



Effect of Scaffolding Instructional Strategy on ... Usaini, J. & Sani, A. G. (2025)

Effect of Scaffolding Instructional Strategy on Performance in Ecology Concepts among Secondary School Students in Gumel, Jigawa State, Nigeria

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Abstract

This study investigated the effects of Scaffolding Instructional Strategy on performance in Ecology concept among secondary school students in Gumel Education Zone, Jigawa State, Nigeria. The study adopts a Quasi-Experimental Design, particularly the pretest, posttest, quasi-experimental and control group design. The population comprised all 3239 SS2 Biology students from 17 public Senior Secondary Schools in Gumel Education Zone. A sample of 124 students from two randomly selected out of 4 co-educational schools was used for the study. The study involves two groups experimental and control. The experimental group was taught Ecology concept using Scaffolding Instructional Strategy while the Control Group was exposed to the same concept using lecture Method. One instrument were used for data collection, namely, Ecology Performance Test (EPT). The instrument were validated by experts in Ahmadu Bello University, Zaria and have reliability coefficients of 0.88 and estimated using Pearson Product Moment Correlation (PPMC). Two research objectives, two research questions and two null hypotheses were formulated to guide this study. Research questions were answered using Mean and Standard Deviation, while null hypotheses were tested using Independent Sample t-test at 0.05 level of significance. The major findings revealed a significant difference between the mean scores of experimental and control groups in their performance, in favour of the experimental group. It is therefore recommended among others that secondary school Biology teachers should frequently employ Scaffolding Instructional Strategy in teaching difficult and abstract concepts in Biology like Ecology

Keywords: Scaffolding Strategy, Ecology, Performance and Students

Introduction

Science is an organized body of knowledge which consists of unbiased and empirical findings obtained from observation and experiment. Science could be seen as a problem solving in order to enhance the living standard of man. There are different definitions of science by different scholars, Shuaib (2014) defined science as a complex human activity that leads to the productions of a body of the universal statement called laws, theories or hypotheses which serve to explain the observable behavior of the universe or part of it which in themselves have predictive characteristics. In addition, science deals with nature by observing it and phenomena to experimental investigation. Science as a discipline has many branches such as Biology, Chemistry, and Physics. Therefore, the importance of science in our society made the federal government of Nigeria, through the Federal Ministry of Education to introduce science education in the Nigerian Schools. Thus, science education is the field concerned with sharing science content and process with individuals not traditionally considered parts of the scientific community. Okeke (2007) described Science Education as an integrated field of study which considers both the subject matter of science disciplines such as



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Biology, Chemistry, and Physics. Alongside the processes involved in the teaching and learning of science. The term “Biology” was coined from two Greek words: bios and logos which simply mean life and study respectively. Biology according to Michael (2012) can simply be defined as the study of life. Biology is the scientific study of plant and animal. According to FRN (2013), Biology as a science subject occupies a central position in the Nigeria Science curriculum. Biology as a course of study embraces the study of living organisms with regards to their structure, functions, growth, evolution, distribution, identification and taxonomy. Umaru (2017) explains that the study of Biology enables human to understand the diversity of life forms, conservation and sustainable use of natural resources. Biology plays a key role as a prerequisite subject for most science and related professions like Physiology, Anatomy, Botany, Zoology, Ecology, Molecular biology, Entomology, Microbiology, Biochemistry, Pharmacy, Medicine, Nursing, Genetics and population dynamic. Umoru and Onoja, (2017) assert that basic knowledge and skills acquired from the subject can be of tremendous help to the society. For instance, in human society, it gives an understanding of how life is formed and how it works, changes and responds to environmental influences like human health, reproduction, quality of life, nutrition, biodiversity in changing climate and almost effect of human everyday life. According to Ugwuadu and Joda (2015) the impact of Biology on the life of living organisms is wide; all ensuring that the required standard of living for both plants and animals are maintained.

