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Effects of Computer Simulation Instructional Strategy on Students' Interest and Achievement in Ecology in Plateau Central Education Zone, Nigeria

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ABSTRACT
The study investigated the effect of computer simulation and conventional Lecture instructional strategies on students' achievement and Interest in ecology in Plateau Central Education zone. The study was guided by four research questions while four research hypotheses were tested at 0.05 level of significance. The study adopted the quasi experimental design specifically the pre-test, post-test non-equivalent control group. The population of the study consisted of all the 5,207 SS1 students in all the government owned secondary schools in the study area for the 2020/2021 academic session. The sample consists of 106 respondents selected through simple random, the sample was assigned to one experimental group and one control group. Data collected were analysed using mean and standard deviation to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses. Data were collected using researchers – made Ecology Achievement Test (E.A.T.) and an adopted Ecology Interest Inventory (E.I.I.). The result of the study indicated significant effect of computer simulation strategy over the conventional lecture strategy (P = 0.1.12< 0.05) in Ecology Achievement Test (EAT). Further findings of the study showed that there was a significant effect on the interest rating scores of students exposed to computer simulation over the conventional lecture strategy (P =20.63 < 0.00) in EII. Based on the findings, it was recommended amongst others that Biology Teachers should adopt the computer simulation to teach ecology to arouse students' interest and improve achievement across location. School authorities should endeavour to provide adequate learning environment for effective study of ecology.

Keywords: Ecology Achievement Test, Ecology Interest Inventory, Computer Simulation, Conventional lecture strategy, Interest, Achievement and Resources.

I. INTRODUCTION:

Science is a systematic process of making inquiry about living and non- living things in any environment. Michael (2012) states that human beings have always been curious to know more about the existence of things around them especially those which have life, thus the study of biology. Biology is the study of life, in other words it is the study of plants and animals. The cardinal objectives of biology education at the secondary school level are that students at the end of their study should acquire adequate laboratory skills , meaningful and relevant knowledge, ability to apply scientific knowledge to everyday life in matters of personal and community health and agriculture, reasonable and functional scientific attitudes (Cirfat,2014). In pursuance of these stated objectives, the contents and context of the curriculum place emphasis on field studies, guided discovery, laboratory techniques and skills along with conceptual thinking. The science teachers are the dominant factor which determines the degree of success of science curriculum delivery in schools (Okoye, 2014; Godfrey, 2016).

The interdependency of man with living and non-living things within the ecosystem is fundamental to human existence. Human beings are in constant interaction with their environment right from birth. At home, they interact with their physical environment and manipulate the resources within their environment for their benefits. Human

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beings have been farming crops to provide food for themselves and there are a lot of plants around them that they feed on. There are other animals in the environment that human beings feed on and other animals (carnivores) feed on man and other animals (Okoye, 2014). This therefore means that ecology as curriculum content in Biology education should be given maximum attention. This is because ecology provides students the opportunities to practically interact with their physical environment for some level of mutual benefits (Toran, 2017; Michael, 2012).

The relationship among living organisms with one another and their environment is an aspect of biology called ecology. Ecology is a branch of biology that deals with the study of organisms in relation to their environment. Ecology as defined by Michael (2012), is the study of plants and animals in relation to their environment. Michael further states that ecology can be defined as a field of study which deals with the relationship of living organisms with one another and with the environment in which they live. Toran (2017) also defines ecology as the scientific study of the interactions between organisms and their environment. This means that the more students are exposed to their environment in Biology instruction, the more in-depth knowledge and interest they may develop towards Biology as a subject (Ukpai, 2014).

A functioning ecosystem is an aspect of ecology. An ecosystem as defined by Michael (2012) is a basic functioning unit in nature. An ecosystem is made up of living organisms (plants and animals) and their non-living environment. An ecosystem could be aquatic (water) or terrestrial (land). Biology as a subject is so wide and important that it is offered in most departments in secondary schools including science, commercial and art departments. However students' performance in Senior School Certificate Examination (SSCE) which is conducted bythe West African Examination Council (WAEC) and the National Examination Council (NECO) has been below average (Njoku&Nwagbo, 2014). The rate of high failure of students in Biology has been attributed to inappropriate methods or strategies of teaching (Ezenduka&Achufusi, 2014; Njoku&Nwagbo, 2014, Zumyil, 2019). Students' persistent low and under achievement in biology in SSCE has been observed much in literature (Okafor&Okeke, 2006; Ndioho, 2007; Ugbaja&Egbunonu, 2008, Samba &Eriba, 2012). These observations are more worrisome as the chief examiners' reports of the West African Examination Council (2010, 2011, 2012, 2015 & 2016) reported that students had poor grasp or understanding of ecological concepts in biology. This could also be due to the technical nature of some of the major and complex topics in Biology like ecology, genetics, nervous system and circulatory system (Olumide, 2013).

