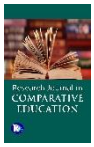
An investigation into the effects of demonstration instruction strategy (DIS) on senior secondary school students' Mathematics achievement in Afijio Local Government, Oyo State, Nigeria



Review article

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Abstract

The study investigated the effects of demonstration instruction strategy on senior secondary school students Mathematics achievement. The study employed a quasi experimental design, specifically the pretest-posttest non equivalent group design. Population of the study consisted of students in Senior Secondary Schools Students in Afijio Local Government Area of Oyo State. One hundred (100) students which comprised of male and female were selected from the Senior Secondary School one students. The instruments used were "Questionnaire on Effects of Demonstration Instructional Strategy on Students Academic Achievement in Mathematics (QEDISSAAM) and Mathematics Achievement Test (MAT). The instruments were validated by experts in the field of test and measurement. Three hypotheses were tested. Data were analyzed using ANOVA. The results revealed that students taught using Demonstration Instruction Strategy methods performed better than students taught using primitive material. It was revealed that male students did not perform better than their female counterparts in Mathematics. The study also revealed that rural students performed better than urban students in Mathematics. Based on the results, it was recommended among others that teaching of Mathematics in schools should be conducted in a manner that students will effectively learn and understand any mathematical concepts taught.

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Public Interest Statement

There are different methods of teaching or instructing, some have better improvements on the performance of students just as students of different locality comprehend differently. In an environment where the wrong strategy of teaching is used, the students' performance will be low. This study will really be of help to the educational system as it will reveal the effects of demonstration strategy on student's mathematical achievement and how it can ultimately and positively affects students understanding of Mathematics. The findings of this study would also provide grounds for some research-based decisions by individuals, teachers, government agencies, curriculum developers, authors and publishers, among others, on mathematics teaching and learning.

Introduction

In Nigeria, Mathematics Education has come a long way. Mathematics can be defined as the science of numbers and figures. As Agomuoh & Nzewi (2013) observes, Mathematics Education is an art of imparting and imbibing the mathematics discipline. Mathematics is also seen as a way of thinking, a way of organizing a sensitive or logical proof. It can be used to determine whether or not an idea is true of false. As a way of thinking it is used to solve all kinds of problems in life, sciences, government, industry and agriculture. According to Babajide (2010) mathematics has been acknowledged all over the world as the "mothers of all sciences". Mathematics has a universal language all over the world. The symbols and formulae are the same everywhere in the world. This subject is a symbol of unity. Mathematics stimulates a sense of thought in a person and promotes his decision making with minimal error. It assists people to look at things around them to enable them search for patterns among different entities as well as to make comparison and generalization, it also helps it to think straight and reason well. Mathematics is used in all aspects of human endeavour to such an extent that secondary mathematics must assume the role of helping fall students to see the relevance of mathematics to their lives rather than preparing only some selected groups of students to become mathematicians, scientists, engineers, physicists even politicians (Ahmed, 2010). It could be seen in their market days and counting systems. The coming of the missionaries introduced formal (or Western type) education to Nigeria. In this system of education, mathematics occupied a central position in the school curriculum (Babajide, 2010).

John (2010) observed that mathematics is the bedrock that provides the spring board for the growth of technology, mathematics in the gate and key to the sciences and economic. Williams (2004) in acknowledging the importance and contribution of mathematics to the modern culture of science and technology stated that “without mathematics there is no science, without science there is no modern technology and without modern technology there is no modern society. More so, mathematics is the precursor and the queen, of science and technology and the indispensable

single element in modern societal development". Mathematics education is therefore indispensable in nation building. Instructional strategies are techniques teachers use to help students become independent, strategic learners. These strategies become learning strategies when students independently select the appropriate ones and use them effectively to accomplish tasks or meet goals (Olumorin, 2004). There are several instructional strategies but this research is primarily on demonstration strategy (Emeke & Odetoyinbo, 2003).