According to Obochi (2018) Biology is divided into many concepts such as photosynthesis, nutrition, genetics, evolution, ecology among others. In spite of the importance of Biology as a science subject empirical studies such as Lawal (2009), Etobro and Fabinu (2017) and Obochi (2018), WAEC Chief Examiners Reports (2014-2022) show that students perform poorly in Biology especially in areas like ecology, genetics, evolution and Biological drawing. Ecology is one of the branches of biology and is defined as the relationship of living organisms with one another and with the environment in which they live. Umeh (2011) defines Ecology as the study of interactions of organisms with their physical environment and with each other. Ecology is described as environmental biology. According to Obochi (2018), Ecology provides knowledge and understanding of the mechanism of change brought about by the interaction of the living things and its effects on their external environment. Ecology gives students the opportunity to relate with some of the most important ecological issues affecting the environment. These include the influence of human activity in altering human ecological relationships and difficulties arising from the stress of modern-day life. In secondary school biology curriculum, Obochi (2018) observed that ecology concept plays a very important role in scientific advancement that affects the lives of mankind. For instance, in the areas of understanding energy allocation, conservation of environment, discovery and production of medicine, disease and pest control, food production and sustaining biodiversity in a changing climate. However, Reports from WAEC (2014-2022) and other researchers such as Anyanwu, Obochi and Isa, (2015) show that there is still poor performance in Biology in external examination. The poor performance in biology in Nigeria has been attributed to many factors; Lawal (2009) identified the use of poor teaching methods. Okoro (2011) found lack of interest and low self-concept. Atadoga and Lakpini, (2013) found teacher’s instructional strategies, attitude and learning style preferred among others. Thus, instructional strategies used by teachers in teaching and learning process, have significant influence on learner’s academic performance. Jafar (2024) found poor performance was due to constant use of lecture method which is teacher-centered encouraging rote learning or memorization and not encouraging formal reasoning of the students. Lecture method is where a teacher does most of the talking, while students listen and take note. According to Nwagbo and Chukelu (2011) lecture method is a teaching method in which teacher present a verbal discourse on a particular subject,



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theme or concepts to the learners, the teacher delivers a preplanned lesson to the students with little or no instructional aides. Danmole (2011) added that teachers need to employ different learning methods and strategies to ensure students understanding of scientific concepts. In pursuance of the objectives, content, and context of Biology curriculum developers recommended teaching approaches which are learner-centered for effective teaching and learning of the subject so as to bring the expected desired learning outcomes. Ugwuadu, (2015) and Obochi, (2018) found that the persistent low performance of students in Biology specifically in Ecology concepts at senior secondary certificate examination raises doubt about the effectiveness of current teaching approaches in use by Biology teachers. Etobro and Fabinu (2017) found that ecology concepts are perceived as difficult concepts by secondary school Biology students. Thus, it becomes imperative to investigate other methods of teaching Biology. In this context, scaffolds may offer favourable support. However, Wolf, (2000) Saye and Brush, (2002) assert that Scaffolding are teaching strategy that guide or help students to gain higher levels of understanding during the teaching process.

In education, Scaffolding refers to different teaching strategy employed by a teacher to help students have deep understanding of concepts during teaching and also participate actively in the learning process. According to Hartman, (2002) Scaffolding is the teaching strategy that emphasizes the teaching of new skills by engaging students collaboratively in tasks that would be too difficult for them to complete on their own. However, Sawyer (2006) stated that instructional scaffolding is the provision of support to promote learning when concepts and skills are being first introduced to the students. Sawyer (2006) further expatiated that these supports may include resources, a compelling task, templates and guidance on the development of cognitive and social skills. Sawyer (2006) added that these supports are gradually removed as the students develop autonomous learning strategies. Thus, promoting their own cognitive, affective and psychomotor learning skills and knowledge. Nonye and Nwosu, (2011) stated that scaffolding strategy emphasizes on the role of teachers and other more skillful persons in supporting the learner's development and providing support structures to get to that next stage or level. Therefore, there is need for considering scaffolding strategy as an instructional way to teach and learn of biology so as to enhance better performance. Another factor to performance in science and biology education is gender. Okeke, (2008) Gender refers to the socio-culturally constructed or created characteristics and roles which are ascribed to male and female in any society. Before now science was preserved for males with little participation of female students. This is due to the fact that girls did not embrace formal education and specifically science education early enough as to their male counterparts. As a result, Okeke, (2008), opined that women and girls grapple with a lot of discrimination and difficulties in science learning. Not withstand in any academic setting such as science learning, there is always the participation of male and female students. This brings to play the issue of gender to educationist and researchers. There is bound to be interaction between male and female students in the cause of learning. It becomes paramount to understand the rate to which both genders can achieve in what is taught as well as their interest towards learning. However, researchers on gender and academic performance such as those of Olorukooba, Lawal and Umar (2013) and Akani (2015) reveal that boys achieved academically better than girls. On the other hand, studies by Lawal (2009) pointed out that female students achieved academically better than their male counterparts. However, a number of other studies like Sangowawa (2019) reveal no significant difference in the academic performance of male and female students. Therefore, the researcher seeks to determine the Effects of Scaffolding instructional Strategy on Performance in Ecology Concepts among Secondary School Students' in Gumel, Jigawa State, Nigeria.



