



Scaffolding Instructional Strategy and Achievement of Students in Biology in Anambra State, Nigeria

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ABSTRACT

This study examines the effects of instructional scaffolding on achievement of students in Biology in Anambra State, Nigeria. The research design used in the study was quasi experimental research design. The sample consists of 120 SS2 biology students selected from the four randomly sampled secondary schools in Awka Education Zone in the state. Three research questions and three hypotheses guided the study. Biology Achievement Test (BAT) was the only instrument used for data collection. The Pearson Product Moment correlation statistics was used to obtain a reliability coefficient of 0.84 using data obtained by the test-retest method. The data collected were analyzed using mean and standard deviation while t - test was used to test the hypotheses. The results reveal that scaffolding instructional strategy enhanced students' achievement in biology. There was no significant difference in the mean gain scores of male and female students taught biology concept in the experimental group but there was a significant difference between mean gain scores of male and female students taught biology concept in the control group. Based on the findings, it was recommended amongst others that teachers should adopt scaffolding instructional strategy for teaching Biology in schools. Curriculum planners should include scaffold as an instructional strategy for enhancing academic achievement.

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Introduction

Biology is the study of living things such as plants and animals (Michael, 2008). It is a science subject offered at senior secondary schools level in Nigeria and is among the subjects taken in Senior School Certificate Examination (SSCE). Many students that registered this subject in external examinations performed poorly (The West African Examination Council Chief Examiner's Report on Biology-WASSCEC, 2013). This suggests that students have difficulty in learning the subject.

Learning is a process requiring effort in which the learner actively constructs his own meaning that is consistent with prior ideas. The ability of a learner to learn well depends on his/her ability to connect or integrate previous knowledge with new ones and also apply it to real life situations. Such learning is described as meaningful learning. For meaningful learning to take place in Biology, the Biology concepts presented to the learner must be potentially meaningful and hence must provide opportunity for the learner to form non - arbitrary relationships with existing conceptual framework (meaningful task). The learner must have a conceptual framework to which the new concepts can be linked (relevant prior knowledge). The learner must manifest the meaningful learning set. Meaningful learning set also implies that learners must have the desire or tendency to make connections among concepts during the teaching / learning process.

Teaching is the act of impacting knowledge and teaching of science in general and Biology in particular requires active

participation of students in the teaching / learning process, to enable students connect scientific concepts and theories to real purposes and practices in the world in which they live. Unfortunately, majority of the teachers teach biology using the traditional methods (Okoli & Azubuike, 2012).

Students' poor performance in external examinations could be as a result of poor teaching methods. However, different teaching strategies have been introduced but could not improve the achievement of students in biology. Thus, it becomes imperative to investigate other methods of teaching students. In this context, scaffolds may offer favourable support. Scaffolds are materials that guide or help students to gain higher levels of understanding during the teaching process (Wolf, 2000; Saye & Brush, 2002).

In education, scaffolding refers to different teaching techniques employed by a teacher to help students have deep understanding of concepts during teaching and also participate actively in the learning process (Hartman, 2002). The study conducted by Aida. (2006) also stated that scaffolding instructional strategy helps students to understand English Language better therefore, instructional scaffolding is a learning process packaged to enhance a deeper level of learning in students. Furthermore, instructional scaffolding can be seen as the support given to learners during the learning process with the intention of helping the student to achieve his/her learning goals. Scaffolding is a teaching strategy that engages students collaboratively in tasks that would be too difficult for them to complete on their own (Hartman, 2002).

This teaching strategy which emanated from Lev Vygotsky socio-cultural theory shows that social interaction plays a vital role in the development of students' cognition (Raymond, 2000). He also believes that active learning takes place via participation of students in social or culturally embedded experiences. Based on this, the learner does not learn alone, rather the learning is strongly influenced by social interactions. The social interaction of students with more knowledgeable persons or teachers and their environment strongly affect their ways of reasoning and interpreting situations.

Vygotsky's Zone of Proximal Development (ZPD) is the second foundation for instructional scaffolding. The ZPD is the point between the mastery level (i.e what learners can do on their own) and task that can be accomplished with the help techniques when applied at the Proximal Development (ZPD). However, Instructional scaffolding as a teaching strategy is based on the belief that students come to the classroom with different pre-existing knowledge and the process of building on what students already know make scaffolding an effective instructional technique.

However, scaffolds enhance students' ability to process new ideas. The most important thing about scaffolding is that the scaffolds are temporary. As the student increases in abilities the teacher gradually withdraws the scaffolds by then the learner is able to master the concepts independently. Omiko (2013) research stated that scaffolding instructional strategy enhances retention and long term learning. Remalyn (2013) study affirmed that Scaffolding teaching strategy is effective in improving students' performance and attitudes toward mathematics.

