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Effect of Computer Assisted Instruction on Students' Academic Achievement in Biology in Nsukka LGA, Enugu

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Abstract

The study investigated the effect of computer assisted instruction on students' academic achievement in biology in Nsukka LGA, Enugu. The population of the study comprises of 2,637 SS1 students, in 31 Public Secondary schools in Nsukka L.G.A. This study employed a non-equivalent quasi-experimental, research design. One hundred and twenty students from two schools (male and female) sampled, were used as sample for the study. Intact classes were assigned by balloting to either experimental or control group. All the groups were pre and post tested. Biology Achievement Test (BAT) was used as the instrument for data collection. The reliability of the instrument was determined using. Kuder Richardson formula (K.R-20) 0.79. The study was guided by two research questions and three null hypotheses tested at 0.05 level of significance. The results showed that students who were exposed to CAI method achieved higher than their counterparts and there is no significant difference between gender and the students' achievement in Biology. The study recommended among other things that Government should provide CAI facilities in public secondary schools so as to provide access to CAI devices to both teachers and learners to ensure proper implementation of computer assisted instructions. Teachers should embrace the innovative instructional materials such as the use of drills & practice, games and other computer software which will help to promote the students' academic achievement in Biology.

Keywords: Computer-Assisted Instruction, Academic Achievement, Biology, Gender, Secondary School Students

Introduction

Biology is a science that deals with the study of life. It is one of the essential science subject offered by students in senior secondary schools in Nigeria. According to Adebanjo [1], Biology is the study of living organisms, their structures, functions and distributions. The study of biology provides essential scientific skills and knowledge for scientific and technical development of our society by providing basic knowledge and helping students to acquire basic concept of plants and animals. It serves as a preparation for further studies such as medicine, pharmacy and agriculture [2]. The study of biology is relevant in all human endeavours as it provides solution to the problems of unemployment, poverty, and hunger. Biology requires sound teaching and learning to improve achievement of students.

Despite the stated relevance of biology, there have been poor achievement of students in biology. It has been confirmed from WAEC Chief Examiners' Report (2018, 2019 & 2020) that there has been reoccurring mass failure of candidate in biology in West African Senior Secondary Certificate Examination (WASSCE) [3]. The reports show that the ability to use and spell technical terms, identification and classification of organisms systematically are below average among biology students. The

consistent poor achievement of biology students in West African Certification Examination (WAEC) have remained on the increase [3]. There are various factors responsible for poor achievement of biology students. These factors as revealed in the literature include; lack of interest in the subjects by students, and poor teaching methods. Since WAEC Examiners' reports on biology students achievements over the years showed reoccurring poor achievement, there is need for more focus on how innovative instructional methods could be used to improve achievement of students' in biology. Achievement is referred to as the degree of success reached or attained by students in some specific or general areas. According to Philip (2019) [4], achievement is the extent of success attained by an individual students on the task he or she was earlier exposed to. Achievement according to Ugwuanyi (2015) [5], means to reach a required standard of performance and to carry out successfully, a particular task. The academic achievement of a student is important to ascertain the mental readiness and for promotion to higher level of learning. Achievement of students have been found to be uninspiring in biology examinations. It is important to realize that the achievement of students in biology at the secondary school level could be influenced by gender.

Gender has become apparent in teaching and learning of biology. Gender is the role expectations and ascription of a society for the male and female members of the society. According to Nwagbo and Onah (2017) [6], gender is a socially or culturally constructed characteristics and roles, which are associated with males and females in the society. According to Kaufman *et al.,* (2023), gender is a set of characteristics distinguishing between male female [7]. Differences exist in the way male and female students learn and consequently affect their achievements. Educators in the society regard gender as a sensitive issue in biology that has not been resolved. Literatures have shown that differences exist in the academic achievement of students based on gender. The findings of some studies revealed that male students performed better than female students [8, 9, 10]. Eya *et al.,* (2024) reported that female students performed better than male students in biology when taught in a technology-enhanced learning environment (TELE) [11]. More so, the solution to the problem of poor achievement of students in Biology could be sought by teachers' use of effective instructional approach.

