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Effect of Scaffolding Instructional Strategy On Senior Secondary School Students' Performance in Mathematics in Ekiti State

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Abstract:

The study examined the effect of scaffolding instructional strategy on senior secondary school students' performance in Mathematics in Ekiti State. Specifically, the study examined the difference in the pre-test mean scores of students exposed to scaffolding instructional and conventional strategies; and the difference in the post-test mean scores of students exposed to scaffolding instructional and conventional strategies. The study adopted pre-test, post-test two group quasi-experimental design (an experimental and a control group). The population of the study consisted of all S.S.S.2 students in public secondary schools in Ekiti state. The sample comprised of 159 students (class intact size) of four public secondary schools in Ekiti State and was selected through multi-stage sampling procedure across the three senatorial districts of the state. The instrument used for this study was a self-constructed Mathematics Performance Test (MPT). The instrument was validated by face and content validity method. Cronbach's Alpha statistics formula was used to establish the reliability coefficient which yielded a coefficient of 0.807 for MPT. The hypotheses were tested using t-test statistics at 0.05 level of significance. The findings of the study revealed that there was no significant difference in the pre-test mean scores of students exposed to scaffolding instructional and conventional strategies but there was significant difference in the post-test mean scores of students exposed to

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scaffolding instructional and conventional strategies. It was recommended among others that teachers teaching Mathematics should incorporate scaffolding instructional strategy to teach in the classroom so as to improve students' performance in Mathematics.

Keywords: Scaffolding, Senior Secondary School Students, Performance, Mathematics,

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Introduction

Mathematics is the major driver to real life advancement; productivity and development of both a person and the nation at large; and even the employment opportunities of students are mostly reliant on their level of mathematical understanding (Awofala, 2012). According to Popoola and Akinwande (2013), mathematics is an important tool required to be able to function successfully in this present technological age. The two researchers further submitted that the study of mathematics is very essential in virtually all aspects of human activities and no human endeavour can detach itself from mathematical inclination. The role play by mathematics in the day to day activities cannot be over-emphasized because mathematics is needed by all.

Oluwayemi (2013), Popoola and Olofin, (2020), Olofin and Kolawole (2020) observed that mathematics is an important instrument for man power expansion of any nation. This nature of mathematics brings with it the assumption that the understanding of the subject is essential for all members of the society. Mathematics know-how is a critical element of post-secondary education and livelihood option available for young people. Despite the importance of mathematics to national development, students' performance in the subject in West African Examinations Council (WAEC) has remained steadily poor (Olofin & Falebita, 2020). Chief Examiners' Reports (WAEC 2016 – 2020) observed that mathematics was the least passed subject in the above-mentioned examination years.

It has been observed that among the component to boost students' performance in mathematics are the methods through which teaching is conveyed to the learners. This goes a long way to show the importance of instructional strategies in a teaching and a learning situation. There are several methods of instructional strategies available to a teacher in the teaching-learning process. The teacher is expected to utilize one or two of these strategies to achieve instructional objectives.

Conventional instructional strategy is a method that places no importance on learners creating their own ideas and does not stress stepwise solution process. The present effort of mathematics teaching is gradually shifting from teacher-centered to learner-centered. This change echoes a move from information transmission view of education to knowledge construction, which is a constructivist theory of learning based on the idea that students must build their own knowledge and develop meaning from their experiences. Students proffer solution to problems and it is via this method of solving problem that students make findings through mathematics or apply ideas themselves. Also, the teacher can enable this process by teaching in a way that makes information significant and applicable to students (Falebita & Olofin, 2020).

Scaffolding instruction as an instructional strategy originated from Lev. Vygotsky's social cultural theory and his concept of the zone of proximal development (ZPD). The activities provided in scaffolding instruction are just away from the level of what the student can do alone. Scaffolding instructions are not permanent, as the students' abilities increase the scaffolding provided by the more knowledgeable other is progressively removed. Finally, the learner is able to finish the task or master the concepts independently. Therefore, the goal of the educator when using the scaffolding instructional strategy is for the learner to become an independent and self-regulating student and problem solver.

Instructional scaffolding offers sufficient assistance to promote learning when concepts and skills are being first introduced to learners. This assistance may include resource, compelling task, patterns and guides, and/or guidance on the improvement of cognitive and social skills. Instructional scaffolding could be employed through modelling a task, giving advice, and/or providing coaching. These supports are gradually withdrawn as students develop autonomous learning strategies, thus promoting their own cognitive, affective and psychomotor learning skills and knowledge. Teachers help the learners master a task or a model by providing assistance. The support can take several forms such as outlines, recommended documents, storyboards, or key questions think-aloud modelling and direct instruction. Scaffolding can occur at the individual, small group, or large group level.