Margaret (2005) and Omiko (2013) in their studies ascertained that scaffolding is the assistance a teacher gives to the students in a learning situation to enhance learning. They added that instructional scaffolding is a learning process designed to promote a deeper level of learning. Scaffolding is the support given during the learning process which is tailored to the needs of the students with the intention of helping the students to achieve their learning objectives. 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. He further expatiated that these supports may include; resources, a compelling task, templates and guidance on the development of cognitive and social skills. He added that these supports are gradually removed as the students develop autonomous learning strategies, thus promoting their own cognitive, affective and psychomotive learning skills and knowledge. Juce and Braz (2008) also stated that in their research that Scaffolding represents the helpful interactions between a teacher and learners that enable the learners to learn something beyond their independent efforts. In this study therefore, the effect of scaffolding instructional strategy on the achievement of students in Biology was investigated.

Academic achievement can be defined as the knowledge acquired and skills developed in the school and is often determined by test scores assigned by a teacher (Akuezuiilo.,& Agu, 2006). Achievement is used to determine the rate at which programmed goals are ascertained. There are conflicting reports in literature concerning effect of teaching strategies on students' academic achievements. In this study therefore, influence of students' achievement in Biology concepts using scaffolding instructional strategy is being investigated.

Gender is the state of being male or female (Hornby, 2006). Closing the gap that exist between male and female in scientific endeavors have been the primary concern of many nations. Despite the fact that there are increases in the number of female scientists, still gender equality has not been realized. Azih and Nwosu (2011) stated that instructional scaffolding improved male and female students' achievement in financial accounting. They added that there was no significant difference in the mean achievement of both male and students taught financial accounting using instructional scaffolding strategy.

Omiko (2013) researched on the effects of instructional scaffolding on achievement of senior secondary students in chemistry proved scaffolding improved students achievement in chemistry. The researcher added that the male students performed better than the female students in chemistry. Hartman (2002) stated that the educational outcomes of scaffolding can be positive, when the teachers are well prepared for their lesson and aware of the theoretical base for the teaching techniques irrespective of gender. However, based on the aforementioned, the need therefore arises for a study of the effect of scaffolding instructional strategy on students' achievement in Biology and also to determine the effect of scaffolding on gender. This is the problem of the present study.

Aim and Objectives of the Study

The aim of the study is to determine the effect of instructional scaffolding on students' achievement in Biology. Specifically, the study will:

1. Determine the mean achievement scores of students taught Biology concepts using scaffolding instructional strategy and those taught using the conventional method.
2. Find out the mean achievement scores of male and female students taught Biology concepts using scaffolding instructional strategy and those taught using the conventional method.

Research Questions

The following research questions guided the study:

1. What are the mean achievement scores of students taught Biology concepts using scaffolding instructional strategy and those taught using the conventional method?
2. What are the mean achievement scores of male and female students taught Biology concepts using scaffolding instructional strategy and those taught using the conventional method?

Hypotheses

The following null hypotheses which were tested at an alpha level of 0.05 guided the study:

1. There is no significant difference between the mean achievement scores of students taught Biology concepts using scaffolding instructional strategy and those taught using the conventional method.
2. There is no significant difference between the mean achievement scores of male and female students taught Biology concepts using scaffolding instructional strategy and those taught using the conventional method.

Method

The research design was Quasi experimental research design. Intact classes were used for both the experimental and control group. The study population comprises of all SS11 students studying Biology in secondary schools in Awka Education Zone of Anambra State. The sample of the study is made up of 120 SS2 Biology students in the selected schools within the zone.

Purposive random sampling was used to select four Local Government Areas that have single sex schools out of the five Local Government areas in Awka Education Zone because schools in the other Local Government are coeducational. Simple Random Sampling Technique was used to select one secondary school from each of the four Local Government Areas. The four secondary schools selected were two boys' schools and two girls' schools which were grouped into two groups. One Boys' School and one Girls' School were designated experimental group and the other two schools as control group.

The only instrument used for collecting data was a Biology Achievement Test (BAT) which is extracted from WAEC and NECO passed questions. The Biology concepts in the test were Skeleton Forms and Components, Types of Skeleton, Bones of Axial and Appendicular Skeleton. The topic "Skeleton" always appear in external examinations especially the sub - topic "axial and appendicular skeleton" which consist of vertebral bones and most students find it difficult to answer the questions correctly. The instrument BAT consisted of 50 items which comprises of 15 questions from forms and components, 10 questions from types of skeleton and 25 questions from bones of axial and appendicular skeleton. The items of the instrument were mixture of open - ended questions and multiple Objective Questions. The instrument was validated by two lecturers in the Department of Measurement and Evaluation and two lecturers in Science Education Department, Nnamdi Azikiwe University, Awka. Test - retest reliability method was used. Thirty (30) biology students in Nnewi Education Zone secondary schools that also have single sex schools were tested on the items (BAT). Their scores were used to calculate the reliability co - efficient using Person Product Moment correlation which gave a reliability test of 0.84.

Results

The scores obtained were analyzed using mean and standard deviations for the research questions. The hypotheses were tested at 0.05 level of significance using t-test.