There is need to improve students' interests and achievements in Biology especially in the functioning ecosystem through the use of appropriate teaching strategies in Biology. This is because, one primary function of Biology teaching is to help students understand its concepts, principles, theories and laws. Hence, the professional teacher is expected to give useful and meaningful instruction to his/her students so as to educate them properly for the general benefit of the nation.

Some science educators including Eriba (2004), Agboghoroma (2009) and Lawal (2012), have stated that the attention of scientists and science educators has been focused on how to improve science instruction in schools. Okoye (2014) asserts that teaching has gone beyond the teacher standing in front of the learners to disseminate information to them without the learners' active participation. Akinbobola and Afolabi (2010) state that the challenge in teaching is to create experiences that actively involve students and support their thinking, explanation, communication and application of the scientific models needed to make sense of these experiences. There has been therefore significant shift of emphasis in science teaching from traditional content and factual acquisition of scientific knowledge to those which make students actively involved in learning science by doing. Ukpai (2014) suggests that Biology which is a practical subject requires the use of practical approach to teach its concepts so as to produce students that would be able to acquire necessary knowledge, skills and competences that are needed to meet the scientific and technological demands of the society. This can be possible when practical approach such as computer simulation strategy is used for lesson delivery rather than the conventional explanatory method.

The use of computer simulation ininstructional strategy is necessary because most of the conventional lecture method presently used in teaching biology especially in secondary schools have not yielded much results judging from the poor performance of students in the West African Senior Secondary Certificate Examination (Nwagbo, 2008, &Uche, Abdullahi, Asogwa and Ofoegbu 2016). The conventional lecture methods, according to Umar (2012) and Ukpai (2014),

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involves the presentation of concepts through talking, reading, note-taking and memorization of facts without actually involving students in activities or practical works that would stimulate their interest to perform better. This is where alternative strategy like computer simulation instruction is brought to be in this study.

Computer simulation as a strategy for teaching, is the use of computer to simulate something. This can be broken into two words; computer and simulation. Computer is an electronic device which is capable of receiving information (data) in a particular form and by performing a sequence of operations in accordance with a pre-determined but variable set of procedural instructions (program) to produce a result in the form of information or signals. Simulation is something that is made to look, feel or behave like something else especially so that it can be studied. According to Okereke and Onwukwe (2011), simulations help a learner to understand complex systems in simplified, risk- free set ups. This is supported by Ezeudu and Ezinwanne (2013) who affirm that simulations are tools that facilitate learning through representation and practice in a repeatable focused environment, that is whyGibbson, Fernando and Spedding (2021) encouraged innovation through developing a total enterprise computer simulation teaching responsible decision making for teaching.

Simulations are important for formulating and improving the conceptual models that scientist and science teachers use in their practice and teaching (Olumide, 2013). Teaching and learning of science Technology and Mathematics (STM) require intensive application of resources that would appeal to all the senses of perception to improve the effectiveness of instruction as well as maximize learning (Cirfat, Zumyil&Tongjura 2006). This strategy also supplies necessary basis for the developmental learning to take place, making learning more permanent (Uduak&Inyang, 2008).

Ugbaja and Egbunonu (2008) state that biology teaching involves exposing students to several opportunities in order to understand different types of concepts, principles as well as expose students to direct physical materials that will make some meaning to the cognitive framework. The implication is that biology teaching must be effective and meaningful to achieve its goal. The use of computer simulation in the teaching and learning of biology provides integrated experiences which may vary from concrete to abstract in the learners as it motivates and makes learners have interest in the subject (Biology). The computer simulation instructional strategy have the characteristics of holding the attention of almost all students in biology, since students like playing with such components of biology with computer.

Simulation is something that is made to look, feel or behave like something else especially so that it can be studied. Computer simulations give students the opportunity to take initiative when learning about a given topic (Olumide, 2013; John, Robert &Isreal, 2013). According to Ezeudu and Ezinwanne (2013), simulation helps to identify and understand factors which control the system and or to predict the future behaviour of a system. Ezeudu and Ezinwanne (2013) further state that simulation can be inferior substitute imitating an original or a display of not real behaviours. They further state that simulation can be classified in many ways as follows:

- **Physical simulation:** Here the physical object is presented on a screen and the students learn about it. For example when electrons are displayed to observe the influence of temperature. Here the students can manipulate the temperature to see its effects in the movement of electrons.
- **Process simulations:** Processes that are not visible can be demonstrated using process simulations. For example how population grows and decline or rise and fall of stock exchange.
- **Procedural simulations:** Here procedures are followed in other to understand sequence of event-s. Students can be asked to follow a set of procedures in observing reaction rates which end in a particular product.
- **Situational simulation:** This has to do with attitudinal and behavioral changes of people. The students use this simulation to explore the effects of different approaches to a problem.