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This study is based on social learning theory of Lev Vygotsky (1978) specifically, the socio-cultural theory and his concept of Zone of Proximal Development (ZPD). Socio-cultural theory spelt out that social interaction plays an important role in cognitive development. In his view, the learner does not learn in isolation, rather learning is strongly influenced by social interactions, which take place in meaningful contexts. The Zone of Proximal Development (ZPD) is that area between what a learner can do independently (mastery level) and what can be accomplished with the assistance of a competent adult or peer (Instructional level). It is believed that any learner could be taught any concept effectively using scaffolding techniques by applying the scaffolding at the ZPD.

Statement of the Problem

There has been a continuous poor academic performance of students in Biology generally and ecology in particular as reported by Etobro and Fabinu (2017). WAEC Chief Examiner's Reports on senior secondary school students' academic performance has consistently revealed poor performance at Biology in Nigeria from (2014-2022). Poor performance of students in Biology have been attributed to different factors, by several researchers for instance, Lawal (2009), Atadoga and Lakpini (2013) found that the persistent low performance in science education were attributed to teachers' instructional strategies such as lecture method in which the learners remain passive while the teacher is always active. Furthermore, Okoro (2011) and Osuafor and Okonkwo, (2013) found that the poor instructional strategies adopted by Biology teachers, inadequate laboratory equipment, lack of creativity in the part of teachers, poor Biology instructional materials, large class size, among others contribute to student's poor performance and lack of interest in Biology. Having identified all these factors responsible for poor performance in ecology, there is the need to explore other ways of presenting Biology to students to enhance meaningful learning and performance. This calls for teachers to use learner-centered strategies such as instructional scaffolding. However, Akani (2015) found that scaffolding strategy steps up students' performance in chemistry than the lecture method of instruction. It is on this note that, this study seeks to determine the Effects of Scaffolding instructional Strategy on Performance in Ecology Concepts among Secondary School Students' in Gumel, Jigawa State, Nigeria.

Objectives of the Study

The objectives of the study are to:

1. determine the effect of scaffolding instructional strategy on academic performance of SS 2 students taught ecology concepts and those taught using lecture method.
2. find out the difference between the academic performance of male and female students in ecology concepts taught using scaffolding instructional strategy.

Research Questions

The following questions are set to guide the study:

1. What is the difference between the mean academic performance scores of students taught ecology concepts using scaffolding instructional strategy and those taught using lecture method?
2. What is the difference between the mean academic performance scores of male and female students taught ecology concepts using scaffolding instructional strategy?

Null Hypotheses

The following null hypotheses are formulated for the study:

H₀₁: There is no significant difference between the mean academic performance scores of students taught ecology concepts using scaffolding instructional strategy and those taught using lecture method.



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Ho₂: There is no significant difference between the mean academic performance score of male and female students taught ecology concepts using scaffolding instructional strategy.

