Nigerian Journal of Mathematics and Applications
Volume **23**, (2014), 96 – 104
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Teachers Teaching Strategies and Students Performance in Senior Secondary Schools Mathematics in Ilorin, Nigeria

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Abstract

This study investigated teachers teaching strategies and students performance in Mathematics at senior secondary schools. Specifically, the focus of the study was to determine the impact of simulation teaching method in relation to students gender and scoring levels in relation to performance in Mathematics. The sample consisted of 68 Senior School 1 Students comprising 33 males and 35 females from two selected public schools in Ilorin South Local Government Area of Kwara State. The research was a quasi-experimental type of $2 \times 2 \times 3$ factorial design and the main instrument used for data collection was Mathematics Academic Performance Test which consisted of 5-item theory questions on Simple equations and Variation drawn from West Africa Senior School Certificate Mathematics Examinations past questions. Three research question were raised and answered while the three corresponding hypotheses were also tested. The findings of the study revealed a significant difference in favour of those exposed to simulation method compared to those not taught using simulation method. Though, the male students performed better than their female counterparts, results from this study have also shown that the simulation teaching strategy was beneficial to all ability levels irrespective of the academic standard of the members of such groupings, but, more relevant at improving weak students academic performance. Hence, it was recommended among other things that simulation method of teaching can be adopted in teaching not only simple equations and variation but also to teach other concepts of mathematics.

1. Introduction

There is a widespread demand in improving the level of numeracy ability in schools. Apart from the economic benefit of the work place and access for larger numbers of young people to post-secondary education, the interest in improving the ability level is of pivotal role to any nations scientific and technological advancement [8]. The depth of mathematical knowledge an individual has, dictates the level of accuracy of his or her decisions. This implies that before an individual can function well in the society, he or she must possess a relatively good knowledge of mathematics especially in this era of technological age [1]. In achieving this, the role of teachers teaching strategies towards ensuring continued production of mathematically literate individuals for desired result in commerce, economics and even humanities is almost at par with the importance of education as a whole.

Odili [7] opined that mathematics as a body of knowledge, collection of techniques and methods, and the product of human activities for solving problems is the most required for the present age development. Accordingly, one special issue which has generated much debate in the course of improving numeracy ability is whether teachers teaching strategies affect students performance or not. The complexity arises because empirical studies have indicated that students performance being feedback to a large extent is dependent on effectiveness of teaching methods.

In line with this, study carried out by Ezeani and Maduewesi [5] revealed that the use of enhanced instructions could be employed to build students capacity for mathematics thinking and reasoning. That is, students should be provided with opportunities, encouragement and assistance in order to engage them in critical thinking, reasoning and brainstorming. The researchers submitted that the kind of instructional strategy and its proper use in mathematics classroom highly influences thinking process that students employ, which in turn influence their learning outcome. The poor performance of students in mathematics which constitutes a serious implication for a developing nation aspiring for scientific and technological advancement has been attributed to several identifiable factors such as teachers ineffective and inefficient methods of teaching, and or unavailability of learning materials among others. Amazigbo [2] identified some specific variables such as poor primary school background in mathematics, lack of incentives, lack of interest on the part of the students, students not interested in hard-work,

Received January 22, 2015. * Corresponding author.

2010 *Mathematics Subject Classification.* 30C45.

Key words and phrases. Mathematics, Students, Teaching, Strategies, Performance.

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incompetent teachers in primary schools, large classes, fear of the subject psychologically, etc. Bryl [4] also confirmed that poor performance in mathematics stemmed from anxiety, fear, the obsolete methods of teaching and inadequate use of instructional materials in teaching mathematics. Further, Bannert [3] corroborating the assertions of Bryl [4] observed that instructional patterns that focuses on theoretical presentation not only contributed largely to students poor performance in mathematics but constitutes an overload of learners working memory to no advantage of both the learners and the society. This was equally observed at the Special Skills Improvement Workshop (SKIW) organized for 54 mathematics teachers drawn from all the 18 Nigerian Air Force primary schools across Nigeria (The Punch, May 8, 2011). Apparently, teachers develop strategies they find appropriate for teaching each topic in their lessons with the aim of attaining the desired change in behaviour of learners, not realizing that the instructional strategies can be patterned in a way that will stimulate learners interest in achieving effective learning outcome. This study therefore investigated teachers teaching strategies, considering the conventional and simulation methods of teaching mathematics, and students performance in selected secondary schools in relation to their gender.

1.1. **Research Question.** The following research questions were formulated as guide in the conduct of this research study:

(1) What is the relationship between the teachers teaching strategies and students performance in mathematics?
(2) Does the students gender have a significant influence on the performance of students in mathematics?
(3) Is there any difference in the senior secondary school students performance in mathematics on the basis of scoring levels when taught using simulation method?

