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EFFECTIVENESS OF DEMONSTRATION TEACHING METHOD ON STUDENTS` ACADEMIC ACHIEVEMENT IN MATHEMATICS IN RIVERS STATE NIGERIA.

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ABSTRACT

The study investigated the effectiveness of the demonstration teaching method on students` academic achievement in Mathematics in Rivers State. The research design adopted for the study was quasi-experimental. Intact classes of (78) JSS1 students formed the sample of the study. A simple random sampling technique was used to select the sample of the study. Two research objectives, questions, and null hypotheses guided the study. The research instrument used for the study was Mathematics Achievement Test. The reliability of the research instrument was computed using the Kuder-Richardson formula (KR -21) which yielded a reliability coefficient of 0.84. The instrument was administered and the data obtained were analyzed using Analysis of Covariance to test the hypotheses while mean and standard deviation were used to answer research questions. The findings established that the students who were taught with the demonstration teaching method achieved higher than the students taught with the deductive teaching method. It was also found that there was no significant difference in students' achievement with respect to the use of demonstration teaching method based on gender. Based on the findings, of the study among others, it was recommended that Mathematics teachers should use demonstration teaching method in teaching Mathematics in other to solve students` problem of poor academic achievement in Mathematics.

Keywords: Demonstration teaching method, academic achievement, Deductive teaching method

Introduction

Adamu (2020) wrote that mathematics influences an individual's personal development and contributes to the wealth of the country. It is one of the oldest fields of study in the history of mankind and has long been one of the most central components of human thought. Mathematics sharpens the human mind, advances rational thoughtfulness; enhances reasoning capability and spatial supremacy.

Mathematical skills for daily life are developed in the school mathematics curriculum. Adedayo (2017) stated that knowledge of mathematics promotes the habit of accuracy, logical, systematic, and orderly arrangements of facts in the individual learner. It also encourages the habit of self-reliance and assists learners to think and solve their problems themselves. Adamu (2020) also recorded that mathematical knowledge indeed equips individuals with the skills to solve a wide range of practical tasks and problems they may encounter in life. From the ongoing, it is necessary that teachers use innovative teaching methods to teach mathematics. In a teaching and learning environment, students' active participation in lessons as well as the use of learning approaches that help students remember what they learn is important dimensions in a demonstration method students and teachers are in a state of dynamic interaction in the classroom. When students interact in the class they learn to give and receive information, develop new understandings and perspectives, and communicate in a socially acceptable manner.

The demonstration teaching method involves stimulating and student-centered activities which could improve students' academic achievement in Mathematics better than teacher-centered methods. In order words, the use of action-inspiring and student-centered teaching methods such as demonstration methods progresses students' academic achievement. Yet most teachers at senior secondary schools still use conventional teaching method which is teacher-centered (McCabe, 2014). Through demonstrations, students are exposed to physical materials that will illustrate some meaning to their cognitive context. Experiences like this go a long way to enriching learning. The demonstration method bridges the gap between theory and practice, enables learners to become good observers and generate their interest; students see immediate progress as a result of a correct effort, and enables the teacher to teach operational skills (Dorgu, 2015). Unlike deductive teaching method.

The deductive teaching method is based on supposition and assumption. This method proceeds from general to particular and from abstract to concrete. At first, the rules are given and then students are asked to apply these rules to solve more problems (Thiyagu, 2015). This means that the deductive method involves applying formulas, principles, or generalization which has been already arrived at in solving problems. Ikitde and Edit (2013) described the deductive method of teaching as a one-way communication pattern in which the teacher is the dominant figure and students' participation is virtually non-existence, rather they listen, ask questions and take notes. In the course of using this method in teaching Mathematics,

the teacher dominates the teaching with little or no participation on the part of the learners. The teacher is seen as the repository of all knowledge while the students are passive recipients of knowledge transmitted by the teacher in the process of learning.