Demonstration involves showing by reason, explaining or making clear by use of examples. Demonstration means "to clearly show". It is a teaching method that allows students to see the teacher actively engaged as a learner and a model rather than merely telling them what they need to know (Miriogu, 2012). The teacher solves a problem before the class and simultaneously explains what he/she is doing. She/he also asks relevant questions to maintain the interest and attention of students. The students are compelled to observe carefully and pay attention because they have to describe each and every step of solving the problem accurately (Nzeribe, 2012). Some of the importance of demonstration instructional strategy is according to Hall (2010) includes;

i. To stimulate students' interest in mathematics
ii. To change students attitude towards mathematics.
iii. To provide a change of pace.
iv. Saves time in solving mathematical problems.

Methodology

The research design adopted for this study was quasi-experimental design. The reason for this is that, no comparison of any kind is involved. This research covers all the secondary schools in Afijio Local Government Area, Oyo State. Population of the study comprised of all Senior Secondary School students in Afijio Local Government Area, Oyo State. Two (2) schools among the Senior Secondary Schools under study were selected. From this schools, Senior Secondary one (SS1) were purposively selected for this study. One school was selected from the urban region of the Local Government Area and one from the rural area. One hundred students comprised of male and female students were selected from the Senior Secondary School one students. The one hundred students was made up of (50) fifty male and 50 fifty female students. The one hundred students are divided into 2 groups of 50 each and in each groups consisted of 25 female and 25 male students. The instruments used for collection data for this research were Mathematics Achievement Test (MAT) and Questionnaire on Effects of Demonstration Instructional Strategy on Students Academic Achievement in Mathematics (QEDISSAAM). The Students Mathematics achievement test was drawn using WAEC and NECO format from the Mathematics concept that was taught. The Mathematics concept was algebra. The Mathematics achievement test was objectives with options A-D. Each correct answer attracted five (5) marks while the maximum score was 50 marks.

The instruments were given both face and content validity by experts in the field of Measurement and Evaluation at Department of Educational Psychology, Federal College of Education (Special), Oyo, Oyo State. The instruments were administered on selected students of Akinmorin Grammar School, Oyo which is not part of the schools under study to ascertain the reliability of the instrument. Croabach alpha method was used with reliability coefficient 0.84.

Procedure for data Collection, Analysis

S/N	Week	Activities	Procedure
1	Week 1	Pre-experimental activities and selection of schools as samples	The researchers select the schools to be used and seek due permission from the principals.
2	Week 2	Training of Research Assistants	Services of two (2) Research assistances were employed and they were adequately trained and orientated on the purpose of the study and what is expected of them.
3	Week 3-5	Pretest Administration	Students from one of the schools selected (control group) were taught using conventional method of teaching.
4	Week 6-8	Treatment and follow-up	The students from the second school (experimental group) were taught using demonstration instruction strategy called the treatment.
5	Week 9	Posttest Administration	Research instruments were administered to both group students.
Total	- 9 **weeks**		

Data collected was analyzed using Analyzed of Covariance (ANCOVA).

Results

The results were organized in accordance with the search hypotheses as follow:

$H0_1$: There is no statistically significant difference between the academic achievement of students who are taught Mathematics using demonstration instructional strategy and those taught with primitive method.

Table 1: Analyses of Covariance of students' achievement scores in demonstration instruction strategy

(I)Teaching Strategies variation	(I) Teaching strategies Sum of squares	Df	Mean difference (I-J) Square	Std	Sig	95% Confidence Lower Bound	Interval Upper Bound
Covariates model	1550.852	8	193.856	5.987	.000	4.43	**7.97**
Teaching strategies	4397.342	1	4397.342	135.811	.000	10.88	
Pretest	468.147	1	468.147	14.459	.000	-7.97	**-4.43**
Posttest	186.706	1	186.706	5.766	.018	4.59	**8.22**
Demonstration	213.85	1	213.851	6.605	.011	-8.22	**-4.59**
Error	4241.570	131	32.378			-6.40	
Total	62153.00	135					
Corrected Total	**5792.421**	**134**					

