent level before the admission with $F(1,59) = 0.563$ and $p > 0.05$. These figures showed experimental and control had no significant in mean achievement scores which indicate the need for treatment in the study.

2. Hypotheses Testing

The results of the analysis have also been presented in the table below;

Table 2. ANOVA Summary of Posttest Analysis between the experimental and the control group

Groups	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	205.350	1	205.350	51.508	0.000
Within Groups	231.233	58	3.987		
Total	436.583	59			

*NS=Significant at p<0.05

Looking at the results Table 2 on the summary of the posttest computed between the two groups shows that the two groups are not more at equivalent level because of the treatment given to the experimental group with $F(1,59) = 51.508$, $p < 0.05$. These figures showed experimental and control had significant difference in mean achievement scores between them. Therefore, the HO₁ was rejected.

Table 3. ANOVA Summary Analysis of Masculine and Feminine scores in the experimental group

Groups	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.533	1	0.533	0.280	0.601
Within Groups	53.333	28	1.905		
Total	53.867	29			

*NS= Not significant at P>0.05

Looking at the results Table 3 on the summary of the Masculine and Feminine scores in the experimental group shows that the two gender are at equivalent level after exposure to Biology via CAI with Animation with $F(1,29) = 0.280$, $p >$

0.05. These figures showed Masculine and Feminine scores in the experimental group had no significant difference in mean achievement scores. Therefore, the H_{O2} was retained.

Discussion

Looking at the results Table 2 on the summary of the posttest computed between the two groups shows that the two groups are not more at equivalent level because of the treatment given to the experimental group with $F(1,59) = 51.508$, $p < 0.05$. These figures showed experimental and control had significant difference in mean achievement scores between them. Therefore, the H_{O1} was rejected. The changes in the result might be attributed to the use of extra instructional aid blended with normal classroom method of instruction the findings are supported with the work of Gana (2013), Mohammed (2014) and Akpomedaye (2014) that indicates a higher gain in the achievement scores of an experimental group to that of a control groups. Looking at the results Table 3 on the summary of the Masculine and Feminine scores in the experimental group shows that the two gender are at equivalent level after exposure to Biology via CAI with Animation with $F(1,29) = 0.280$, $p > 0.05$. Based on the formulated hypothesis stated that there is no significant disparity between the masculine and feminine achievement scores exposed to Biology via CAI with Animation was retained. This confirmed the study of Sanjay (2010), Ahmed, & Abimbola, (2014) and Ayolola and Abiodun (2010) their finding recommended that CAI with animation should be adopted as the most effective instructional in Biology because of its influence on achievement of male and female students.

Conclusions and Suggestions

Conclusions

This study revealed that, CAI with animation enhanced the achievement of students in Biology better than normal classroom instruction and it also revealed that CAI with animation improved the achievement of the Masculine and Feminine students in Biology. Recommendations were made to improve the application of CAI with animation software in our Senior Secondary Schools.

Suggestions

1. The use of CAI with animation software should be encouraged in all Senior Secondary Schools in order to improve students' performance in Biology in case of any outburst of a pandemic diseases such as Covid-19 rather than just closing schools.
2. Adequate functional computer gadgets should be provided to students not just in schools but also at their respective homes so as to facilitate the practice of packages with or without schools in session.

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