1.2. **Research Hypotheses.** The following hypotheses were tested in this study:

HQ_1. There is no significant difference in the post- test mean scores of the senior secondary school students irrespective of the teaching method adopted.
HQ_2. There is no significant difference in the post-test mean scores of students irrespective of the students gender.
HQ_3. There is no significant difference in the post-test mean scores of the secondary school students with respect to the high, medium and low scoring levels when taught using simulation method.

2. Research Methodology

The study was a quasi-experimental design of pre-test, post-test, non-randomize non-equivalent and Control group design involving a $2 \times 2 \times 3$ factorial type. The teaching strategy was at two levels (simulation and non-simulation method), the

gender also at two levels (male and female) and the scoring ability at three levels (high, medium and low scorers). A total of 38 students (22 males, 16 females) were involved in the experimental group while 30 students (11 males, 19 females) participated in the control group. This design had been chosen because it allows for separate determination of main effect as well as the interaction effects of both the independent (simulation method of teaching) and the moderating (non-simulation method of teaching) variables on students performance in the selected mathematics topic (simple equations and variation).

3. Research Instrument

The main instrument used was Mathematics Academic Performance Test (MAPT). The MAPT comprised of five (5) standardized questions on simple equations and variation which was drawn from the West Africa Senior School Certificate Examinations Mathematics past questions. Minimum of 0 and maximum of 100 scores were expected respectively to be the range within which the performance of both groups should fall (0-39 categorized as low scoring, 40-69 categorized as medium scoring and 70-100 as High scoring students). For the purpose of reliability, the test was administered and re-administered within the interval of two weeks on a non-participating intact school and their scores were correlated. The control group was exposed to non-simulation mode of teaching and taught by the class teacher while the experimental group with the help of research assistant were personally taught by the researcher and it was student-centred with a lot of interaction between the students and the researcher.

The experiment lasted for six (6) weeks. The first, second and the last week were used for permission/preparation, pre-test and post-test respectively while the third, fourth and fifth weeks were dedicated to teaching.

4. Results

Three research questions were raised and answered. Hypotheses one and two were tested using t-test statistics while hypothesis three was tested with Analysis of Covariance (ANCOVA) using pre-test scores as covariates. This is in line with Fajemidagba (1995) who stated that ANCOVA is the appropriate statistics to use when testing hypothesis where effects of more than two independent variables are to be determined

RQ 1: What is the relationship between the teachers teaching strategies and students performance in Mathematics?

Table 1:
Mean Gain Scores of students performance in both Experimental and Control groups

Group	Group Statistics	Pre Test	Post-Test	Mean-Gain Scores
Experimental Group	N	38	38	
	Mean	23.5789	55.5000	31.9211
	Std Deviation	20.4868	24.5090	
Control Group	N	30	30	
	Mean	35.9333	46.0667	10.1334
	Std Deviation	18.5806	18.6361	

Table 1 reveals that the mean gain score of students exposed to simulation method was 31.92 while that of the control group was 10.13. Thus, the mean gain difference between the two groups was 21.79 and this was in favour of the experimental group (students exposed to simulation method of teaching).

HQ_1: There is no significant difference in the post-test mean scores of the senior secondary school students irrespective of the teaching method adopted.

Table 2:
t-Test Analysis on the pre-test and post-test mean scores of the Experimental and Control groups.

	t	df	p-value	mean diff
Pre-test	1.746	66	0.085	9.4333
Post-test	2.571	66	0.012	12.3544

To test whether or not the difference in the post-test mean score of both the experimental and the control groups was statistically significant, an independent sample t-test statistics was employed to test for significant difference between the two groups using the pre-test scores and post test scores.

The independent sample t-test was employed to determine significant difference between the experimental group and the control group as shown in Table 2. Comparing the pre-test scores for the two groups, since the p-value $(0.085) > \alpha(0.05)$, the null hypothesis was not rejected. Therefore, there is no significant difference between the means of the experimental group and the control group at 5% significant level. This implies that using the pre-test scores, the experimental group and the control group are equivalent in term of performance. Comparing the post-test scores for the two groups; since p-value $(0.01) < \alpha(0.05)$, the null hypothesis

was rejected. The post-test mean score of the experimental group (55.50) is significantly greater than that of the control group (46.07). The result was in favour of the experimental group (students exposed to simulation method of teaching) which implies that there is significant difference in the post-test mean scores of the senior secondary school students when taught using simulation method.