Tippler in Ezeudu and Ezinwanne (2013) pointed out that simulation has three types namely;

- **Live simulation:** This shows human behavior in real life. Example is training of soldiers in war games.
- **Virtual simulation:** Simulation occurs in a computer controlled setting. For example a pilot flying and aircraft but is controlled from the control room.
- **Constructive simulations:** this does not involve humans or equipment but by proper sequencing of events for example weather changes like wind directions or water waves and be controlled through application of temperatures and pressures. (Institute of simulation and Training(SIT) University of Florida in Ezeudu and Ezinwanne (2013).

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These will enable students to connect what happens in the class and to what happens in the communities. Thus, knowledge and competences acquired in school should be applied in solving problems (Ukpai, 2014). Unfortunately, biology teaching in secondary schools has not been effective due to a number of reasons such as poor instructional methods, overloaded curriculum, lack of / insufficient instructional materials, large class size just to mention but few. For these reason, teachers do simply adopt instructional approach like the conventional lecture method which neither leads to objective reasoning nor arouse interest in students.

Agogo (2009) states that interest is a fundamental factor that is necessary for effective science education. Agogo sees interest as quality that arouses concern or curiosity that holds one's attention. Interest is a condition of wanting to know or learn about something or somebody (Agogo, 2009).

Academic achievement refers to a student's success in meeting short or long-term goals in education. Academic achievement means completing secondary school or earning a higher certificate. Academic achievement as defined by Crow and Crow in Nuthanap (2007) is the extent to which a learner is profiting from instructions in a given area of learning. This is reflected by the extent to which skill or knowledge has been imparted to the learner. Academic achievement is knowledge acquired and skills developed in school subjects, which is generally indicated by marks obtained in tests in an annual examination (Sunitha, 2005). Academic achievement can be influenced by factors like parent's education, parental occupation, type of school, location of school, gender, teaching method and many other factors.

Despite all efforts, including the use of innovative teaching methods to help science students achieve higher, such a factor as school location still may pose some problems. Studies have shown that school location has significant effects on students' achievement (Ok, 2009; Okereke&Onwukwe, 2011). Individual's interest is understood to develop gradually and affects one's knowledge and values over time (Onoja, 2016). Meaningful learning can only occur when students' interest are developed and sustained.

A school could be located in an urban or rural area. Location of a school (rural or urban) could have effect on a child's ability to study and perform at the level expected of him/ her. In Plateau State, most schools located in the rural areas have shortage of qualified teachers, insufficient facilities and no seats in the schools. This is supported by Ok (2009) who states that in Nigeria, most rural based schools lack enough qualified teachers. More often than not, they are poorly equipped and lack basic amenities. All these serve as inhibiting factors of good academic performance. Students in urban areas are often exposed to more social amenities such as electricity, radio, television, computers, mobile phones which they use to access facebook, twitter, youtube and other social media sites where they interact even with people beyond Nigeria. These students usually have access to computers as it can be seen that most schools in urban areas have computers and canas well operate them. Schools in rural areas do not often have computers, even if they have, there is usually no electricity. This research work therefore focused on the effects of computer simulation on the achievement and interest of students in ecology. The study also examined the effect of location of schools on the achievement and interest of the students in ecology.

The study was based on Hull's 'drive reduction theory of motivation 1942, Bruner's learning theory of constructivism in Education 1960 and Ausubel'ssubsumption theory of learning 1968.

Problem Statement/ Justification

Evidences show that there have been persistent low achievements of students in Biology in external examinations such as the Senior Secondary Certificate Examination (SSCE). This trend has posed a lot of worry and concern to Biology experts and researchers over the years. The Chief Examiners' Reports of the West African Examinations Council for years (between 2002 and 2017) revealed that students poorly grasped or understood ecological concepts in Biology.

Ecology can be better studied in the natural environment but many biology teachers often use the laboratory and other teaching aids in the classroom only as their resources or the only resources for teaching biology. Alternative strategy such as computer simulation strategy which is the imitation of the real world processes or system can be sought to teach ecology.

Many schools located in the rural areas in Plateau State have shortage of qualified teachers, lack of facilities and basic amenities in the schools. This trend may affect the interest of students towards Biology instruction. Therefore, considering the need to improve Students' interest and achievement in Biology, alternative means should be sought. This is where the strategy of computer simulation is brought to bear in this study.

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This study is aimed at comparing the effects of computer simulation and conventional explanatory instructional strategies on the achievement and interest of secondary school students in ecology. The problem of the study which is posed as two questions are: How will computersimulation instructional strategy raise students' interestin ecology irrespective of their location? How will computer simulation influence achievement in ecology among students from different school locations?

