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**Impact of Computer-Assisted Instruction with Animation on Students' Performances in  
Ecology in Minna Niger State**

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**Abstract**

This study investigated the Impact of Computer-Assisted Instruction with Animation on Students' Performances in Ecology in Minna Niger State. A quasi-experimental, pretest posttest control group design was used in carrying out the research. One hundred and seventeen students, from the two selected schools (male and female) formed the sample for the study. The selected schools were randomly assigned as experimental and control group. Computer Assisted instruction package and Biology Achievement Test (BAT) containing twenty multiple choice test were used as research instruments. The research instruments were validated by biology and educational technology experts. The reliability coefficient of BAT is ( $r = 0.98$ ) and reliability coefficient of BII ( $r=0.76$ ). Two research questions and Two hypotheses guided the study. The mean and standard deviation were used in answering the research questions while Analysis of Covariance (ANCOVA) was used in testing the hypotheses at  $p<0.05$  level of significance. The results showed that the use of Computer Assisted Instruction package with animation in teaching enhanced students' achievement in ecology. However, there was no significant interaction effect between the teaching method and gender on students' achievement in ecology. The study recommends the adoption of CAI packages with animation as a viable strategy for improving

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Biology instruction in Nigerian schools. Government bodies and educational stakeholders are encouraged to support the development and distribution of CAI tools to foster better learning outcomes in science subjects.

**Keywords:** Computer-Assisted Instruction, Animation, Performances, and Ecology

## Introduction

Science is a core subject in educational systems worldwide, and educators widely believe that any nation striving for development must prioritize science education in its schools (Ogunleye, 2018). Science education emphasizes the teaching and learning of scientific processes and principles that foster both fundamental and applied research. In Nigeria, science subjects are introduced as integrated science at the junior secondary school level and later specialized into Biology, Chemistry, and Physics at the senior secondary schools level (FRN, 2018).

Biology is a popular science subject offered by senior secondary school students in Nigeria (FRN, 2018). Its popularity is attributed to its perceived simplicity compared to subjects like Physics and Chemistry (Abdullahi, 2017). Biology's significance extends beyond the classroom, serving as a foundational subject for numerous science-related professional fields such as Medicine, Agriculture, and Pharmacy. As a branch of natural science focused on living organisms and vital processes, Biology plays a crucial role in promoting human well-being and environmental sustainability.

Despite Biology's importance, students' performance in the subject has been consistently poor in Nigerian secondary schools, raising significant concerns among educators (Akinyemi, 2018). Research has attributed this poor achievement to various factors, including ineffective teaching methods, abstract biological concepts, and students' weak foundational knowledge (Kuta, 2019). Olorundare (2018) identified additional contributing factors such as inadequate teaching resources, lack of qualified teachers, and overcrowded classrooms. Ajewale and Akinyemi (2019) highlighted the persistent underachievement of Biology students, particularly in ecology a key area that demands conceptual understanding rather than rote memorization.

This has proven particularly challenging for students due to its abstract and symbolic nature (Commonwealth, 2017). Consequently, the need for innovative teaching strategies that actively

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engage students and enhance their understanding of ecological concepts has become evident. One promising approach is the use of Computer-Assisted Instruction (CAI) with Animation an instructional method that combines text with multimedia elements to improve comprehension, promote engagement, and enhance content delivery (Min & Ephraim, 2017). Studies (Yaki, 2019; Gambari, 2019) have demonstrated the effectiveness of CAI in improving students' academic achievement, especially in science-related subjects.

Given the persistent challenges in teaching ecology and the proven potential of CAI, this study aims to evaluate the impact of Computer-Assisted Instruction with Animation on students' achievement in ecology. The study will also examine the influence of gender on students' performance when taught ecology using this innovative method.

### **STATEMENT OF THE PROBLEM**

Over the years, students' performance in Biology in Nigerian schools has remained consistently poor. The West African Examination Council (WAEC) Chief Examiner's report of November/December 2017 highlighted that over 75% of secondary school students performed poorly in ecology-related topics. Among the major weaknesses identified was students' inadequate understanding of ecology as a concept. This difficulty stems from the abstract and complex nature of ecological concepts, making it challenging for students to grasp.

Several factors have contributed to this poor performance. The nation's economic challenges have hindered the purchase and importation of instructional materials and equipment, limiting the use of visual aids that are crucial for effective teaching. Consequently, students are often faced with verbal descriptions rather than practical, visual experiences that could enhance their understanding. Additionally, overcrowded classrooms reduce the opportunity for effective practical sessions, further hampering students' comprehension. Other contributing factors include poor foundational knowledge in Biology, incomplete syllabus coverage, inadequate exam preparation, continuous promotion of underperforming students, lack of teacher dedication, and the persistent use of inappropriate teaching methods.