Methodology

The study adopted the quasi-experimental design, specifically the pre-test, post-test, quasi-experimental and control group design. Pre-test was administered before treatment to measure the students' initial level of Interest and academic performance in Ecology Concept. The students in the experimental group were taught using Scaffolding Instructional Strategy while those in the control group were taught using Conventional Method. Treatment lasted for six weeks each. The concept Ecology Concept as derived from the Senior Secondary school Biology Curriculum (NERDC, 2012) was taught in six lessons (one topic per week for each group). After the treatment post-test, was administered to both groups to measure their Interest and performance ability of learnt concepts. Two (2) instruments were used for data collection, namely, Ecology Performance Test (EPT) and Ecology Interest Questionnaire (EIQ). EIQ is a 25-item questioner with a reliability coefficient of 0.80 while EPT is a 40-item multiple-choice test with a reliability coefficient of 0.88. One hundred and twenty four (124) SS2 Secondary school Biology students constituted the sample for this study and were derived from two (2) co-educational schools sampled from the seventeen (17) public senior secondary schools in Gumel Education Zone. The population of this study is made up of three thousand, four hundred and ninety-six (3,496) SS2 Secondary school Biology students in the study area. The data collected were analyzed using Descriptive statistics of Means and Standard Deviations to answer the research questions as well as Independent Sample t-test and Mann whitney U-test to test the null hypotheses at $p < 0.05$ level of significance. All analyses were done using the Statistical Package for Social Sciences (SPSS) IBM Version 26.

Presentation of Result

Research Question One: What is the difference between mean performance scores of Secondary school students taught Ecology Concept using Scaffolding Instructional Strategy and those taught using lecture method?

To answer research question one, the data obtained from posttest were subjected to descriptive statistics using mean and standard deviation. The summary of the findings is presented in Table 1

Table 1: Mean, Standard Deviation Statistics Posttest EPT scores for Students in Experimental and Control Groups

Group	N	Mean	STD	Mean difference
Experimental	61	33.02	1.78	13.96
Control	63	19.06	3.03	

In Table 1, the result of the analysis shows that there was difference in the mean performance scores of students taught Ecology Concept using Scaffolding Instructional Strategy and those taught using lecture method. Their mean Academic Performance Scores were 33.02 and 19.06 in posttest experimental and posttest control respectively. The computed mean difference was found to be 13.96 in favour of the experimental group. The Mean Academic Performance Scores of Students in experimental group is higher than their counter parts, in the control group.

Hypothesis One: There is no significant difference between the mean performance scores of SSII Secondary school students taught Ecology Concept using Scaffolding Instructional Strategy and their counterparts taught using lecture method.



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To test null hypothesis one, the posttest scores of students in EPT for the experimental and control groups were subjected to Independent Samples t-test statistic and a summary of the analysis is presented in Table 2.

Table 2: Summary of Independent Sample t-test of Mean Posttest EPT Scores for Experimental and Control Groups.

Group	N	Mean	STD	Mean diff.	Df	t value	p value	Remark
Experimental	61	33.02	1.78					
				13.96	122	31.1	0.001	Sig
Control	63	19.06	3.03					

Significant at $P \leq 0.05$

Table 2 shows a p-value of 0.001, observed at degree of freedom Of 122. This p-value is less than the 0.05 level of significance, indicating that there is significant difference between the mean performance scores of SSII Secondary school Biology students taught Ecology Concept using Scaffolding Instructional Strategy and their counterparts taught same concept using lecture method. The observed difference is in favour of the experimental group who were exposed to the scaffolding instructional strategy. Hence, the null hypothesis is rejected, implying that Scaffolding Instructional Strategy significantly enhanced secondary school Biology students' academic performance in Ecology than lecture method.

Research Question Two: What is the difference between the mean performance scores of male and female students taught Ecology Concept using Scaffolding Instructional Strategy?

To answer research question two, the data obtained from posttest scores for male and female were subjected to descriptive statistics using mean and standard deviation. The summary of the findings is presented in Table 3.

Table 3: Mean, Standard Deviation Statistics of Posttest EPT scores for Male and Female Students in Experimental Group

Gender	N	Mean	STD	Mean difference
Male	34	33.00	1.74	
Female	27	33.03	1.87	0.03

Table 3 shows that the Mean Academic Performance scores of Male Students in experimental group was 33.00 and standard deviation of 1.74 was observed. Female students in the experimental group also have a mean score of 33.03 with standard deviation of 1.87. The mean difference in performance is 0.03, this shows that both male and female students have a very close mean performance when taught Ecology Concept using Scaffolding Instructional Strategy.