Statement of the problem

The researchers observed that teachers continue to use the old system of teaching that has nothing interesting or enjoyable to offer to the learners to teach Mathematics. Some classrooms still present a situation where topics are just simply introduced and exercises are selected from the textbook and solved for the students who are expected to learn by rote memorization of formulas and facts. Results of studies conducted on mathematics performance and the deteriorating students' achievement in the subject clearly demonstrate the failure of these teaching methods of learning by rote memorization of formulas and facts (Onyeka and Arukoyu 2021, Onyeka and Charles-Ogan 2021 and Akpan et al 2022). This poor performance in Mathematics can be attributed to the non-utilization of appropriate teaching methods (Umar, Tudunkaya & Muawiya, 2019). Therefore, the aim of this study is how to offer real evidence of the effectiveness of the use of demonstration teaching method in solving the problem of poor academic achievement in Mathematics.

Research Questions

The following research questions guided this study.

1. What is the difference in the mean academic achievement of students taught with the demonstration teaching method and those taught using the deductive teaching method?
2. How does the mean academic achievement of students taught with demonstration teaching method differ by gender?

Hypotheses:

The following null hypotheses were formulated and tested at a 0.05 significant level.

H_{O1}. There is no significant difference in the mean academic achievement of students taught with the demonstration teaching method and those taught using the deductive teaching method.

H_{O2}. There is no significant difference between the mean academic achievements of students taught with the demonstration teaching method when analyzed based on gender.

Research Method

Research design

The study adopted quasi-experimental research, structured as pretest-posttest non-randomized design. Intact classes were used. The pretest-posttest control group design was used to investigate effectiveness of demonstration teaching method on students` academic achievement in Mathematics in Oyigbo Local Government Area of Rivers State.

Area of the study: The study was carried out in Oyigbo Local Government Area in Rivers State.

Population of the study:
The population of this study comprised of all the JSS1 students in the seven mixed government junior secondary schools in Oyigbo Local Government Area of Rivers State. As at the time of the study (2018/2019 academic session) there were three thousand four hundred and fifty-one (3451) students made up of one thousand seven hundred and seventy-seven females (1777) and one thousand six hundred and seventy-four males (1,674), (Source, Zonal Post-primary School Board, Oyigbo Education Zone).

Sample and sampling technique:
Intact classes comprising of a total of 78 JSS1 students formed the sample of the study. Simple random sampling technique was used to select two junior secondary schools one in Oyigbo Local Government Area of Rivers State, in which one school was used as experimental group, the other school as control group. Simple random sampling technique was also used to select one arm of JSS1 classes in each school, experimental group consisted of (26) students made up of (13) females and (13) males. The control group was made of fifty-two (52) students made up of thirty-one (31) females and twenty-one (21) males.

Instrument for data collection:
The researchers developed an instrument titled "Mathematics Achievement Test (MAT) which was used to collect data. MAT was made up of twenty-five multiple choice test items with options A to D. Each test item was allotted 4 marks to give a total of 100% for the 25 items. The content of the test items was derived from the topics that were taught on plane geometry. The instrument contained 2 sections. Section A elicited information on the students' personal data. Section B contained 25 test items on plane geometry which measured students' performance and retention. The instrument was used for pre-test, post-test and post posttest. The items of the instrument were re-shuffled before the administration of posttest and the post posttest to reduce memory effect. The students were required to answer all the questions from each section.

Validation of the instrument
To establish whether the test items in MAT addressed the topic of the research, the instrument was presented to one research expert in department of Curriculum Studies and Educational Technology one research experts in measurement and evaluation in University of Port Harcourt and one experienced mathematics teacher to vet the content and errors in grammar, spellings, eliminate ambiguity and ascertain proper coverage of the instrument. The inputs were corrected at the final construction of the instrument.

AJEMATES
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Reliability of the instrument

The reliability of MAT was established by carrying out a trial testing on a sample of 20 students who were not part of the sample for this study. The students were administered MAT once without any form of teaching with regards to the study. The answer scripts were retrieved, marked and graded in percentage. Reliability was computed using Kuder Richardson formula (KR - 21) which yielded a reliability coefficient of 0.84. This reliability index showed that MAT was reliable for the conduct of the investigation.

Method of data collection: The instrument was used to generate data on two different times during the study, namely pretest and posttest. Participants of the experimental groups and the control group were given pretest before treatment and posttest after treatment respectively. The results of the test formed part of the data of this study.