Janneke, Monique and Jos (2010) construed scaffolding as assistance given by a teacher to a learner when doing a task that the student might otherwise not be able to achieve. There are three essential features of scaffolding that facilitate learning. The first feature has to do with the interaction between the student and the expert. This interaction should be co-operative for it to be effective. The second, learning should take place in the learner's zone of proximal development (ZPD). To do that, the expert needs to be aware of the learner's present level of understanding and then work to a certain extent beyond that level.

Manko (2016) expressed that experts play a vital role in scaffolding by ensuring careful and productive engagement with the task, tools and peers. Students are well guided in the learning process, pushing them to reflect deeply and the kinds of enquiries that they need to be asking them; forming a cognitive apprenticeship. Scaffolding is not restricted to cognitive domain only but it also relates to affective and emotive factors. During the task, the teacher might need to cope and control for frustration, fear and loss of interest that could be shown by the learners. He further stated that the teacher becomes a supportive tool for the learner in the zone of proximal development.

Ugwuda (2008) conducted a quasi-experimental study on the effect of scaffolding on students' achievement and interest in learning simultaneous linear equation. Multi-stage random sampling and simple random sampling techniques were used to select Three hundred and twenty (320) JSS II students, drawn from four (4) schools in Ogbaru local government area of Onithsa Education Zone in Anambra State. Two instruments were used for data collection and two lesson plans were drafted one for the scaffolding strategy and the other one for the conventional strategy. Results of the study showed that students exposed to the scaffolding technique attained more and showed greater interest in learning content than those who were taught using the conventional method.

Aditi (2017) investigated the effect of Instructional Scaffolding on academic achievement and attitude towards science of high school students. The study was a true experimental research and was conducted on 100 high school students (50 male and 50 female) studying in two reputed C.B.S.E. schools located in district Bathinda. One school was made control group while the other was considered as experimental group. Control group was taught by using conventional method while the experimental group was taught by using various scaffolding strategies for two weeks. The results clearly showed a significance difference in the mean scores in students' academic achievement of the two groups i.e.

students taught by scaffolding strategies performed much better than those taught by traditional methods.

The purpose of the study was to examine the effect of scaffolding instructional strategy on senior secondary school students' performance in Mathematics in Ekiti State. Specifically, the study examined:

i. the difference in the pre-test mean scores of students exposed to scaffolding instructional and conventional strategies; and
ii. the difference in the post-test mean scores of students exposed to scaffolding instructional and conventional strategies.

Research Hypotheses

The following null hypotheses were postulated for this study.

1. There is no significant difference in the pre-test mean scores of students exposed to scaffolding instructional and conventional strategies.
2. There is no significant difference in the post-test mean scores of students exposed to scaffolding instructional and conventional strategies.

Methodology

The study adopted pre-test, post-test two group quasi-experimental design (an experimental and a control group). The population of the study consisted of all S.S.S.2 students in public secondary schools in Ekiti state. The sample comprised of 159 students (class intact size) of four public secondary schools in Ekiti State and was selected through multi-stage sampling procedure across the three senatorial districts of the state.

The first stage involved the selection of one Local Government Area from each of the three senatorial districts of Ekiti State to make a total of three (3) Local Government Areas (LGA) using simple random sampling technique. The second stage involved the selection of four public secondary schools from the three selected LGAs using stratified random sampling technique putting into consideration that at least one secondary school was selected from a LGA. In stage 3, S.S.S 2 class intact was selected and used from each of the schools.

The instrument used for this study was a self-constructed Mathematics Performance Test (MPT). The instrument was made up of two sections namely section A and B. Section A sought for the demographic data of the students while section B was made up of 40 items. The instrument was used for pre-test and post-test. The content of MPT used for pre-test was reshuffled for the post-test in order to prevent carry-over effect. The instrument was validated by two senior lecturers who are experts in Mathematics Education and Test and Measurement. The instrument was also validated by two experienced mathematics teachers who are WAEC/NECO examiners. Cronbach's Alpha statistics formula was used to establish the reliability coefficient which yielded a coefficient of 0.807 for MPT.