Table 1. Mean Scores and Standard Deviation of Students in the Experimental and Control Groups.

Subject	Pretest			Posttest		
	N	\bar{X}	SD	\bar{X}	SD	Gain
Experimental group	68	15.7	5.68	54.8	14.18	39.1
Control group	51	15.2	5.53	42.8	11.55	27.6

From Table 1, the mean score of students in the experimental group is 54.8, while students in the control group have a mean score of 42.8. This indicates that experimental group has a higher mean score than the control group.

Table 2. Mean Scores and Standard Deviation of Male and Female Students in the Experimental and Control Groups.

Subject	Pretest			Posttest		
	N	\bar{X}	SD	\bar{X}	SD	Gain
Experimental group						
Male	28	17.0	5.890	56.1	15.84	39.1
Female	40	15.6	5.7	55.0	12.55	39.4
Control group						
Male	20	14.2	5.63	41.0	10.54	26.8
Female	32	15.4	5.41	36.7	9.15	21.3

Table 2 shows that the mean score of male and female students in the experimental group are 56.1 and 55.0 respectively. The mean scores of male and female students in the Control group are 41.0 and 36.7. This implies that the experimental group has higher mean scores than the control group.

Table 3. t - Test Analysis on Post Test Mean Scores of Students in Experimental and Control Groups.

Subject	Pretest			Posttest		
	N	\bar{X}	SD	\bar{X}	SD	Gain
Experimental group	68	54.8	14.18	118	3.65	1.98
Control group	52	42.8	11.55			

Table 3 indicates that t- critical value at .05 level is 1.96 while the t - calculated is 3.65. Based on the result, the t - calculated is greater than the t - critical which means that there is a significant difference in the mean scores of students taught biology concepts using scaffolding approach and those taught using the conventional method.

Table 4. t - Test Analysis on Posttest Mean Scores of Male and Female Students in both Experimental and Control Groups.

Subject	Pretest			Posttest		
	N	\bar{X}	SD	\bar{X}	SD	Gain
Experimental group						
Male	28	56.1	15.84	66	0.34	1.96
Female	40	55.0	12.55			
Control group						
Male	20	41.0	10.54	50	3.25	1.96
Female	32	15.4	5.41	36.7	9.15	21.3

Table 4 shows that t- critical value at .05 levels is 1.96 while the t -calculated are 0.34 and 3.25 respectively in the experimental and control groups. Since the t - calculated of 0.34 is less than the t - critical of 1.96, the null hypothesis that there is no significant difference in the mean scores of male and female students taught biology concepts using scaffolding instructional strategy is accepted and rejected among male and female students taught using conventional method.

Discussion

The findings reveal that scaffolding instructional strategy promotes achievement of students in biology. The mean scores of students taught biology concept using scaffolding instructional strategy was higher than those taught using the conventional method. This is because scaffolding instructional strategy involved students 'active participation in the class. Hartman (2002) had indicated that the essential factor in scaffolding is the active participation of the learner during the teaching and learning processes. This finding is in agreement with the findings of Aida. (2006) who found out that scaffolding instructional strategy help students to understand English Language better. Margaret (2005) and Omiko (2013) in their studies ascertained that scaffolding is the assistance a teacher gives to the students in a learning situation to enhance learning. They added that instructional scaffolding is a learning process designed to promote a deeper level of learning.

The result of this present study also shows that there is no significant difference in the mean scores of male and female students taught biology concepts using scaffolding instructional strategy. The finding is in agreement with the findings of Omiko (2013) which stated that instructional scaffolding improved the achievement of secondary school

male and female students in secondary school chemistry and the present finding is also in agreement with the finding of Azih and Nwosu (2011) which stated that instructional scaffolding improved male and female students' achievement in financial accounting. Azih et al (2011) added that there was no significant difference in the mean achievement scores of both male and students taught financial accounting using instructional scaffolding strategy which is also in line with the present study. This means that instructional scaffolding can promote the achievement of students in Biology irrespective of gender.

Conclusion

This study shows that scaffolding instructional strategy enhanced the performance of students in biology irrespective of gender. Therefore, it is very necessary for Biology teachers to adopt scaffolding instructional strategy as an innovative teaching strategy, to promote learning and understanding of biology concepts in secondary schools. Secondary school science teachers should always scaffold their lessons to improve students' learning in science subjects.

Recommendations

The following recommendations were made based on the findings:

1. Biology teachers should adopt scaffolding instructional strategy as an effective teaching strategy for teaching and learning of biology.
2. Teachers training colleges and faculties of education in Nigerian Universities should incorporate scaffolding instructional strategy into their teacher education programmes.
3. Curriculum planners should develop scaffolding instructional strategy as an innovative instructional strategy for teaching biology concepts in secondary schools in Nigeria.
4. Workshops and seminars should be organized for biology teachers on how to scaffold their lessons for effective teaching and learning.

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