There are basically two instructional approach used in the teaching and learning of biology, traditional and modern instructional approach. The traditional instructional approach (lecture) is the oldest method of instruction used in teaching Biology in this present age. This approach deals with crude instructional materials such as chalk, and black board. And learners do more on recitation and rote memorization during this process of instruction. On the other hand, modern instructional approach has to do with the use of computer its devices in the process of instruction. For instance, computer assisted instructional approach which deals with the use of computers and other computer aided devices to assist instructional processes. Such computerized devices include computer assisted instructions in form of smart board, ICT, Projectors and computer among others [12]. Asuquo & Chibueze, (2023). suggested that computer assisted instructions could contribute immensely toward improving biology students' academic achievement [13].

Computer Assisted Instruction (CAI) is an interactive instructional technique whereby computer is used to present instructional material and monitor the learning that takes place. According to Panja & Kumar, (2023), CAI is a teaching approach that uses computer as a supportive element so that learning can take place [14]. CAI has become an important part of education, because it makes classroom learning interesting and effective by providing teachers with more time to teach, evaluate the progress of activities and breaks the distance barriers in education; as students can learn with ease at convenient time in their homes.

Biology education in Nigeria appears to be in crisis as reflected in the poor achievement of students in examination. This poor achievement in both internal and external Biology examinations is a pointer to the fact that teachers could be using poor instructional approaches which do not promote teaching and learning. Furthermore, WAEC Chief Examiners' reports attributed the poor achievement in Biology to difficulty for the students to use and spell technical terms correctly. It was established that the problem of poor achievement in Biology sometimes is not limited to the students' factors alone but also to teachers' use of poor instructional approach.

The poor instructional approach used by teachers have made students to face difficulties in learning Biology, it equally made teachers to face difficulties in evaluating the learners performance in school. The problem of persistent low biology achievement could affect advancement in science especially in medical fields, this because biology is one the basic subject required to study all medical discipline. Therefore, there is need to adopt a better instructional approach in Biology teaching and learning so as to increase students' academic achievement in the subject. As the main focus of the study aims at assessing the effects of Computer Assisted Instruction on students' academic achievement. The study investigates the effect of computer assisted instructional approach on senior secondary school biology students' academic achievement. Specifically, the study sought to determine the effect of CAI on students' achievement in Biology, and influence of gender on students' academic achievement in Biology.

Materials and Method

This chapter deals with the research method and procedure for gathering and analyzing data collected for this study, The method is presented under the following Sub headings; design of the study, area of the study, population of the study, sample and sampling technique, instrument for data collection, validation of the instrument, reliability of the instrument, experimental procedure, method of data analysis.

Design of the Study

This study implemented the quasi-experimental research design making us of pre-test and post-test non-equivalent group design in studying the effect of computer assisted instructional-approach in senior secondary school students' achievement in biology. Quasi- experimental designs aims at demonstrating causal relationship between an intervention and an outcome, permitting the use of intact classes, pretest, post-test of non-equivalent group. According to Ali (2006) this design is often used in classroom experiment, when experiment and control groups are assembled as intact classes and no possibility of randomization [15]. The design of the study is shown below:

Grouping	pre-test	Treatment	Post test
Experimental group	A_1	X_1	A_1
Control group	A_2	_-_	A_2

These symbols are defined as follows;

X1 = Treatment (teach with drill and practice power point package)

A1 = Pre-test

- = No Treatment

Area of Study

The study was conducted in Nsukka Local Government Area Educational zone in Enugu State. There are 31 Secondary schools in Nsukka Local Government Area. The researchers decided to carry out this research in Nsukka Local Government Area because of students' poor academic achievement in biology in both internal and external examination.

Population for the Study

The population of this study comprised all senior secondary class one (SS1) students in all the 31 public secondary schools in Nsukka Local Government Area of Enugu State. There are 2,637 (1391 male and 1246 female) students Post Primary School Management Board (PPSMB) Nsukka Zone 2022.