Experimental procedure: The researchers employed the intact classes' Mathematics teachers as assistant researchers to deliver the lessons. These teachers were trained for two days by the researchers on the modality of instruction. The students in the two different groups were first given a pretest of (MAT) without any form of prior teaching. After the pretest, the research assistants taught their respective groups the assigned lesson plans. The students in the experimental groups were taught with the experiential teaching method, while the control group was taught with the deductive method. A posttest of (MAT) was given to the two groups after the teaching which lasted for a period of four consecutive weeks. The posttest was administered to the same students but this time, the test items were reshuffled starting with an even number item from the bottom. The scripts for both the pretest and posttest were collated, marked, and graded in percentage.

Method of data analysis: The research questions were answered using mean and standard deviation, while Analysis of Covariance (ANCOVA) was used for the testing of the hypotheses. This was used to take care of the initial differences in the groups and to control selection bias. $P \leq 0.05$ level of significance was set for rejecting or accepting the null hypotheses

Presentation of Results

The results of the study were presented based on the research questions and hypotheses

Research Question 1: What is the difference in the mean achievement scores of junior secondary school one students taught with the demonstration teaching method and those taught using the deductive teaching method?

AJEMATES
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Table 1: Mean achievement of students in the experimental group and control group.

Groups	Methods		Pretest	Post_test	Mean Gain	% mean gain
Experimental Grp	DEM	Mean	23.39	69.23	45.84	66.21
		N	26	26		
		SD	9.45	11.64		
Control Grp	DM	Mean	26.10	33.15	7.05	21.27
		N	52	52		
		SD	9.23	9.28		

Key: DEM = Demonstration teaching Method and DM= Deductive teaching Method

Table 1, shows that students taught with the demonstration teaching method had a mean gain of 45.84 and a percentage mean gain of 66.21, while those taught using the deductive method had a mean gain of 7.05 and a percentage mean gain of 21.27 when the pretest and posttest were compared. It was empirically established that students taught with the demonstration teaching method achieved higher than their counterparts taught with the deductive method.

Research Question 2: How do the mean achievement scores of junior secondary school one students taught with the demonstration teaching method differ by gender?

Table 2: Mean achievement of students taught with the demonstration teaching method based on gender.

			Pretest		Posttest		Performance Gain	
Group	**Gender**	**N**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
DEM	Male	13	23.08	10.35	66.15	12.50	43.07	14.44
	Female	13	23.69	8.86	72.31	10.26	48.62	12.74

Table 2 revealed that the male students taught with the demonstration teaching method had a mean achievement of 43.07, SD=14.44 while the female students taught with the demonstration teaching method had a mean achievement of 48.62, SD=12.74

Test of Hypotheses

Hypothesis H_{O1}: There is no significant difference in the mean achievement of students taught with the demonstration

teaching method and those taught using the deductive teaching method.

Table 3: Summary of ANCOVA of achievement of Students in experimental group and control group.

Tests of Between-Subjects Effects

Dependent Variable: Post_test

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	22560.10[a]	1	22560.10	220.40	.00
Intercept	181698.56	1	181698.56	1775.09	.00
Methods	22560.10	1	22560.10	220.40	.00
Error	7779.39	75	102.36		
Total	189552.00	78			
Corrected Total	30339.49	77			

a. R Squared = .744 (Adjusted R Squared = .740)

Table 3 revealed a summary of the Analysis of Covariance of students' achievement based on the two methods, using pre-test scores as a covariate, $F_{1,75} = 220.40$ at (75) degree of freedom and 0.05 level of significance with $p = 0.00$, $P < 0.05$. The null hypothesis was rejected and the alternative hypothesis was retained. This indicated that there is a significant difference between the mean achievement of students taught with the demonstration teaching method and those taught using the deductive teaching method in favor of the demonstration teaching method.

H_{02}: There is no significant difference between the mean achievements of students taught with the demonstration teaching method based on gender.