Purpose of Study

The purpose of this study is to compare the effects of computer simulation instructional strategies on students' achievement and interest in biology in Plateau Central Education Zone. Specifically, the objectives of the study were to:

1. Compare students' mean achievement in ecology when taught using computer simulation and conventional lecture method.
2. Compare students' mean interest rating in ecology when taught using computer simulation and conventional lecture method.
3. Compare the mean achievement of students from urban and rural schools in ecology when taught using computer simulation strategy.
4. Compare the mean interest rating of students from urban and rural schools in ecology when taught using computer strategy.

Research Questions

The following research questions guided the study

1. What are the mean achievement scores of Biology students exposed to computer simulation and conventional lecture method in ecology?
2. What are the mean interest ratings of Biology students taught ecology using computer simulation and conventional lecture method?
3. What are the mean achievement scores of students from urban and rural schools taught ecology using computer simulation?
4. What are the mean interest ratings of students from urban and rural schools taught ecology using computer simulation.

Hypotheses

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

1. There is no significant difference in the mean achievement scores of Biology students taught ecology using computer simulation strategy and conventional lecture method
2. There is no significant difference in the mean interest ratings of Biology students taught ecology using computer simulation strategy and conventional lecture method
3. There is no significant difference between the mean achievement scores of students from urban and rural schools taught ecology using computer simulation.
4. There is no significant difference between the mean interest ratings of students from urban and rural schools taught ecology using computer simulation.

Significance of the Study

It is hoped that the outcome of this study may be of great importance to Biology teachers, students, and curriculum planners. The Biology teacher may benefit from the study as it provides him/her with a better understanding of using the computer simulation for teaching functioning ecosystem. The study may sensitize the teachers on the best strategy for teaching functioning ecosystem.

This study could give students the opportunity to use and play the simulation in the computer. The knowledge gained by the students in functioning ecosystem may equally help them answer questions from this area in their internal and external certificate examinations.

Curriculum planners may benefit from this study especially in the area of activities for each topic. The findings may help the curriculum planners to focus on the use of computer simulation for the teaching and learning of ecology and science related subjects. All these could lead to increase in students' achievement in biology, as well as improve their interest in ecology.

Scope of the Study

This study focused on the comparative effectiveness of using computer simulation and the conventional lecture strategies on students' achievement and interest in ecology. The study covered the central education zone of Plateau State. The zone comprises five local government areas of Pankshin, Mangu, Bokkos, Kanke and Kanam.

The content Scope was delimited to computer simulation strategy and conventional lecture method. This enabled the researchers to effectively control the research conditions and manipulated the treatment and controlled aspects of the independent variables and its effect on the dependent variables. The study also focused on SS1 students located in both urban and rural areas. The preference for SS1 students was because they had just been introduced to biology as a subject. Therefore introducing the computer simulation strategy and field trip strategy could help in establishing an effective foundation of teaching and learning of biology to improve and enhance interest

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and achievement in ecology. Besides, using SS1 class gave the researchers enough time to expose them to the treatment because there was no interruption since, it was not a certification class. The topics covered in the study included autotrophs, heterotrophs, decomposers, food chain, food web, pyramid of numbers, energy and energy transformation in nature and nutrient cycling in nature. **Research Design**

The design employed for this study was the pre – test, post - test quasi-experimental design. Specifically, the study used the non-equivalent control-group design. This was adopted because it was not possible to randomly assign subjects to treatment groups. This design was appropriate because according to Achor and Ejigbo (2006), some classroom conditions do not allow for excessive manipulations. The study therefore used intact classes. The independent variables were computer simulation strategy and the conventional lecture methods. The dependent variables were achievement and interest in ecology. The design entailed all the groups took the pre-test before the treatment took place, while the post-test was also administered to all the groups. Based on this, the study employed one experimental group and one control group from urban and rural areas. The experimental group was exposed to computer simulation strategy while the control group was exposed to the conventional lecture method.

The design is represented diagrammatically as thus:

$ER0_1X_10_2$

$C\ R0_1\ X\ 0_2$

Where:

E represents the experimental group

C represents the control group

R refers to the random assignment of classes to experimental and control groups

0_1 pre-test for all groups

0_2 post-test for all groups

X_1 represents the treatment given to experimental group

X represents no treatment for control group

It was not possible for the researchers to randomly assign Students to groups, so as not to disrupt classes that were already in existence, especially as the experiment lasted for five weeks. The intact classes in the sampled schools were therefore used for the study.

Area of Study

The study was carried out in Central Education Zone of Plateau State. The Central Education Zone of Plateau State is made up of five Local Government Areas and each of the Local Government Areas has Area Directorate Office (ADO). The Local Government Areas that make up the Central EducationZone are; Bokkos, Kanke,Kanam, Mangu and Pankshin Local Government Areas.

