TEACHERS AWARENESS AND UTILIZATION OF INNOVATIVE INSTRUCTIONAL STRATEGIES IN SCIENCE TEACHING: A CHALLENGE TO SCIENCE EDUCATION IN NIGERIA.

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Abstract

One of the major challenges to functional science education in Nigeria is, Unarguably, the use of inappropriate, non-effective teaching strategies in our science classes. This study was, therefore, aimed at investigating the extent of science teachers awareness and utilization of some identified teaching strategies. A sample size of two hundred teachers from a teacher population size of 1025 responded to 10 selected teaching strategies used as questionnaire items in the study. Findings showed that science teachers had fairly high knowledge of the teaching strategies but, that the level of the utilization of such strategies were poor. Similarly, the study indicated that the mean utilization of the strategies differed across teachers' age, experience and qualification. It was accordingly recommended, amongst others, that capacity of teachers for utilization of these strategies be vigorously pursued.

It is not an exaggeration to say that, mathematics, science and technology education have been widely acclaimed as the index for measuring nations socio-economic development. The achievements in technology have become a yardstick for measuring the strength of nation. Mathematics is the bedrock of science and technology. Clarkson (2003), schematically put it as ***"Mathematics –> Science –> Technology –> Development –> Progress".*** This self explanatory analogy immediately brings to mind the importance of mathematics not only as a school subject but to the technological and economic development of the country as it plays great roles in day to day activities of every living being all over the globe.

According to Lassa (1983), today, more than ever before, it is apparent that all fields of knowledge are directly or remotely dependent on mathematics for solving problems, stating theories and predicting outcomes. Mathematics has thus become an indispensable tool in creating new knowledge.

Based on this same idea, the submission of the Governing Board of Co-operative Education Study and Adaptation Centre (CESAC, 2002), stated that:

> *"Mathematics is a means of developing skills, fostering the desire and ability to be accurate to a degree relevant to the problem at hand, developing precise logical and abstract thinking, developing ability to recognize problems and to solve them with related facts, stimulating and* encouraging creativity"

One fact that is readily observable in the forgoing is that, they all share a cardinal commonality that mathematics is an instrument for solving problems arising in day to day Endeavour.

However, in spite of the indispensability of mathematics, the majority of our students exhibit loathe some attitude

towards its study, it is most abysmally taught by our teachers and it registers the poorest students' performance at every level of our educational system (Udele, 1999).

Despite the seemingly exalted position and lofty credentials of significance that the various definitions tend to give to mathematics among other subjects, there is no dispute among scholars concerning the abysmal and dismal performance of students in mathematics most especially in the Senior School Certificate Examinations (SSCE) such as West African School Certificate Examinations (WASCE) and National Examinations Councils (NECO) and so on.

Purpose of the Study

The persistent failure of secondary school students in mathematics most especially external examinations gives concern to parents, teachers, students and stake holders in education. As a result of this, there is need for urgent provision of how to improve these students' poor performance in mathematics, if they are to meet the requirements of furthering their studies and perform better. Teachers as the disseminators of knowledge need to use appropriate method that will facilitate proper understanding and create interest on the students and this include discovery and project teaching methods. Therefore, the major purpose of this study is to improve on the poor performance of the students in both the internal and external examinations in mathematics through the use of appropriate teaching methods by the teachers. The performance of the students of secondary school students in Mathematics from 2008 in West African School Certificate Examination are given in the bellow table I.

TABLE 1: Senior School Certificate Examination Results in Mathematics (2008-2012)

	MAY / JUNE			**NOVEM/DECEM**		
YEAR	REGISTERED	A1 – C6	%PASS	REGISTERED	A1 – C6	%PASS
2008	4873071	1761351	12.2	4382442	114192	4.5
2009	6988942	1110743	20.9	4614882	461300	10.8
2010	8276873	7126331	11.5	6762911	1509071	32.7
2011	9669941	1182114	15.6	9076421	2028871	30.0
2012	9747584	1311232	14.5	9445522	2606621	29.6

SOURCE: W.A.E.C. RECORDS, 2012

With regard to the National Examination Council results, many students have started having good performance generally and especially in mathematics, thus the reverse has become the case since 2009 when the body started experiencing dismal performance of students in their Senior Secondary School Certificate Examination results.