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Since Biology is a subject that relies heavily on factual understanding, students' inability to visualize concepts often impairs their learning. Therefore, continued reliance on conventional teaching methods may not effectively promote meaningful learning in ecology.

To address this challenge, the adoption of innovative teaching methods has become necessary. One promising strategy is the use of Computer-Assisted Instruction (CAI) with Animation, which integrates interactive visual aids to improve students' engagement and understanding. Research has shown that CAI is more effective than traditional methods in enhancing students' achievement across various subjects. Consequently, evaluating the impact of CAI with animation on students' achievement in ecology along with the influence of gender on learning outcomes is essential to identifying effective strategies for improving Biology education in Nigeria.

### **AIM & OBJECTIVES OF THE STUDY**

The major purpose of this study is to evaluate the impact of computer-assisted instruction with animation on students' achievement in ecology. Specifically the study seeks to;

- i. Determine the effect of computer assisted instruction package with animation on the mean achievement scores of the students in ecology.
- ii. Determine the influence of gender on the mean achievement scores of students taught ecology with computer assisted instruction with animation.

### **Research Questions**

The following research questions will guide the study:

- i. What is the mean achievement scores of students taught ecology using computer assisted instruction package with animation and those taught without animation.
- ii. What are the mean achievement scores of male and female students taught ecology using computer assisted instruction package with animation.

### **Research Hypotheses**

The following hypotheses will be tested at the 0.05 level of significance:

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HO<sub>1</sub>: There is no significant difference in the mean achievement scores of students taught ecology using computer assisted instruction (CAI) package with animation and those taught without animation.

HO<sub>2</sub>: There is no significant difference in the mean achievement scores of male and female students taught ecology using computer assisted instruction package with animation.

## METHODOLOGY

The research design used for the study is a quasi-experimental design. Specifically, pretest-posttest control group design was used. Population of the study comprises all the senior secondary schools students in Chinchaga Local Government Area of Niger State with a total number of 9,396 and total numbers of 31 senior secondary schools. The target populations are fifty two thousand five hundred and thirty three, (52,533) senior secondary students who were registered in Biology programme for the session 2018/2019. The sample for the study was intact class of the SSI students, one hundred and seventeen students (117) of 2018/2019 academic session. Purposive sampling technique was employed to sample two schools from chanchanga Local Government Area of Niger State. Three instruments used for the study; are; computer assisted instruction package (CAI) (Animation), (CAP), Test instrument; Ecology Achievement Test (EAT) The test instrument (package) was developed by a programmer and validated by Educational Technologist of Federal University of Technology Minna determined the appropriateness of the package in terms of the clarity, and simplicity of the package, coloured used, spellings, text, voicing, as well as the font size used; the Ecology Achievement Test was developed by the researcher and validated by Biology experts, went through the test items and evaluate its face and content validity. The (EAT) consist of twenty biology achievement test (1 - 20). In the analysis of the data, the researcher used descriptive statistics mainly mean, standard deviation and answer research questions, while ANCOVA was used to test the research hypothesis. Hypotheses were tested at 0.05 level of significance.

## Results

### Research Question 1

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What is the mean achievement scores of students taught ecology using computer assisted instruction package with animation and those taught without animation.

**Table 1: Mean Achievement Scores and Standard Deviations of Students who were taught with CAI package with Animation and without Animation.**

Pre – test		Post test				
Groups	N	Mean	S.D	Mean	S.D	Mean Gain
Experimental	53	30.18	9.75	68.39	12.04	38.21
Control	64	30.17	9.74	61.79	6.62	31.62
Total	117					

Table 1 show the mean scores and standard deviation of students who were taught with CAI package with animation and without animation. From the result, the mean standard deviation of pretest scores and posttest scores of experimental and control group are  $30.18=9.75$  and  $68.39 = 12.04$  respectively. This gives a mean gain score of 38.21 in favour of posttest. Similarly, the mean and standard deviation of pretest and posttest scores of the control group are  $30.17=9.74$  and  $61.79 = 6.62$  respectively. The control group had a pretest/ posttest mean gain of 31.62.

**Research Question 2**

What are the mean achievement scores of male and female students taught ecology using CAI package with animation.