Population

The population for this study comprised all the 5,207 SS1 students from the 107 government owned schools of the five local government areas in the Central Education Zone of Plateau State for the 2021/2022 academic session (Plateau Central Education Zone Statistics, 2021).

Sample and Sampling

A sample size of 106 students was used for the study which comprised the number of biology students found in the intact classes used. Government owned schools were used for reason of uniformity. The procedure took a multi-stage approach. The schools were stratified into the five Area Directorates of Education to ensure fair coverage of the entire Education Zone and enhance generalizability of the results. Sampling was purposively carried out in order to select co-educational schools from both rural and urban areas to reflect location of the schools. The criteria for selecting the sampled schools were: they should be Government approved schools, the school must have WAEC and NECO centres and having been presenting students for external examinations for not less than ten years. Schools selected must have a biology teacher with not less than three years post qualification experience.

Instrumentation

Two instruments were used for data collection in this study namely;

i. Ecology Achievement Test (EAT)
ii. Ecology Interest Inventory (EII)

Method of Data Collection

The data for the study were gathered through the administration of Ecology Achievement Test (EAT) and Ecology Interest Inventory (EII). The researchers visited the Zonal Education office and the schools selected for the study to obtain permission from the Director and the school authorities to conduct the study.

Experimental Procedure

a. Training of Biology teachers as research assistants for the Study

The following procedure was followed for the experiment;

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The researchers collected information such as years of experience from the Biology serving teachers who were used as research assistants.

The researchers trained the Biology teachers for four days in Government Secondary School Pankshin. The training lasted for four (4) hours daily. The training of the research assistants involved a careful explanation of the purpose or objectives of the research. All the teachers from 8 schools were trained on the instructional strategies to be used in their various Schools. Four teachers from four schools were trained on the use of the conventional lecture method of instruction. Four other teachers were designated for computer simulation instruction and were trained on how to use computer simulation instructional strategy. The teachers were observed in a practice session after training so that necessary corrections were made. The practice was repeated until the required skills were acquired. The best four teachers, 2 from urban schools (1 for computer simulation and 1 for conventional lecture)and 2 from rural schools (1 for computer simulation and 1 for conventional lecture) were used.

b. Procedures for the Treatment

A computer simulation on functioning ecosystem was developed and used as instructional material for the experimental groups that were treated with computer simulation strategy. Afterward, the following steps were taken in carrying out the investigation:

i. The researchers met separately with the teachers (i.e. the research assistants) from the 4 schools that were involved in teaching the control and experimental groups to ensure uniformity.
ii. Before the treatment, the EAT and EII were administered on the respondents as a pre-test in all the 4 schools before the commencement of the treatment. This was to help establish the entry behaviour of the respondents before the actual treatment.
iii. The teachers in the control group classes taught the students with the conventional lecture method of teaching using only verbal instruction.
iv. The teachers in the computer simulation classes used the computer with the simulation disc to teach the students.
v. The experiment was carried out for a period of five weeks.
vi. After five weeks of the experimentation, the items on EAT and EII which earlier served as pre-test was reshuffled and administered to the respondents as post-test to determine the effects of the treatment.
vii. The research assistants handed over the collected data to the researchers.

Method of Data Analysis

The research questions were answered using descriptive statistics of mean and standard deviations while all the hypotheses were tested at 0.05 level of significance using Analysis of Co-variance (ANCOVA) with the pre-test scores serving as a covariate. ANCOVA was used because it removes the initial differences among groups so that the groups could be considered equivalent since intact classes were used (Ali, 2006).

II. ANALYSIS, INTERPRETATION AND DISCUSSION

The research questions are addressed alongside with the hypotheses as follows:

Research Question 1

What are the mean achievement scores of biology students exposed to computer simulation, and conventional lecture method in ecology?

Table 1: Mean Achievement Scores of Biology Students Taught Ecology Using Computer Simulation and Conventional Lecture Method

Method		PreTest	PostTest	Man Gain
Computer Simulation	Mean	36.029	57.794	21.76
	N	34	34	
	Std. Deviation	12.457	13.742	
Conventional Lecture Method	Mean	38.500	43.133	4.63
	N	30	30	
	Std. Deviation	12.099	12.428	

Students in all the groups benefitted from the instruction using computer simulation, and conventional explanatory method. However, students taught using computer simulation had the highest mean gain (21.76) as against those taught using conventional explanatory method which has the least mean gain of 4.63. This shows that the

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computer simulation strategy is more effective for teaching ecology.

Research Question Two

What are the mean interest ratings of biology students taught ecology using computer simulation and conventional explanatory method?

