EFFECT OF SCAFFOLDING INSTRUCTIONAL TECHNIQUES (SIT) ON ACADEMIC ACHIEVEMENT AMONG JUNIOR SECONDARY SCHOOL MATHEMATICS STUDENTS IN OBOLLO-AFOR EDUCATION ZONE OF ENUGU STATE NIGERIA

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Abstract
The study investigated the effect of Scaffolding Instructional Techniques (SIT) on academic achievement among junior secondary school (JSS) mathematics students in Obollo-Afor Education Zone of Enugu State. The study was guided by two research questions and two null hypotheses. The design of the study was quasi-experimental research design; specifically non-equivalent control group. The population of the study comprised of 7,842 JSS 1 students in the 48 public secondary schools in Obollo-Afor Education Zone of Enugu state. The sample size of the study was 178 JSS 1 students from four (4) sampled schools drawn using proportionate stratified sampling technique. Mathematics Achievement Test (MAT) was the instrument used for the study. The instrument was validated by three experts in Department of Science Education (one from measurement and evaluation unit and two from mathematics education unit), University of Nigeria Nsukka. The instrument was trial tested on a sample of 20 JSS 1 students from the same zone outside the sampled schools and the reliability index was 0.79 using Kuder Richardson 20 formula. The data collected analyzed Mean and standard deviation to answer the research questions and Analysis of Covariance (ANCOVA) to test the null hypotheses at 0.05 level of significant. The results of the study revealed that the students taught mathematics using Scaffolding Instructional Techniques (SIT) achieved higher than the group taught without Scaffolding Instructional Techniques (SIT). There was no significant difference in the mean achievement score of male and female students in mathematics as result of Scaffolding Instructional Techniques (SIT). Based on the findings, it was recommended that mathematics teachers should use Scaffolding Instructional Techniques (SIT) while teaching the subject. Moreover, seminars and workshops should be organized by government for mathematics teachers on this technique for its proper application in mathematics classrooms.

***Keywords**: Scaffolding, Achievement, Instructional Techniques.*

Introduction

Mathematics is the science of structure, order and relation that is evolved from elemental practices of counting, measuring and describing the shapes of objects. It is a mental activity which consists of carrying out one after the other, the mental constructions which are inductive and effective (Ukwueze, 2017). Mathematics is seen everywhere, in everything we do. It is the starting point for everything in our daily lives. Umaru, Onuigbo & Eze (2013) asserted that mathematics is the key to success in the study of science and other related discipline. Mathematics is an essential ingredient in manufacturing industries and essential tool in economic activities. This is to say that the applications of mathematics to problem areas depend on the understanding of the concepts and the principles of mathematics by the problem solver

(Ukwueze, 2017). Ayogu, Okoro & Omosowon (2019) revealed that students' achievement in mathematics as a subject has been consistently (below average) especially in external examinations. Poor achievement in mathematics in Nigeria secondary schools has assumed an alarming proportion and attracts the attention of researchers in the field (Ukwueze, 2017).

In the words of Uka, Iji and Ekwueme (2012), students achievement in mathematics in Nigeria is still in a deplorable state at all levels of Nigeria educational systems. This is because most Nigeria students are unable to retain the mathematical concepts learnt to produce them when needed. According to Ojimba (2012), achievement in mathematics has been generally poor despite the fact that it is one of the key subjects expected to turn Nigeria into an industrialized country by the year 2020. Moreover, the West Africa Examination Council's (WAEC) Chief Examiners reports (2008, 2013, 2014, 2016 & 2018) and National Examination Council's (NECO) Chief Examiners report, (2009, 2014, 2015 & 2017) have also stated that the overall achievement of candidates in mathematics was generally poor and below average. The reports showed that in 2008, 1,373009 candidates enrolled and only 356,981 (25.99%) had credit pass. In 2013 the number of mathematics candidates enrolled was 1,543,683 and only 555,726 (36%) passed with credit. In 2014 1,692,435 candidates enrolled in Nigeria and 529,732 (31.3%) had a credit pass. In 2016 1,544,234 candidates enrolled 597,310 (38.68%) had a credit pass. According to WAEC Chief Examiners reports (2008, 2013, 2014 & 2016), the poor achievement of the students among others was attributed to use of poor instructional technique in the classroom.