The secondary school students' performance in mathematics from 2009 to 2011 can be seen from the table 11 below:

TABLE II: Senior School Certificate Examination Results in Mathematics (2009-2011) NECO EXAMINATION

	JUNE / JULY			**NOVEM/DECEM**		
	REGISTERED	A1- C6 PASS	% PASS	REGISTERED	A1- C6 PASS	%PASS
2009	1467896	607462	4.1	10229764	904442	8.8
2010	1355746	552843	4.2	9154460	213242	2.3
2011	1538771	604270	3.9	18152861	113246	1.3

SOURCE: NTA REPORTS

From the results analyses above, it could be observed and agreed to that, the rate of secondary school students' failure in Mathematics is quite high and there is need for researchers, parents, teachers, students, and government not only to pay serious attention to it but to look for possible solutions to obtain

better performance of students in mathematics and science related subjects.

Research Questions

The following research questions guided the study:

i. Is there any significant effect of discovery method of teaching on the academic performance of secondary school students in mathematics?

ii. What is the significant effect of project method of teaching on the academic performance of secondary school students in mathematics?

iii. What is the interactive effect of method and gender on the performance of the secondary school students in mathematics?

iv. What is the significant difference between the performance of secondary school students exposed to the discovery and those exposed to the project methods of teaching in mathematics?

Research Hypotheses

The following postulated hypotheses were tested at 0.05 alpha level of significance using Analysis of Covariance (ANCOVA).

i There is no significant effect of discovery method of teaching on the performance of secondary school students in mathematics.

ii There is no significant effect of project method of teaching on the performance of secondary school students in mathematics

iii. There is no significant interactive effect of teaching method and gender on the performance of secondary school students in mathematics.

Iv There is no significant difference between the performance of secondary school students exposed to discovery and project methods of teaching in mathematics.

Methodology

Research Design

Since there was no assignment of subjects through random sampling to the experiment and control groups, for the whole classes were used, the quasi- experimental research design was used for this study, Fife-schaw (1995) as shown in the table III below.

TABLE III: Non- equivalent Pre-test and Post-test Control Group Research Design

EXPERIMENTAL	O	X	O
EXPERIMENT II	O	X	O
CONTROL GROUP	**O**		**O**

The two experimental groups were given instruction using the discovery and project methods of teaching, while the control groups were given instruction using the conventional method of teaching.

Population and Sampling

The overall population under study consisted of all secondary school students in Gombe state. However, the target population consists of about five hundred (500) J.S.S.III students from twelve (12) secondary schools in five (5) local government areas randomly and purposively selected for the study.

Instrumentation

The **instrument** used was the Mathematics Achievement Test (MAT) which consisted of fifty (50) multiple choice questions from the topic of plane shapes, taught to both the experimental and control groups of this work. The Mathematics Achievement Test (MAT) was administrated after the treatment

has been given to both the experimental and control groups. In the design, four (4) and eight (8) groups were used as control and experimental groups respectively. The pre-test and post-test were administrated to the twelve(12) groups before and after the instruction were given to the groups using whole classes (intact groups) as shown in the table.

TABLE IV: Application of Non Equivalent Control-Group Design

Group	Method	Pre-test	Treatment	Post-test
Experimental I	Discovery	X	X	X
Experimental II	Project	X	X	X
Control	Conventional	X	-	X

Data Collection Procedures

Data were collected immediately after the administration of the Mathematics Achievement Test (MAT), scores of the students, school - by-school, group-by-group and method-by-method were recorded after marking their scripts.

Data Analysis

Analysis of Covariance (ANCOVA) was used to analyze the collected data. The calculated f-ratio was obtained and compared with the critical f-value at 0.05 alpha level of significance to test the five postulated hypotheses of the study.

Results

The collected data from five hundred randomly selected from twelve secondary schools students in Gombe metropolis consisted of two hundred and sixty (260) male and two hundred and forty female students with the average age 16.5years.The gender distribution students used for the study is shown in the table V below.

TABLE V: Gender Distribution of the Respondents.

GENDER	FREQUENCY	PERCENTAGE
Male	260	52
Female	240	48
Total	500	100

The postulated four research hypotheses were tested with the scores of the students from the Mathematics Achievement Test (MAT) using the statistical method of Analysis Of Covariance (ANCOVA) at 0.05 alpha level of significant.