The Mean difference is statistically significant at 0.05 level

Data in table 1 showed that there is a statistically significant impact for mode of instruction on students achievement in Mathematics f (1, 134) =5.766, t tab.018. The null hypothesis therefore, was rejected indicating that there is statistically significant difference in the mean achievement score of students taught Mathematics using students' improvised instructional methods and those taught using primitive instructional methods. The mean achievement score for students' improvised instructional material was 24.76, while that for primitive material was 18.51. The difference was in favour of students' demonstration instructional methods. The student's instructional methods therefore, were superior to primitive material in Mathematics instruction.

$H0_2$: There is no statistically significant difference in the mean achievement scores of female and male students taught Mathematics using student's demonstration instructional methods and those taught using primitive instructional material.

Table 2: Analyses of Covariance of students achievement scores by sex.

(I)Teaching Strategies variation	(I) Gender Sum of squares	Df	Mean difference (I-J) Square	Std	Sig	95% Confidence Lower Bound	Interval Upper Bound
Covariates model	1550.852	4	193.856	5.987	.000	4.43	**7.97**
Male	4191.342	1	4191.342	135.811	.000	10.81	
Pretest	468.147	1	468.147	14.459	.000	-7.97	**-4.43**
Posttest	186.706	1	186.706	5.766	.018	4.59	**8.22**
Female	69.301	1	69.301	2.140	.146	-14.33	**-10.88**
Error	4241.570	131	32.378			-6.40	
Total	62153.00	135					
Corrected Total	**5792.421**	**134**					

The Mean difference is statistically significant at 0.05 level

The table 2 revealed no statistically significant mean effect of gender on students achievement in Mathematics f (1, 134) = 2.140, $f_{tab.}$= 146. The null hypothesis was therefore; not rejected indicating that there is no statistically significant difference in the mean achievement scores of male and female students in Mathematics.

$H0_3$: There is no statistically significant difference in the mean achievement scores of Rural and Urban students taught Mathematics using student's demonstration instructional methods and those taught using primitive instructional material.

Table 3: Analyses of Covariance of students achievement scores by Location

(I)Teaching Strategies variation	(I) Location Sum of squares	Df	Mean difference (I-J) Square	Std	Sig	95% Confidence Lower Bound	Interval Upper Bound
Covariates model	1550.852	4	193.856	5.987	.000	4.43	**7.97**
Urban	3397.342	1	3397.342	135.811	.000	10.88	
Pretest	468.147	1	468.147	14.459	.000	-7.97	**-4.43**

Posttest	186.706	1	186.706	5.766	.018	4.59	**8.22**
Rural	213.85	1	213.851	6.605	.011	-8.22	**-4.59**
Error	4241.570	131	32.378			-6.40	
Total	62153.00	135					
Corrected Total	**5792.421**	**134**					

The Mean difference is statistically significant at 0.05 level

There is no statistically significant difference in the mean achievement scores of urban and rural students taught Mathematics using student's demonstration instructional methods and those taught using primitive instructional material. Table3 also revealed statistically significant main impact of location on students achievement in Mathematics f (1, 134) = 6.605, $f_{tab.}$= 011. The null hypothesis was therefore; rejected indicating that there is statistically significant difference in the mean achievement scores of urban and rural students in Mathematics.