The persistent students' poor achievement in mathematics has also been attributed to students' phobia for mathematics (Umaru, Onuigbo & Eze, 2013). Such phobia is characterized by persistent, abnormal or irrational fear of taking mathematics tests, fear of failure and lack of self confidence (Umaru, Onuigbo & Eze, 2013). Galadima (2002) posited that instructional technique employed by the teachers which is teacher centered is one of the major causes of poor achievement among secondary school students in mathematics. Hence, there is need to investigate other teaching strategies to see if it could boost students' achievement in mathematics. One of such teaching strategies whose efficacy is needed to be determined in students' achievement in mathematics is scaffolding instructional techniques (SIT).

Scaffolding is a teaching strategy that helps students reach higher levels of comprehension and skill acquisition that they would not be able to achieve without assistance. Andrianes (2013) defined scaffolding as a teaching method that enables student to solve a problem, carry out a task or achieve a goal through a gradual shedding of outside assistance. In education, scaffolding refers to a variety of instructional techniques used to move a student progressively toward stronger understanding and, ultimately, greater independence in the learning process. Scaffolding instructional techniques is a support system that helps children to achieve success in tasks that would be too difficult for them to achieve by themselves (Wood, Bruner & Ross, 1976). Scaffolding is derived from mother-child observations and has been applied to many other contexts, such as computer education (Azevedo & Hadwin, 2005). The term is used to describe certain kinds of support which learners receive in their interaction with parents, teachers, and other 'mentors' as they move to new skills, concepts or levels of understanding. It is a term which helps to portray the temporary, but essential nature of the mentors' assistance as the learner advances in knowledge and understanding (Olubunmi & Ese, 2018). Olubunmi & Ese (2018) have tried the use of scaffolding in Chemistry and revealed that it improved students' achievement in Chemistry. Therefore, this study tried to determine if students' achievement in

Mathematics could be improved using Scaffolding Instructional Techniques (SIT). Students' poor achievement in mathematics has also been attributed to gender

Gender has been a controversial issue in many educational studies. This is because some research findings reports that there is no significant gender differences in mathematics abilities and achievement (Geary, 2000; Ukwueze, 2017), some others like Alio & Harbor-Peters (2000), Imoko & Agwagah (2006), Okigbo (2010) reported that boys achieved better than girls in mathematics generally, while Anibueze (2017) reported that girls achieved better than boys in mathematics. Voyer (2014) reported that girls had a higher school graduation rate, 84 percent than boys who had a rate of 77 percent irrespective of course area. Since, there is no general consensus made yet on the issue of gender differences in mathematics achievement. Therefore, the researchers tried to investigate if the use of Scaffolding instructional techniques in teaching of mathematics could bridge the gap between male and female students' achievement in mathematics. Therefore, the study tried to find out if the teaching of mathematics with SIT could improve students' achievement in mathematics with consideration of gender.

Statement of the Problem

Students' achievements over the years have been reported to be poor as revealed by WAEC and NECO Chief Examiner's Report. The poor achievement has been blamed mostly on poor instructional techniques on the part of some teachers. It is on this premise that the researchers decided to see if Scaffolding instructional techniques could help in improving JSS one students' achievement in mathematics. Sequel to this, it was noticed that there was a gap in the use of instructional scaffolding techniques in the teaching and learning of mathematics in Obollo-Afor Education Zone of Enugu State. This study therefore investigated among junior secondary school one students' the effect of scaffolding instructional techniques on students' achievement in mathematics. It also determined the influence of gender on students' achievement in mathematics using SIT since, there is no general consensus made yet on the issue of gender differences in mathematics achievement.

Purpose of the Study

The general purpose of this study was to determine the effect of scaffolding instructional technique on students' achievement in mathematics among JSS one students in Obollo-Afor Education zone of Enugu State. Specifically, the study sought to determine:

1. the effect of scaffolding instructional techniques on students' achievement in mathematics;
2. the influence of gender on students' achievement in mathematics.