Sample and Sampling Techniques

The sample of the study comprised SS1 Biology students from two public co-educational secondary schools in Nsukka education zone. Purposive Sampling technique was used for the study. A proper survey of secondary schools was carried out to identify schools that have computerized devices. In the first stage, two schools were randomly selected from the thirty-two public secondary schools in the local government area that was selected for the study. From each school, one intact SS1 class was assigned to experimental group, while the other was assigned to control group. The selection of classes for either of the groups was done through simple random sampling (balloting, without replacement) technique.

Instrument for Data Collection

The instrument for data collection consist of Biology Achievement Test (BAT), Achievement test are designed to measure the outcome of accomplishment in a specified program of instrument. The test was carefully designed to test students' knowledge and comprehension on recognition of living things, test was constructed in a multiple choice form. The (BAT) consist of 30 items achievement test question items constructed by the researchers' base on the topics chosen for the study. The BAT instrument has options lettered A-D with only one correct option. A correctly chosen option is scored while a wrong option attracts a zero score.

Validation of the Instrument

The biology achievement test was subject to both face and content validation. The BAT was face validated by giving the test instrument to three experts in the Department of Science Education, two in biology education and one in measurement and evaluation unit. The experts were required to validate the instrument based on the appropriateness of the items and whether the questions are suitable for SS1 students. The content of validity was determined using the test blue print validated by the experts in generating the test items. They also examine the test items generated in relation to the test blue print. The final modifications were reflected in the final version of the instrument.

Reliability of the Instrument

The reliability of the instrument was determined by administering the test instrument to the same level of students in another local government but in the same educational zone. The data obtained were used to determine the internal consistency of the instrument. This was done using the Kuder Richardson formula (K.R-20) because the instrument was dichotomously scored. The obtained internal consistency reliability estimate is 0.79.

Experimental Procedure

Two set of lesson plan have been developed for teaching the topics in biology. Conventional lesson plan was used to teach students' in the control group while the experimental lesson plan was written based on the use of computer assisted instruction particularly the drill and practice power point presentation package for teaching the students in the experimental group. The plan highlighted the contents covered. The instrument of BAT was administered to the experimental and the control before commencing treatment. After treatment, the researchers with the help of the biology teachers administered the instruments.

The treatment lasted for two weeks. The students in the control group and the experimental group were taught by their regular teacher.

Control of extraneous variable

Numbers of step were being taken to control some extraneous variables that constituted threats to the validity of the study. These variables include.

1. Teacher variables
2. School Variables
3. Inter group contamination

Teacher Variables

The students' regular biology teachers were used to carry out the study. The teacher involved in both the control and the experimental groups were trained.

School Variable

Schools used for the study were schools that provide similar environmental conditions and homogeneous learning background to the subjects.

Inter Group Contamination

Students in a particular sampled school were taught separately and they did not have idea that another schools was used for the study.

Method of Data Analysis

The research questions were answered using mean (x) and standard deviation (S.D) Hypotheses were tested at 0.05 level of significance using Analysis of covariance (ANCOVA).

Results

This chapter presents the results of data analysis based on the sequence of the research questions that guided the study. The major findings of the study are also presented in this chapter.

Research Question One: what are the mean achievement scores of students taught Biology using CAI method and those taught using lecture method?

Table 1: Mean and Standard Deviation Achievement Scores of Students taught Biology using CAI method and those taught using Lecture Method

		Pre-test		Post-test		
Teaching Method	N	x̄	SD	x̄	SD	Mean Gain.
CAI	61	9.85	3.38	22.67	3.50	12.86
Lecture Method	59	10.23	4.77	18.12	7.85	7.89

From Table 1, the pre-test mean and the standard deviation scores for students taught Biology using CAI method are 9.85 and 3.38 whereas the pre-test mean and the standard deviation score for those taught using lecture method are 10.23 and 4.77 respectively. The post-test mean and standard deviation score for students taught Biology using CAI method are 22.67 and 3.50 while the post-test mean and standard deviation scores for those taught using lecture method are 18.12 and 7.85. The mean difference in the post-test and pre-test score revealed that the students taught with CAI method outperformed those taught with lecture method.

Hypothesis One: There is no significant difference between the mean achievement scores of students taught Biology using CAI method and those taught using lecture method.