Table 2: Mean Interest Ratings of Biology Students Taught Ecology Using Computer Simulation and Conventional lecture Method

Method		Pre-Interest	Post-Interest	Mean Gain
Computer Simulation	Mean	2.878	3.515	0.63
	N	34	34	
	Std. Deviation	.458	.623	
Conventional Lecture Method	Mean	1.972	2.198	0.23
	N	30	30	
	Std. Deviation	.548	.523	

The students in all the groups had mean gain on their interest ratings. The students taught with conventional lecture method has a mean gain of 0.23, while those taught using computer simulation had mean gain of 0.63. The high mean gain of 0.63 over 0.23 in interest rating for computer simulation and conventional lecture method respectively indicated that computer simulation was more effective for teaching ecology than the conventional lecture method.

Research Question Three;What are the mean achievement scores of students from urban and rural schools taught ecology using computer simulation?

Table 3: Mean Achievement Scores of Students from Urban and Rural Schools Taught Ecology Using Computer Simulation

Location		Pre-Test	Post-Test	Mean Gain
Urban	Mean	39.409	62.046	22.64
	N	22	22	
	Std. Deviation	11.291	12.952	
Rural	Mean	29.833	50.000	20.17
	N	12	12	
	Std. Deviation	12.547	11.992	

Table 3 shows the mean achievement scores of urban and rural students taught ecology using computer simulation strategy.The urban students exposed to computer simulation had higher achievement mean gain of 22.64 while the rural students had a mean gain of 20.17. The high mean gain in achievement of urban students indicated that computer simulation is more effective in teaching ecology in this location than in the rural area which had less mean gain.

Research Question four

What are the mean interest ratings of students from urban and rural schools taught ecology using computer simulation?

Table 4: Mean Interest Ratings of Students from Urban and Rural Schools Taught Ecology Using Computer Simulation

Location		Pre-Interest	Post-Interest	Mean Gain
Urban	Mean	2.8705	3.8545	0.98
	N	22	22	
	Std. Deviation	.48884	.42001	
Rural	Mean	2.8917	2.8917	0.00

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N	12	12
Std. Deviation	.41442	.41442

The students in urban area taught ecology using computer simulation had a mean gain of 0.98 while the students in rural area had no mean gain (0.00). The high mean gain of 0.98 in interest rating for urban students indicated that teaching ecology using computer simulation enhances the interest of biology students in the urban area but the no mean gain of biology students taught ecology using computer simulation in the rural area means that the method did not improve students' interest in that area.

Hypotheses 1

There is no significant difference in the mean achievement scores of biology students taught ecology using computer simulation strategy and the conventional lecture method.

Table 5: Summary of ANCOVA Effect of Biology Students Taught Ecology Using Computer Simulation Strategy and Conventional Lecture Method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	19668.595[a]	3	6556.198	309.933	.000
Intercept	1970.983	1	1970.983	93.175	.000
PreTest	15864.428	1	15864.428	749.963	.000
Method	5913.996	2	2956.998	139.787	.000
Error	2157.669	102	21.154		
Total	313464.000	106			
Corrected Total	21826.264	105			

a. R Squared = .901 (Adjusted R Squared = .898)

On Table 5, F value for method is 139.787, P = .000 < 0.05. Since P < 0.05, it shows that there is significant difference among the mean achievement scores of biology students taught ecology using computer simulation strategy and the conventional lecture method. This implies that the differences among the mean scores of students exposed to computer simulation strategy and a conventional lecture method in ecology was statistically significant. The null hypothesis was therefore, rejected. This means that there was a significant difference in the mean achievement scores of the biology students in the experimental group taught ecology using computer simulation and those in the control group taught using conventional lecture method.

Hypotheses 2

There is no significant difference in the mean interest ratings of biology students taught ecology using computer simulation strategy and conventional lecture method.

Table 6: Summary of ANCOVA Effect of Interest Ratings of Biology Students Taught Ecology Using Computer Simulation Strategy and Conventional LectureMethod

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	48.561[a]	3	16.187	116.936	.000
Intercept	5.191	1	5.191	37.503	.000
PreInterest	20.753	1	20.753	149.920	.000
Method	5.636	2	2.818	20.359	.000
Error	14.120	102	.138		
Total	973.970	106			
Corrected Total	62.681	105			

a. R Squared = .775 (Adjusted R Squared = .768)

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On Table 6, F value for method is 20.359, P = .000 < 0.05. Since P < 0.05, it shows that there is statistically significant difference in the mean interest ratings among biology students taught ecology using computer simulation strategy and conventional lecture method. This implies that the differences in means among students exposed to ecology using computer simulation strategy and conventional lecture method was statistically significant. The null hypothesis was therefore, rejected. This means that there was a significant difference in the mean interest of the biology students in the experimental group taught ecology using computer simulation and those in the control group taught using conventional lecture method.