Hypothesis Two: There is no significant difference between the mean performance score of male and female SSII students taught Ecology Concept using Scaffolding Instructional Strategy.

To test null hypothesis, the posttest EPT scores for male and female students in the experimental group were subjected to Independent Samples t-test statistic and a summary of the analysis is presented in Table 4:



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Table 4: Summary of Independent Sample t-test of Mean Posttest EPT Scores for Male and Female in Experimental Group.

Gender	N	Mean	STD	Mean diff.	Df	t value	P value	Remark
Male	34	33.00	1.74	-0.37	59	-0.080	0.91	NS
Female	27	33.03	1.87					

Not Significant at $P \geq 0.05$.

Table 4. Shows a p-value of 0.91 observed at degree of freedom Of 59. This p-value is greater than the 0.05 level of significance, indicating that there is no significant difference between the mean performance scores of male and female SSII students taught Ecology Concept using Scaffolding Instructional Strategy and their counterparts taught using lecture method. Hence, the null hypothesis is retained, implying that gender does not significantly influence secondary school Biology students' academic performance in Ecology when taught using scaffolding Instructional strategy.

Discussion of Findings

The results of the findings show that students in the experimental group had a higher mean performance score than those in the control group. The difference was significant as indicated by the t-test analysis in Table 1. This signifies that students taught Ecology Concept using Scaffolding Instructional Strategy had a significantly higher mean performance score than those taught using lecture Method. By implication, the Scaffolding Instructional Strategy was able to foster a significant higher performance than the lecture Method. The significant difference implies rejection of null hypothesis and retaining alternate hypothesis. Therefore, null hypothesis that states that there is no significant difference in the mean performance score of SSII students taught Ecology Concept using Scaffolding Instructional Strategy and their counterparts taught using lecture method is rejected. The significant difference indicates that students in experimental group recorded a higher mean score than those in the lecture Method. This finding supports that of Okechukwu and Udo (2019). These researches revealed that students exhibited significant improvements in performance as a result of treatment with Scaffolding Instructional Strategy as compared to the lecture method. The findings of this study also agree with findings of Mohammed (2019) and Sangowawa (2019). The finding of this study also concurs with the assertion of Nonye, and Nwosu (2011) that effective use of Scaffolding Instructional Strategy facilities in teaching should be employed as it will enhance student's performance of in JSS level of education. The finding also provides support to the research findings of Ogunseemi (2013) that students exhibited significant improvements in performance as a result of treatment with Scaffolding Instructional Strategy as compared to the lecture method. From the findings in Table 2 and 4, it was revealed that no significant difference in the performance of male and female students when exposed to Scaffolding Instructional Strategy. This showed that the strategy is gender friendly in terms of performance. This is in harmony with the findings of Ogunseemi (2013) who found that boys in heterogeneous groups do not dominate their female counterparts in performance. Okechukwu and Udo (2019) in their independent studies revealed that gender has no significant on performance among secondary school students when exposed to Scaffolding Instructional Strategy.

Conclusion

From the results and the findings of this study, it could be concluded that:



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1. The use of Scaffolding was found to enhance performance of secondary school students in Ecology concept.
2. The scaffolding instructional strategy is gender friendly as it is very effective for the enhancement of both male and female students' performance in Ecology concepts.

Recommendations

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

1. The teaching of Ecology concept should be carried out by biology teachers with tasks that involve using Scaffolding that promotes interaction among students and teachers.
2. Biology teachers should be encouraged to attend seminars, workshop, conference and in-service training programme specifically on Ecology teaching using Scaffolding Instructional Strategy.
3. Secondary school Biology teachers should frequently employ the Scaffolding Instructional Strategy in teaching difficult and abstract concepts in Secondary school Biology like Ecology Concept.
4. Professional bodies like STAN in collaboration with the Federal and State Ministries of Education should embark on nationwide re-training of Secondary school Biology teachers to design and implement classroom instructions based on the Scaffolding Instructional Strategy through regular national, state and local seminars, workshops and conferences.

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