Table 2: ANCOVA showing Significant Difference in the Mean Achievement scores of Students taught Biology using CAI method and those taught using Lecture Method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	707.789a	4.00	176.95	4.83	0.00	0.14
Intercept	6685.45	1.00	6685.45	182.29	0.00	0.61
Pre-test	1.07	1.00	1.07	0.03	0.87	0.00
Teaching-Method	644.18	1.00	644.18	17.56	0.00	0.13
Gender	37.13	1.00	37.13	1.01	0.32	0.01
Teaching-Method * Gender	47.95	1.00	47.95	1.31	0.26	0.01
Error	4217.68	115.00	36.68			

Table 2 shows F-ratio of 17.56 with associated probability (Sig.) of 0.00 and effect size of 0.13 under teaching method. The associated probability level is less than the 0.05 level of significance stated for testing of the null hypothesis. 17.56, 0.00 and 0.13. Therefore, the null hypothesis is rejected, which implies that there is a significant difference in the mean achievement scores of Biology students taught using CAI method and those taught using lecture method. This is also evident in the moderate effect size of 0.13.

Research Question Three: what is the influence of gender on students' achievement in Biology?

Table 3: Pre/Post-test Mean and Standard Deviation Achievement Scores of Students in Biology

		Pre-test		Post-test		
Gender	N	x̄	SD	x̄	SD	Mean Gain.
Male	58	10.41	4.84	20.66	6.76	10.25
Female	62	9.69	3.14	20.23	6.16	10.54

Table 3 shows that the pre-test mean and standard deviation achievement scores for male students taught Biology using CAI method are 10.41 and 4.84 while the pre-test mean and standard deviation pre-test achievement scores for female students are 9.69 and 3.14. The post-test mean and standard deviation achievement scores for the male students are 20.66 and 6.76 while post-test mean and standard deviation achievement scores for the female students are 20.23 and 6.16 respectively. The mean gain for the male students is 10.25 and that of the female is 10.54. The differences in the mean post-test and pre-test achievement scores revealed that female students outperformed their female counterparts.

Hypothesis Three: there is no significant influence of gender on students' achievement in Biology?

Table 2 shows F-ratio of 1.01 with associated probability (Sig.) of 0.32 and effect size of 0.01 under gender. The associated probability level is higher than the 0.05 level of significance stated for testing of the null hypothesis. Therefore, the null hypothesis is not rejected, which implies that there is indeed no significant difference in the mean achievement scores of male and female students in Biology. This is also evident in the weak effect size of 0.01. In other words, gender has no significant effect on students' achievement in Biology.

Research Question Three: what is the interaction effect of teaching method and gender on achievement scores of students in Biology?

Table 4: Post Mean and Standard Deviation Achievement Scores of the Interaction of Teaching Method and Gender of Students Achievement Scores in Biology

Teaching-Method	Gender	N	Mean	Std. Dev.
CAI method	Male	25	22.60	4.23
	Female	36	22.72	2.94
Lecture Method	Male	33	19.18	7.92
	Female	26	16.77	7.69

Table 4 shows that the mean and standard deviation scores for male student taught using CAI method are 22.60 and 4.23 while mean and standard deviation scores of the female students in the same CAI method group are 22.72 and 2.94. The mean and standard deviation scores for the male students in lecture method group are 19.18 and 7.92 while that of the female students in the same lecture method group are 16.77 and 7.69 respectively. Female students outperformed female students for the group taught using CAI, however, male students outperformed female students for the group taught using lecture method.

Hypothesis Three: There is no significant interaction effect of teaching method and gender on students' achievement in Biology.

Table 2 and Fig 1 shows F-ratio of 1.31 with associated probability (Sig.) of 0.26 and effect size of 0.001 under the interaction of teaching method and gender. The associated probability is greater than the a priori probability level (0.05) stated for testing the null hypothesis. Therefore, the null hypothesis was not rejected which implies that there is no significant interaction effect of gender and teaching method on students' achievement in Biology.