Scaffolding instructional strategy guide was developed by the researcher, explaining into detail the stages involved, activities and roles of both teachers and the learners in the group. Scaffolding instructional strategy consists of six (6) stages. Stage 1: Introduction, Stage 2: Discussion, Stage 3; Cooperative learning: Stage 4: Number head, Stage 5: Apprenticeship, Stage 6: Evaluation. Scaffolding Instructional Package consisted of eight (8) lessons that were used for the teaching of experimental group. It was prepared in agreement with the steps involved in scaffolding instructional strategy. Its features included the lesson objectives, duration, activities of the teacher and the students at each step in the lesson. The content taught and learnt by the teacher and students respectively were stated in the instructional package.

The researchers personally visited the sampled schools where the study was carried out to seek the permission of the principals. The consents and co-operations of the head of the department (HOD), mathematics teachers and those of the students involved in the study was sought before carrying out the study. The class mathematics teachers served as research assistants. The procedure was divided into three sections: the pre-treatment stage, treatment stage and post- treatment stage. Two days training on the use and application of scaffolding instructional strategy was organized for the research assistants from the sampled schools.

The Mathematics Performance Test (MPT) was administered on experimental and control groups as pre-test in order to ascertain the entry point of each group. The reshuffled Mathematics Performance Test in Mathematics (MPT) which served as post-test was administered on the two groups after teaching the groups for 4 weeks. The scores in pre-test and post-test in the two groups were collated and subjected to appropriate statistical analysis. The data collected were analysed using inferential statistics of t-test statistics at 0.05 level of significance.

Results

Hypothesis 1: There is no significant difference in the pre-test mean scores of students exposed to scaffolding instructional and conventional strategies.

Table 1: t-test analysis for pre – test mean scores of students exposed to scaffolding instructional and conventional strategies

Variations	N	Mean	SD	df	t_{cal}	P (Sig)	Rem.
Scaffolding	83	9.88	1.31	157	1.016	0.218	Not Significant
Conventional	76	10.13	1.74				

P>0.05

Table1 shows that the t-cal value of 1.016 is not significant because the P value (0.218) > 0.05 level of significance. Therefore, the null hypothesis is not rejected. Hence, there was no significant difference in the pre-test mean scores of students exposed to scaffolding instructional and conventional strategies. This implies that the students in both groups were homogeneous at the commencement of the study.

Hypothesis 2: There is no significant difference in the post-test mean scores of students exposed to scaffolding instructional and conventional strategies.

Table 2: t-test analysis for post – test mean scores of students exposed to scaffolding instructional and conventional strategies

Variations	N	Mean	SD	df	t_{cal}	P (Sig)	Rem.
Scaffolding	83	33.67	1.92	157	33.691	0.000*	Significant
Conventional	76	19.81	3.08				

*P<0.05

Table 2 shows that the t-cal value of 33.691 is significant because the P value (0.000) <0.05 at 0.05 level of significance. This implies that null hypothesis is rejected. Hence, there was significant difference in the post-test mean scores of students exposed to scaffolding instructional and conventional strategies. The mean score revealed a large difference of 14.15 in favour of students exposed to scaffolding instructional strategy.

Discussion

The study revealed no significant difference in the pre-test mean scores of students exposed to scaffolding instructional and conventional strategies. This implies that the groups were homogeneous at the commencement of this study.

The study also revealed a significant difference in the post-test mean scores of students exposed to scaffolding instructional and conventional strategies. The significant difference is in favour of students exposed to scaffolding instructional strategy. It implies that when scaffolding instructional strategy was used by teachers to teach Mathematics, it is effective than conventional method. The result agrees with Ugwuda (2008) and Aditi (2017) who concluded that students exposed to scaffolding instructional strategy performed better than students exposed to conventional methods in Mathematics. The implication of this finding is that students in the scaffolding instructional group were able to increase their understanding of Mathematics by scoring higher in Mathematics than the students exposed to conventional method.

Findings of Study

1. There was no significant difference in the pre-test mean scores of students exposed to scaffolding instructional and conventional strategies.
2. There was significant difference in the post-test mean scores of students exposed to scaffolding instructional and conventional strategies.

Conclusion

It can be concluded from the findings that the use of scaffolding instructional strategy is very effective in ensuring Senior Secondary School students' academic performance in Mathematics as it was effective in the teaching and learning of Mathematics than the conventional strategy.

Recommendations

Based on the findings of this study, it was recommended that:

1. Teachers teaching Mathematics should incorporate scaffolding instructional strategy to teach in the classroom so as to improve students' performance in Mathematics.
2. Teachers of Mathematics should be given passable orientation through mathematical workshops to keep abreast their knowledge in the application of scaffolding instructional strategy.

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