**Table 2: Mean Achievement Scores and Standard Deviations of Male and Female students who were taught with CAI with Animation.**

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Pre – test Groups	N	Post test		Mean	S.D	Mean Gain
		Mean	S.D			
Male	24	33.94	2.23	72.70	12.50	38.76
Female	29	33.90	2.20	64.82	10.56	30.92
Total	53					

Table 2 shows mean achievement scores and standard deviations of male and female students who were taught with CAI package with animation. From the result, the mean and standard deviation of pre-test and post-test scores of male 33.94=2.23 and 72.70=12.50 respectively. This gives a mean gain score of 38.76. However, the mean and standard deviation of pre-test and post-test scores of female students is 33.90 =2.20 and 64.82=10.56 respectively, this gives a mean scores of 30.92.

**HO<sub>1</sub>**

There is no significant difference in the mean achievement scores of students' taught ecology using computer assisted instruction (CAI) Package with animation and those taught without animation.

**Table 3: Summary of ANCOVA Table of Students Scores in the Ecology Achievement Test**

Source	Type III Sum of Square	df	Mean Square	F	Sig.
Corrected Model	2085.202 <sup>a</sup>	4	521.301	6.156	.000
Intercept	60092.568	1	60092.568	709.621	.000
Pretest	4.855	1	4.855	.057	.811
Gender	334.929	1	334.929	3.955	.049
Error	502650.000	112	84.683		
Corrected Total	11569.658	116			

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Table 3 reveals that the main effect treatment of students taught using CAI package (experimental) and those taught the same topic without animation (control) produce  $F= 12.398$  and this value is significant at 0.001. That is ( $p=0.001$ ;  $p<0.05$ ). The treatment using CAI package produced significant difference in the mean achievement score of students taught ecology using CAI package with animation and those taught without animation is therefore rejected.

### **HO<sub>2</sub>**

There is no significant difference in the mean achievement scores of male and female students taught ecology using computer assisted instruction package with animation.

The result on table 3 above reveals that the mean treatment of male and female students taught ecology using CAI package with animation produce  $F= 3.955$ , and this value is significant at 0.49 That is ( $p=0.49$ ;  $p< 0.05$ ). The treatment using CAI package produced significant difference in the mean achievement score of male and female students. Therefore, the hypothesis which states that there is no significant difference in the mean achievement scores of male and female students taught ecology using CAI package is hereby rejected.

### **Summary of Findings**

The following findings were recorded based on the statistical analysis.

1. Students taught ecology using CAI package with animation achieved more than those taught ecology using CAI package without animation. The difference in achievement was found to be significant.
2. Male students taught ecology using CAI package with animation achieved more the female students taught ecology using CAI package with animation. The male student achievement is significant from the female achievement.

### **Discussion of Results**

#### **Students' Achievement in Ecology Due to CAI Package Used**

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The results in table 1 show the post-test achievement score of students taught using CAI package with animation (Experimental) is higher than the post –test mean achievement score of students taught using CAI package without animation (Control). This is further confirmed by the result in table 3 which revealed that the achievement of experimental and control groups differ significantly. The result indicated that the treatment using CAI package with animation produced significant difference on students' achievement in ecology. (Salau (2017) pointed materials supported by audio and animations are more effective on students' achievement and interest. The significant achievement of the students taught with CAI with animation over those taught without animation could be explained by the fact that learning through visual resources is the key to acquisition of knowledge when a student is instructed verbally there is the tendency to forget. This support the findings of kareem (2017) who stated that instructional material of which computer tools are inclusive help teacher to teach more effectively and also enable the students to learn more efficiently. This also in agreement with Okwo&Illiya (2017); Okwo&Ottubah (2018); Nwachukwu (2018) who all noted that the experimental groups performed better than the control group.

### **Students' Achievement in Ecology Due to Gender**

The result in table 2 show the post-test mean achievement of male and female taught ecology using CAI package. The mean achievement score of the male students taught using CAI package with animation is higher than that of the female students taught with the same CAI package with animation. However, table 3 showed that this difference is significant. This result agrees with Oakes, cited in Odogwu (2019) who stated that only fifteen percent of the scientist, engineers and mathematics in the united states of America are women. This according to Oakes is because academically qualified girls choose not to take science courses in high school. Odogwu said that this choice is related to the findings of Hyde, Fennema and Lamén that boys do better than girls in story problems and spatial relation problems.

### **Conclusion**

The result of this study established the following

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1. The use of computer animation approach significantly enhanced students' achievement in ecology topics taught more than the one taught without animation approach. This was observed in the mean score of the experimental group being higher than that of the control group.
2. There is a significant difference between the mean achievement scores of male and female students both in the pre-test and post-test in favour of males.

### Recommendations

In view of the findings of this study and their implications the following recommendations are made.

1. Biology experts should be encouraged and funded by government for the production of computers and computer animation programmes in various biology topics for schools.
2. The state and federal ministries of education should invest on massive acquisition and distribution of computer machines and biological software to secondary schools.

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