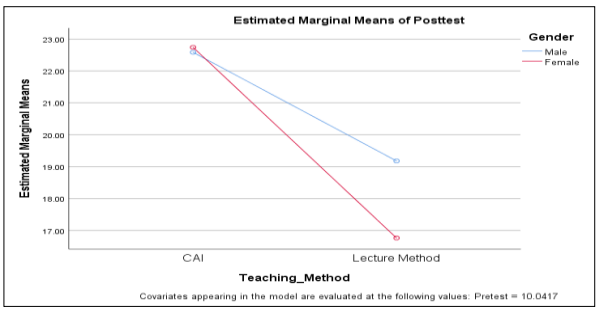

Fig 1

Summary of the Finding

The major findings of the study are as follows:

1. There is a significant effect of CAI method on students' achievement in Biology.
2. There is no significant influence of gender on students' achievement in Biology.
3. There is no significant interaction effect of gender and teaching method on students' achievement in Biology.

Discussion

This chapter focuses on the discussion of findings of this study. The recommendations based on the findings and the conclusions drawn from the study are presented. The educational implications of the study, suggestions for further research and summary of the entire study are also highlighted.

Discussion of findings

- The findings of this study were discussed under the following sub-heading:
- The effect of using computer Assisted Instructional (CAI) method on student's achievement in Biology.
- The influence of using computer Assisted Instructional (CAI) method on male and female students achievement in Biology.
- The interaction effect of teaching method and gender on Students' achievement in Biology.

The effect of using CAI Method on students Achievement in Biology

The result of this study indicated that the use of CAI method has a significant effect on students' achievement in biology. The group (experimental) taught using CAI method performed significantly better than the group (control) taught Biology without using CAI method.

Students' better academic achievement could be attributed to strategy adopted during the use of CAI method. During the instruction, the students were actively involved and had control of their learning. When students gain greater control over their own learning, they become more enthusiastic about the subject and increase their own understanding. This shift towards a student-centered instruction also encourages students to make their own opinion about the material they are learning. Students can then investigate their conjectures through experimentation with drills and practice.

The significant differences in the achievement of the experimental groups as compared to the control groups indicates that the drill and practice shows promising implications for the potential of using the CAI in teaching Biology at the secondary school level. The significant improvement of Biology achievement on account of the drill-and-practice used in this study also suggested that there is a need to provide more interactive and hands-on learning activities for Biology learning at the secondary school levels. The result of this study agrees with the findings of Kareem (2015), Chieke and Anaekwe (2019), and Bilesanmi-Awoderu (2006), who reported that students exposed to computer-assisted instruction achieved significantly better academic outcomes in Biology than those taught using conventional teaching methods [16, 17, 18]. The significance difference of CAI method over the conventional method in recognition of living things topics taught could be attributed to the fact that CAI method could provide such properties as interaction. In other words, students participate actively and work interactively with the CAI thereby increasing students' awareness in the lesson.

The Influence of Gender on students' achievement in Biology

The result of this study revealed that there is no significant influence of gender on male and female students' achievement in Biology. The finding of this study is in agreement with some other similar studies on gender and biology achievement. The finding of this study is in agreement with Yusuf and Afolabi (2010) and Bilesanmi-Awoderu (2020), who found that gender did not significantly influence the achievement of students exposed to computer-assisted instruction in Biology [19, 18]. However, the finding is contrary to studies that reported a significant influence of gender on students' achievement following the use of computer-assisted instruction [20]. The finding of this study could be attributed to the fact that males and females students were carried along when the teaching was going on because the lesson was interesting to them.

The interaction effect of CAI method and gender on students' achievement in Biology

The result of this study revealed that there is no significant interaction influence of computer instructional method and gender on students' achievement in Biology. The finding of this study is in agreement with some other similar studies on gender biology achievement. This study is in agreement with the study conducted by Mudasiru and Modupe (2013) with respect to gender and achievement. However the finding of this study is not in agreement with the study conducted by Ezenwa (2016) who found that there is significant interaction influence of CAI method and gender on students' achievement. The finding of this study could be attributed to the fact that males and females students were highly motivated to learn because of the introduction of CAI in the teaching of recognition of living things.

Conclusion

This study has shown that the use of CAI method has a facilitative effect on students' achievement in biology. There is a significant difference in biology mean achievement scores between students exposed to CAI instructional method and those not exposed to it. The study indicated that there is no significant influence in the use of CAI method on male and female students' achievement in biology.