AJEMATES
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Table 4: Summary of ANCOVA on the difference between the mean achievements of students taught geometry with the demonstration teaching method based on gender

Dependent Variable: PostTest					
Source	Type III Sum of Squares	Df	Mean Square	F	p-value
Corrected Model	340.76[b]	2	170.38	1.29	.30
Intercept	14612.02	1	14612.02	110.41	.00
PreTest	94.61	1	94.61	.72	.41
Gender	**235.85**	**1**	**235.85**	**1.78**	**.20**
Error	3043.86	23	132.34		
Total	128000.00	26			
Corrected Total	3384.62	25			

a. Group = GTS
b. R Squared = .101 (Adjusted R Squared = .022)

Table 4 showed the summary of ANCOVA on the difference between the achievement mean score of students taught geometry with the demonstration teaching method based on gender. The result showed that no significant difference exists between the achievement mean score of students taught with the demonstration teaching method when analyzed based on gender ($F_{1, 23}$=1.78, p = 0.20, p>0.05). The null hypothesis three was retained at a probability level of 0.05 since the p-value is greater than 0.05.

Discussion

Table 1, showed that students taught with the demonstration teaching method had a mean gain of 45.85 and a percentage mean gain of 66.22, while those taught using the deductive method had a mean gain of 7.06 and a percentage mean gain of (21.29). It is empirically established that students taught with the demonstration teaching method achieved higher than their counterparts taught with the deductive method. This is further confirmed by the result in Table 3 which revealed a summary of the Analysis of Covariance of students' achievement, using pre-test scores as a covariate, $F_{1,75}$ = 230.24 at (75) degree of freedom and 0.05 level of significance with p = 0.00, P < 0.05. The null hypothesis is rejected and the alternative hypothesis is retained. This indicated that there is a significant difference between the mean performance score of students taught with the demonstration teaching method and those taught using the deductive teaching method in favor of the demonstration teaching method. This significant difference is attributed to the treatment in the experimental group. This revealed that the use of the demonstration teaching method in teaching has positively influenced the academic performance of students in Mathematics. This finding agrees with the

findings of Adamu (2020) the result of the regression analysis indicates that the demonstration method has a positive effect on the performance of mathematics students in secondary schools in Makurdi Metropolis, Benue State, Nigeria. Also, the study by Ehiwario (2019) revealed that there exists a significant difference in the learning outcome between students taught with demonstration and those taught with lecture methods of instruction in favor of those taught with demonstration. And, Giridharan & Raju (2016) in their research work revealed that the demonstration strategy was found to be significantly better than the lecture strategy with regard to students' academic achievement. Likewise in consonance with the present study is the study carried out by Emmanuel (2019) whose results reveal that the demonstration method significantly improved students' performance in probability.

The result in table 2 revealed that the female students who were taught in the experimental group using the demonstration teaching method achieved better than the male students who were taught the same concept in that same group. When subjected to statistical analysis, the result in table 4 showed that no significant difference exists between the achievement mean score of the male and the female students taught with the demonstration teaching method ($F1, 23=1.78, p>.05$). As a result of this, H_{02} was therefore retained at a probability level of 0.05 since the p-value is greater than 0.05. This finding is in agreement with the findings of Umar, Tudunkaya & Muawiya, (2019), Ulelu (2015), Ehiwario, (2019) their result revealed no significant difference in the academic achievement of male and female students taught with the demonstration method. Also, the study of Emmanuel (2019) revealed that, there is no significant difference between the performance of boys and girls when taught probability using the demonstration method. However, research findings of Effiong and Nse (2014) showed that the male students taught using a practical approach performed significantly better than the female students which do not agree with the findings of the present study.

Conclusion

Based on the findings of this study, it was concluded that the use of the demonstration teaching method enhanced the academic achievement of students in Mathematics more than the deductive method. It was also found that there was no significant difference in students' achievement with respect to using the demonstration teaching method based on gender.

Recommendations

Based on the findings and conclusions of the study, the following recommendations were made by the researchers:

1. Mathematics teachers should ensure the active hands-on participation of students during mathematics classroom instruction.
2. Mathematics teachers should use the demonstration teaching method in

teaching Mathematics since it improves academic achievement and is not gender biased.

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