RQ 2: Does the students gender have a significant influence on the performance of students in mathematics? [5mm] **Table 3:**
Mean Gain Scores of Experimental group performance based on Gender

Group	Group Statistics	Preest	Post-Test	Mean-Gain Scores
Male	*N*	22	22	
	Mean	23.3182	61.8636	38.5454
	Std Deviation	23.28373	18.95432	
Female	*N*	16	16	
	Mean	23.9375	46.75	22.8125
	Std Deviation	16.61513	28.94247	

Table 3 reveals that the mean gain score of male students exposed to simulation method was 38.55 while that of female students was 22.81. Thus, the mean gain difference between the two groups was 15.73 in favour of male students.

HQ_2: There is no significant difference in the post-test mean scores of the students irrespective of the students gender.

Table 4:
t-Test Analysis on pre-test and post-test scores of the male and female students when taught using simulation method.

	t	df	p-value	mean diff
Pre-test	0.091	36	0.928	0.6193
Post-test	1.946	36	0.039	15.1136

From Table 4, an independent sample t-test was employed to determine significant difference between the male and the female students. Comparing the pre-test scores for the two groups, since the p-value $(0.93) > \alpha(0.05)$, the null hypothesis was not rejected. Therefore, there is no significant difference between the means of the male students and the female students. This implies that using the pre-test scores, the male students and the female students are equivalent. However, comparing the post-test

scores for the two groups; with p-value $(0.04) < \alpha(0.05)$, the null hypothesis was rejected. This implies that there is significant difference in the post-test mean scores of the students with respect to the their gender.

RQ 3: Is there any difference in the senior secondary school students performance in mathematics on the basis of scoring levels when taught using simulation method? **Table 5:**

Analysis of Low, Medium and High Scoring Students Performance

Group	Group Statistics	Preest	Post-Test	Mean-Gain Scores
Low Scorers	N	26	26	
	Mean	11.6538	48.6154	36.9616
	Std Deviation	9.3934	24.5765	
Medium Scorers	N	10	10	
	Mean	45.3	67	21.7
	Std Deviation	8.1520	16.3639	
High Scorers	N	2	2	
	Mean	70	87.5	17.5
	Std Deviation	0	10.6066	

Table 5 reveals the mean gain scores of students that were exposed to simulation method as categorized into low, medium and high scorers. Students in the low scoring level category have the highest mean gain score of 36.96 followed by those in the medium scoring group with 21.7 and those in the high scoring group having 17.5.

HQ_3: There is no significant difference in the post-test mean scores of the secondary school students with respect to the high, medium and low scoring levels when taught using simulation method. **Table 6:**

Analysis of Covariance (ANCOVA) of Low, Medium and High scoring Students Performance

Sources	Type III of sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5929.266^a	3	1976.422	4.124	0.013
Intercept	2099.644	1	2099.644	4.381	0.044
PRT	1326.42	1	1326.42	2.767	0.015
Score 2	78.439	2	39.22	3.82	0.043
Error	349.078	34	10.267		
Total Error	123327.8	38			
Corrected Error	6278.344	37			

a. R Squared $=$ (Adjusted R Squared $= .202$)

Table 6 indicates that there is significant difference in the post-test mean

scores of the students with respect to the high, medium and low scorers with the F value of 3.82 at 0.05 significance level when taught using simulation method. Hence, the null hypothesis was rejected.

5. Discussion and Conclusions

From the results of this study, the experimental group exposed to simulation method of teaching performed significantly better than their counterparts in the control group. This attests to the efficacy of simulation teaching strategy as a tool for improving students academic performance in Mathematics as observed in teaching simple equations and variations concept. It should also be noted that the male students when exposed to the same simulation teaching strategy performed significantly better than their female counterparts in mathematics particularly in simple equations and variation. This provides evidence that gender has effect on students performance in mathematics. As regarding the scoring levels of the students, there is a significant difference in the performance of high, medium and low scorer students when taught Simple equations and variation using simulation method of teaching with the low scorers benefiting most, followed by the medium scorers and the high scorers.

Based on the above indications from empirical data, this study revealed the effectiveness of simulation teaching strategy in improving students performance in Mathematics in simple equations and variation. Though, the male students performed better than their female counterparts, results from this study have also shown that the teaching strategy (simulation method) was beneficial to all ability levels irrespective of the academic standard of the members of such groupings, but, more relevant at improving weak students academic performance.

Hence, the study recommends that: (i) simulation method of teaching can be adopted in teaching not only simple equations and variation but also to teach other concepts of mathematics with more time allotted to Mathematics lessons in schools; (ii) male and female students should be treated as equivalent with role equally assigned to them in Mathematics class; and, (iii) for expected learning outcome, professional bodies such as Science Teachers Association, Mathematical Association and Curriculum developers should begin to encourage the use of appropriate teaching strategies through organized seminars, workshops and conferences for teachers.

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