References

1. Adebanjo AA. Effects of Dick and Carey instructional model on students' learning outcomes in secondary school biology [PhD thesis]. Ago-Iwoye, Ogun State: Olabisi Onabanjo University, Department of Science & Technology Education, 2019, 1-7.
2. Alkan F, Kocak C. Chemistry laboratory applications supported with simulation. Procedia Soc Behav Sci. 2015; 176:970-976. Available from: https://cyberlennika.org/article
3. Awobodu VY. Problem-based learning and programme instruction as strategies for enhancing learning outcomes in biology [PhD thesis]. Ago-Iwoye, Ogun State: Olabisi Onabanjo University, Department of Science and Technology Education, 2016, 40-50.
4. Phillip JM, Uche NS, Ugwu AC. Effect of computer simulation on secondary school students' interest and achievement in organic chemistry in Abakaliki Education Zone of Ebonyi State [bachelor's project]. Nsukka: University of Nigeria, 2019.

5. Ugwuanyi CC. Meta-analysis of studies on effects of teaching methods on students' achievement, interest and retention in mathematics [doctoral dissertation]. Nsukka, Enugu State: University of Nigeria, 2015.
6. Nwagbo CR, Onah P. Effect of gender-friendly instructional materials on student interest. Int J Instr Resour, 2017.
7. Kaufman MR, Eschliman EL, Karver TS. Differentiating sex and gender in health research to achieve gender equity. Bull World Health Organ. 2023; 101(10):666.
8. Sani Yar'adua A, Zakariya N. Comparative analysis of male and female students' academic performance among senior secondary school mathematics in Katsina State. Nuradeen, Jul 23, 2021.
9. Ogundiwun OA, Olusa OL. Gender and school type as correlates of students' performance in biology, chemistry and physics in Ondo State, Nigeria. Unilorin J Lifelong Educ. 2017; 1(2):91-105.
10. Wrigley-Asante C, Ackah CG, Frimpong LK. Gender differences in academic performance of students studying science, technology, engineering and mathematics (STEM) subjects at the University of Ghana. SN Soc Sci. 2023; 3(1):12.
11. Eya PE, Odunukwe CN, Eya GN, Nwanya DU. Impact of gender on students' interest and achievement in biology in technology-enhanced learning environment. Gender Truth J. 2024; 1(1):117-136.
12. Haleem A, Javaid M, Qadri MA, Suman R. Understanding the role of digital technologies in education: A review. Sustain Oper Comput. 2022; 3:275-285.
13. Asuquo UA, Chibueze AM. Effects of computer-assisted instruction on integrated science students' interest and achievement in Uyo, Akwa Ibom State. Int J Arts Commun Pedagogy. 2023; 2(2):106-118.
14. Panja M, Kumar U. Computer-aided or computer-assisted instruction. In: Encyclopedia of mathematical geosciences. Cham: Springer International Publishing, 2023, 165-169.
15. Ali A. Conducting research in education and the social sciences. Enugu: Tashiwa Networks Ltd, 2006, p. 65.
16. Kareem AA. Effects of computer assisted instruction on students' academic achievement and attitude in biology in Osun State, Nigeria. J Emerg Trends Educ Res Policy Stud. 2015; 6(1):69-73.
17. Chieke AI, Anaekwe MC. Effects of computer assisted instruction on students' achievement in biology. J Sci Technol Educ. 2019; 3(1):188-197.
18. Bilesanmi-Awoderu JB. Effect of computer-assisted instruction and simulation/games on the academic achievement of secondary school students in biology. Sokoto Educ Rev. 2006; 8(1):49-63.
19. Yusuf MO, Afolabi AO. Effects of computer assisted instruction (CAI) on secondary school students' performance in biology. Turk Online J Educ Technol. 2010; 9(1):62-69.
20. Oruakpor JA, Oyovwi EO. Computer assisted instruction (CAI) with animation in biology curriculum delivery: A panacea for students' achievement and motivation. Br J Educ. 2024; 12(5):58-70.