Research Questions

The study was guided by the following research questions:

(1) What are the mean achievement scores of students taught mathematics using scaffolding instructional technique and those taught mathematics without scaffolding instructional technique?

(2) What are the mean achievement scores of male and female students in mathematics?

Hypotheses

The following null hypotheses guided the study and were tested at 0.05, level of significance.

Ho1: There is no significant difference in the mean achievement scores of students taught using scaffolding instructional technique in mathematics and those taught without scaffolding instructional technique.
Ho2: There is no significant difference in the mean achievement scores of male and female students in mathematics.

Methods

The study adopted a quasi-experimental research design, specifically non-equivalent control group. The population of the study comprised of all the (7842) junior secondary school one (JSS1) students found in Obollo-Afor Education Zone of Enugu State. The study sampled one hundred and seventy eight (178), eighty nine (89) males and eighty nine (89) JSS1 students found in four (4) intact classes from four (4) different schools. The sample was done using stratified proportionate random sampling technique. Two of the intact classes made of Eighty Nine (89) students were assigned to experimental group (teaching with scaffolding instructional technique) and two other classes of Eighty Nine (89) students also were assigned to control group (teaching without scaffolding instructional technique). Data on mathematics achievement were obtained using Mathematics Achievement Test (MAT). The MAT consisted of 30 items with four multiple choice mathematics questions in the area of Equivalent Fractions, Ratios, Percentage, Proportion, Sharing, LCM, HCF, Prime factors, Number base. The MAT measured students' ability using Table of specification in mathematics. The MAT and lesson plan constructed were face and content validated by three experts in the field of mathematics education and measurement and evaluation units of science education department all from University of Nigeria Nsukka. These validates' corrections were incorporated into the final draft of test items. Their observations include inappropriate questions, unclear statements, poor, framing of the test items. The reliability of MAT was established using Kuder Richardson formula 20 (K-R 20) which was found to be 0.79. The instrument for collection of relevant data was administered to mathematics students in the sampled schools before the commencement of the experiment to ensure homogeneity among the students which serves as the pretest score. After the pretest, the actual experiment started with the training of the mathematics teachers who were used for the study. The experiment lasted for three weeks and the students were post-tested after the experiment. Means and Standard deviations were used to provide answer to the research questions while the Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significant.

Results

Research Question One: What are the mean achievement scores of students taught mathematics using Scaffolding instructional techniques and those taught without scaffolding instructional technique?

Table 1: **Mean achievement scores and standard deviation of students taught mathematics using SIT and those taught without SIT**

Group		Pre-test		Post-test		
	N	Mean	S D	Mean	SD	Mean Gain
Experimental	89	36.54	8.79	72.64	6.27	36.10
Control	89	38.29	9.34	55.84	10.25	17.55

Table 1 showed the mean achievement scores of students that were taught mathematics using Scaffolding instructional techniques (SIT) and those taught without SIT. From the table, mean achievement scores of 36.54 and 38.29 with the standard deviations of 8.79 and 9.34 were recorded for both experimental and control groups respectively at the pre-test. However, at the post-test, mean achievement scores of 72.64 and 55.84 with standard deviations of 6.27 and 10.25 were recorded for both experimental and control groups respectively. Moreover, mean gain scores of 36.10 and 17.55 were recorded for both experimental and control groups which implied that the students that were exposed to SIT (Experimental group) achieved higher than their counterparts in the control group.

Hypothesis One: There is no significant difference in the mean achievement scores of students taught mathematics using Scaffolding instructional techniques SIT and those taught without SIT.