Hypotheses 3

There is no significant difference between the mean achievement scores of students from urban and rural schools taught ecology using computer simulation.

Table 7: Mean Achievement Scores of Students from Urban and Rural Schools Taught Ecology Using Computer Simulation

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	5378.231[a]	2	2689.115	97.691	.000
Intercept	1595.417	1	1595.417	57.959	.000
PreTest	4251.627	1	4251.627	154.455	.000
Location	46.668	1	46.668	1.695	.202
Error	853.328	31	27.527		
Total	119797.000	34			
Corrected Total	6231.559	33			

a. R Squared = .863 (Adjusted R Squared = .854)

Table 7 shows the ANCOVA test of mean achievement of urban and rural students taught ecology using computer simulation. The table shows F = 1.695 with P = .202 > 0.05. Since P > 0.05, the observed difference between urban and rural biology students taught ecology using computer simulation was not statistically significant. The null hypothesis was therefore, not rejected. This means that there is no significant difference between the mean achievement scores of urban and rural students taught ecology using computer simulation. Therefore location is not important when a good strategy such as computer simulation is used in teaching ecology.

Hypotheses 4

There is no significant difference between the mean interest ratings of students from urban and rural schools taught ecology using computer simulation.

Table 8: ANCOVA Effect of Mean Interest Ratings of Students from Urban and Rural Schools Taught Ecology Using Computer Simulation

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	11.334[a]	2	5.667	120.468	.000
Intercept	1.060	1	1.060	22.543	.000
PreInterest	4.135	1	4.135	87.906	.000
Location	7.443	1	7.443	158.210	.000
Error	1.458	31	.047		
Total	432.800	34			
Corrected Total	12.793	33			

a. R Squared = .886 (Adjusted R Squared = .879)

Table 8 shows the ANCOVA test of mean interest rating of urban and rural students taught ecology using computer simulation. The table reveals F = 158.210 with P = .000 < 0.05. Since P <

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0.05, this implies that the hypothesis of no significant difference was hereby rejected. It therefore, implies that there was significant difference in the mean interest ratings between the urban and rural students taught ecology using computer simulation. This means that the method enhanced urban and rural student's interest in ecology differently.

III. DISCUSSION OF FINDINGS

The discussion of findings is based on the variables examined in the study which are guided by the research questions and the hypotheses.

The findings of this study revealed that the experimental instructional strategy, computer simulation had significant effect on the students' achievement in ecology. Students in the computer simulation group achieved higher than the conventional lecture group. The improvement of students' achievement in ecology could be attributed to the opportunity students had to take initiative while learning about a given topic which is the basic traits of computer simulation. This finding is in agreement with the finding of Olumide (2013); Ezeudu and Ezinwanne (2013), Nwafor and Abonyi (2016). Olumide found in a study that students exposed to computer simulation instructional strategy performed better than those taught biology using conventional lecture method. Nwafor and Abonyi ((2016) also proved in a study that students taught basic science using simulation strategy achieved higher than those taught with conventional lecture method. In the same vein, Ezeudu and Ezinwanne (2013) found in a study that exposing students to simulation instructional strategy had their achievement improved in chemistry. In relation to the effect of computer simulation, Nwafor and Abonyi (2016) affirm that the strategy encourage students to become active participants in the classroom.

Another finding of this study showed that there was a significant difference in the mean interest ratings of students in Ecology among the groups in favour of the experimental strategy – computer simulation. This finding is in consonant with the findings of Denen and Isah (2015) who found in a study that there was a significant difference in the interest and achievement of students in biology when taught with computer simulation strategy than those taught with the conventional lecture method.

For the achievement scores of urban and rural students taught ecology with computer simulation, the findings showed that the urban students had higher mean gain of 22.64 after treatment as against rural students with a mean gain of 20.17. On the other hand, the finding shows that the urban students mean gain in the interest rating was found to be 0.98 while there was no mean gain in the interest rating of the students in the rural location. The high mean gain (0.98) in the interest rating for urban students indicated that teaching ecology using computer simulation enhanced the interest of biology students. However, the no mean gain of biology students taught ecology using computer simulation in the rural area means that the method did not improve students' interest. This could be attributed to the fact that urban students are more exposed to computer more than the rural students.

Further finding indicated that there was significant difference in the mean achievement scores of students exposed to computer simulation and conventional lecture methods. Students taught using computer simulation strategy had higher means than those of the control group. This means that computer simulation strategy enhanced students' performance in ecology more than the conventional lecture method. This is because computer simulation strategy equally enhanced students' performance in ecology due to their active participation in the lesson, as they observed the simulation in the computer. The analysis of the mean achievement of students based on location shows that there is no significant difference in the mean achievement of urban and rural students taught ecology with computer simulation strategy. This is supported by the findings of Macmillan (2012) who conducted a research on school location versus academic achievement in physics using computer assisted instruction and found out that there was no significant difference in the mean achievement scores of urban and rural students. Therefore, location is not important when a good strategy like computer simulation is used in teaching ecology. On interest rating, results show that there is significant difference in the mean interest ratings of urban and rural students taught ecology using computer simulation strategy. This means that the method enhanced urban and rural students' interest in ecology differently. This implies that the urban students developed interest in ecology more than the rural students when they were taught using computer simulation.