Discussion

The result in table 1showed that students taught using demonstration instructional methods performed better than students taught using primitive material. This support the assertion of Olumorin (2004) who reported that students taught using aid in the teaching and learning process tends to perform better than students taught with primitive methods which the result of this research has buttressed. It was revealed in table 2 that male students did not perform better than their female counterparts in Mathematics when taught using student's demonstration instructional strategy. This is in line with the view of Ajaga (2016) who says that gender does not in any way affect the learning and teaching of mathematics. The result is against the opinion of Ahmed (2010) who says that male students are better in mathematics than their female counterpacts. In table 3 above, it was shown that rural students (students who are from local areas) performed better than urban students (students who are from the city) in Mathematics when taught using student's Demonstration Instructional Material. This indicates that location is a barrier in the learning of mathematics. It is in tandem with the opinion of Tajudeen (2003) and Olumorin (2004) who discovered that some of the students in the rural areas can perform better in mathematics if properly taught. If the issue of equity is taken into consideration and properly adhere to, students in the rural areas will perform better than students in urban areas. This is corroborated by Williams (2004), Emeke & Odetoyinbo (2003) and Ayodele (2015).

The implications of this study border on development of more demonstration instructional materials for teaching mathematics. The study revealed that it was students taught using improvised instructional materials performed better than students taught using conventional

material; there is no difference between the performance of male students in Mathematics; rural students performed better than urban students counterpart in mathematics; The results do not suggest ordinal interaction the impact between mode of method and gender on students' mathematical achievement. This was because at all the levels of gender, the mean scores were higher for student's demonstration instructional material; the result suggests ordinal interaction effects between modes of method and location on students' Mathematical achievement; this was because at all the levels of location, the mean scores were higher for student's improvised demonstration instructional material compared to conventional materials with lower mean scores. In addition, the findings have implications for mathematics teachers. With these findings on the efficacy of students' improvised instructional materials on students' achievement in mathematics, it has become obvious that the current conventional instructional materials recommended by the Ministry of Education are inadequate to meet the needs of the student and consequently need to be reviewed. This will, without doubt, enhance students' achievement in science, particularly in mathematics.

Conclusion

From the results obtained from the study, demonstration instructional strategy has the potential of overturning the misfortunes of mathematics as the hated subject. The result of this study showed that the use of demonstration instructional strategy can significantly increase students' interest and attitude in mathematics. Lack of interest in mathematics is one of the major reasons for student's failure in the subject. Therefore, the use of demonstration instructional strategy in our schools holds a great promise of regaining the interest and positive attitude of students in mathematics. The study investigated the effect of demonstration instruction strategy on academic achievement in Mathematics in Afijio Local Government Area, Oyo State, Nigeria. Three hypotheses guided the study. The study used a non-equivalent quasi-experimental research design. The sample for the study comprised fifty (50) male and fifty (50) female students in Senior Secondary schools. The instrument for in this study was Mathematics Achievement Test (MAT). Two intact classes were assigned to treatment and control group. Data were analyzed using Analysis of Covariance.

It is generally summarized as thus,

1. Students taught using demonstration instructional strategy performed better than students taught using primitive methods.
2. Male students did not perform better than their female counterparts in Mathematics and
3. Rural students performed better than urban students in Mathematics;

Based on the findings of this study the following recommendations are made.

1. The teaching of Mathematics in secondary school should be conducted in a manner that students will effectively learn and understand the concept of mathematics.

2. Teaching of mathematics should be practical as the use of demonstration instruction strategy will play a greater role in students' achievement.
3. It is suggested that regular meaningful workshop on improvisation technique for Science teachers should be conducted to improve and update their competence in teaching.
4. Teachers are, however, advised to adopt child centred approaches
5. Teachers are also admonished to use instructional materials or their improvised versions, to promote meaningful secondary mathematics education

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Conflicts of Interest: The authors declare no conflict of interest

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Authorship and Level of Contribution

Kamoru Abiodun SABITU is the Principal Author. He led the research team and orientated the research assistances. He took permission from the school principals of the schools selected for the study. He played active role in data collection and analysis. Taofeek Oyesola LAMIDI is a Co- author who took part in the collection of data and writing of report. Oluwafunmike Oyenike EZEKIEL is also a Co- author. She took part in all the collection of data and analysis.

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