Table 2: Analysis of Covariance of the effect of SIT on students' achievement in mathematics

Source	**TypeIII Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	22506.980[a]	4	3126.745	29.710	.001	.181
Intercept	71557.174	1	71557.174	576.17	.000	.881
Pre-test	3986.056	1	3986.056	39.941	.000	.016
Group	14058.612	1	14058.612	157.95	.000	.562
Gender	6471.631	1	6471.631	76.053	.189	.342
Group* Gender	6 8.192	1	68.192	74.207	.185	.521
Error	764.716	172	41.745			
Total	563672.000	178				
Corrected Total	65615.143	176				

a. R Squared = .198 (Adjusted R Squared = .178)

The analysis of data in table 2 shows that the probability associated with the calculated value of F (157.95; df=1,172) for the effect of SIT on students' achievement in mathematics is .000. Since the probability value of .000 is less than .05 level of significant (P<.05), the null hypothesis was rejected. Thus, there was significant difference in the mean achievement scores of students taught mathematics using SIT and those without SIT in favour of the experimental group.

Research Question Two: What are the mean achievement scores of male and female students in mathematics?

Table 3: Mean achievement scores and standard deviation of male and female students in mathematics

Group	Pre-test			Post-test		
	N	Mean	S D	Mean	SD	Mean Gain
Male	43	37.62	7.50	73.33	3.42	35.71
Female	46	35.51	6.43	71.96	4.13	36.45

Table 3 revealed the achievement mean scores of male and female students in mathematics. From the table, male students obtained a mean achievement score of 37.62 with standard deviation of 7.50 and female students obtained a mean achievement score of 35.51 with standard deviation of 6.43 were recorded at the pre-test. However, at the post-test, male students obtained a mean achievement scores of 73.33 with the standard deviation of 3.42 while their female counterparts obtained a mean achievement scores of 71.96 with the standard deviation of 4.13. Moreover, there were mean gain scores of 35.71 and 36.45 for the male and female students respectively. This indicates that male students achieved higher than their female counterparts.

Hypothesis Two: There is no significant difference in the mean achievement scores of male and female students in mathematics.

Table 2 showed that the probability associated with the calculated value of F (76.053; df= 1,172) for the influence of gender on students' achievement in number bases is 0.189. Since the probability value of .089 is greater than 0.05 level of significant (P <.05), the null hypothesis was not rejected. Thus gender has no significant influence on the achievement of students in number bases.

Discussion

The findings of the study in Table 1 shows that the students exposed to Scaffolding instructional techniques (SIT) had higher mean achievement score compared with students that were not exposed to SIT. The achievement difference was further strengthened by the analysis of covariance in the table 2 which showed significant difference in the mean achievement scores of students taught mathematics using Scaffolding instructional techniques (SIT) and those taught without SIT. This implied that SIT significantly enhanced students' achievement in mathematics compared with those taught without SIT. This result is in agreement with the earlier research findings which were conducted by Odo and Ugwuada (2014) and Ukwueze (2017) who observed that the use of innovative techniques has positive effect on students' academic achievement in mathematics. The result of this study also revealed that there was no significant gender influence of Scaffolding instructional techniques (SIT) on male and female students' achievement in mathematics. The finding of this study showed that gender had no significant influence on the achievement of students in mathematics. The finding is in agreement with the findings of Okeke (2011) and Ukwueze (2017) on gender and science achievement. However, it is at variance with the study conducted by Ayotola and Adedeji (2009), and Amatobi (2013) with respect to gender and mathematics achievement. The finding could be attributed to the fact that both sexes enjoyed the technique equally.

Conclusion

The study sought to find out the effect of scaffolding instructional techniques on students' achievement among JSS one mathematics students in Obollo-Afor Education zone of Enugu

State. On the basis of the findings of this study showed that, the group that was taught mathematics using Scaffolding instructional techniques (SIT) performed higher than those taught without Scaffolding instructional techniques (SIT). Also, gender had no significant influence on students' achievement in mathematics.

Recommendations

The following recommendations are made based on the findings of this study.

1. Since, the group that was taught mathematics using Scaffolding instructional techniques (SIT) performed higher than those taught without Scaffolding instructional techniques (SIT). Mathematics teachers should employ the Scaffolding instructional techniques (SIT) for the teaching and learning of mathematics. This will help to enhance achievements of students in mathematics.
2. Scaffolding instructional technique is gender friendly, as such; teachers should use SIT freely to teach both male and female students.
3. Seminars and workshops should be organized by government so as to train mathematics teachers on the use of Scaffolding instructional techniques (SIT) in mathematics classrooms.

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