Another finding showed that there is no significant difference between the mean interest ratings of urban and rural students taught ecology using computer simulation. This implies that the hypothesis of no significant difference was hereby rejected. It therefore means that there was significant difference in the mean interest rating of urban and rural students taught ecology using

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computer simulation strategy. Thus, computer simulation used in teaching ecology to urban and rural students enhanced their interest in ecology differently. The students in the rural schools developed more interest than the students in the urban schools.

IV. SUMMARY

The study investigated the effects of computer simulation and the conventional method on students' achievement and interest in ecology in Plateau Central Education Zone. Effect of location on the two instructional strategies were also examined. Four research questions guided the study while four hypotheses where formulated and tested at 0.05 level of significance. The study was anchored on three theories. These were Hull's theory of drive reduction, Bruner's learning theory in education and Ausubel'subsumption theory of learning. The relevance of these theories to the variables of the study were stressed. Related conceptual literatures were reviewed on computer simulation, ecosystem, school location, achievement and interest were also reviewed. Empirical studies related to the variables of the study were also reviewed.

The research design adopted for the study was the quasi-experimental, specifically, the pre-test, post-test non-equivalent control group design since intact classes were used. The population of the study was all the 5,207 SS1 students in the 107 Government-owned secondary schools. One hundred and sixty SS1 students found in four intact classes in four schools cut across urban and rural areas formed the sample of the study. The four intact classes were assigned to the experimental and control conditions through purposive, stratified and simple random sampling as techniques adopted.

The following were the findings of the study;

1. Students who were taught ecology using computer simulation achieved higher in ecology than those taught using the conventional lecture method.
2. Students who were taught using computer simulation strategy had higher interest rating scores in ecology than those taught using the conventional lecture method.
3. There was a significant difference in the mean achievement scores of urban students taught ecology using computer simulation strategy than those in the rural area in the EAT.
4. The interest ratings of students in urban area taught using computer simulation was significantly higher than those in the rural area in EII.

V. CONCLUSION

This study has established that computer simulation is a practical and purposive way of improving students' achievement and interest in ecology. The students who were taught ecology using computer simulation strategy performed better than the students taught using conventional lecture method. This was because students in the experimental group were given the opportunity to participate actively, and so they would remember easily what they had been taught since they were involved. Computer simulation was efficacious and learner-centred than the conventional lecture method which was passive and teacher-centred.

Computer simulation strategy gives students the opportunity to take initiative when learning about a given topic and arouse interest of the students than the conventional lecture method, thereby leading to better achievement. The implications of the findings therefore are that computer simulation strategy arouse students' interest thereby improved their achievement in ecology. This study has proved that interest is an important factor that enhanced students' achievement in ecology. The study also concluded that students need exposure to simulations to arouse their interest which could enhance their performance in ecology.

VI. RECOMMENDATIONS

Based on the findings of this study, the following recommendations are made;

1. Biology teachers should employ the computer simulation strategy to teach students ecology and other topics in biology in order to enhance students' achievement and interest in Biology.
2. Biology teachers should use computer simulation strategy to teach as this will help to identify and understand factors which control a system and or predict the future behaviour of a system.
3. School authorities should ensure the provision of adequate materials and conducive teaching and learning environment for teachers and students for effective study of ecology and Biology generally.
4. Curriculum developers should create a medium to inform biology teachers and other science teachers to use computer simulation strategy for teaching and learning biology and other science subjects.
5. The secondary school biology curriculum should be reviewed with a view to integrate

computer simulation packages into the curriculum.

6. Nigerian Government at all levels should provide and support computer systems, video players and projectors. The use of these ICT products should be enforced by the government in all secondary schools.
7. School principals, administrators, teachers and other stakeholders in secondary schools should be trained and be updated periodically on the use of computer systems in the teaching and learning of Biological concepts especially in ecosystem functions.

Limitations

Some of the teachers used as research assistants in the sampled schools were not used to teaching ecology or biology using computer simulation in any significant ways. Some of them may not have paid much attention to the teaching of ecology. Their reluctance, incompetence and attitude may have affected the results of the study even though they were given some training. The researchers could not select Biology teachers based on gender since the selection was based on available teachers of the classes sampled in the various schools used for the study. Computer simulation is not suitable for topics as it cannot be simulated easily.

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