The means of the achievement scores of students exposed to discovery, project and convectional were 38.5, 26.4 and 20.1 respectively as shown in the table iv bellow.

TABLE VI: The Means of Students from the Mathematics Achievement Test

METHOD	MEAN	PERCENTAGE
Discovery	38.5	45.2
Project	26.4	31.1
Conventional	20.1	25.7

Hypotheses Testing

The summary table of the Analysis Of Covariance (ANCOVA) on the performances of secondary school students based on the discovery and project methods of teaching and the gender of students are shown in the table VII below.

Table VII: ANCOVA Summary Table of Teaching Method and Gender on the Performance of Secondary School Students in Mathematics.

Source	Sum Of Squares	Df	Mean Square	F-ratio	F-critical	Significant
Corrected model	11005.22	6	1834.20	11.40		.000
Intercept	22571.60	1	22571.60	138.60		.000
Covariates	35.62	1	35.62	1.40		.776
Discovery Method	4441.82	1	4441.82	13.66		.000
Project method	4287.64	1	4287.64	13.22	3.02	.430
Gender	162.38	1	182.38	2.119		.005
Teacher method						
And gender	2099.94	234	1044.97	6.852		
Error	20711.12	248	83.51			
Total	221142.00	246	88.28			
Granted Total	21717.34					

Dependent variable: Performance.
Independent variables: Method and Gender

Hypothesis One

There is no significant effect of the discovery method of teaching on the performance of secondary school students in mathematics.

From the summary table VII above, it could be observed that the calculated-f ratio of 13.7 of the discovery method is greater than the critical-f ratio of 3.02 at 0.05 alpha level of significance. Hence, the null hypothesis of no significant effect of discovery teaching method on the performance of secondary school students is hereby rejected.

Hypothesis Two

There is no significant effect of project method of teaching on the performance of secondary school students in mathematics.

Looking at the summary table VI above, it can be seen that the calculated-f ratio of 13.2 of the project method is greater than the critical-f ratio of 3.02, therefore, the null hypothesis of no significant effect is rejected at 0.05 alpha level of significant, hence there is significant effect of project teaching method on the performance of secondary school students in mathematics

Hypothesis Three

There is no significant effect of interactive of teaching method and gender on the performance of secondary school students in mathematics.

Observing the summary table VII above and reading from gender and teaching method section, it can be seen that, the calculated- f ratio of 6.85 is greater than the critical- f ratio of 3.02 at 0.05 alpha level of significant, therefore the null hypothesis of no significant effect of teaching method and gender on the performance of secondary school students is thereby rejected at 0.05 alpha level of significant.

Hypothesis Four

There is no significant difference between the academic performance of secondary school students exposed to discovery and project methods of teaching in mathematics.

From the VII, the mean of the calculated-f ratio of discovery and project methods of teaching is 13.44 and this is greater than the critical-f ratio of 3.02. Therefore, the null hypothesis of no significant different is thereby rejected at 0.05 alpha level of significance.

Discussion

It was shown from the first hypothesis that there is a significant effect of discovery method on the performance of secondary school students in mathematics. This is in line with the findings of Olonade and Abdullahi (2000) who found out that students exposed to discovery method of teaching in their learning performed better.

It could also be seen from the second hypothesis that, there is significant effect of project method of teaching on the performance of school students in mathematics. This finding is in line with the findings of

Abdullahi and Adewumi (1982) who opined that the method of teaching provides a basis for the assessment of originality, creativity thoroughness, perseverance, cooperation, etc in learners and also provides the opportunity for knowledge integration and aquisition of skills.

In the hypothesis three it can be seen that, there is significant effect of interactive teaching method and gender on the performance of secondary school students in mathematics. This result is similar to that of the finding of Fennema (1974) in the work of Abdullahi (2005), who discovered that, teachers are the most important educational influence on the learning of students. He further stressed that, teachers treat male and female students equally in the course of their teaching. In general, male students appeared to be more noticeable or important in the frame of reference of some teachers in their teaching. Lastly it can be seen from the hypothesis four that, there is significant difference between the academic performances of secondary school students exposed to discovery and project methods of teaching in mathematics. This finding supports the submission of Gardner (1972) and Hard (1976) in Abdullahi (2005), with the identification from their similar work that there is significant difference in the academic performance of students exposed to discovery and project methods of teaching in secondary schools.

Recommendations

Teachers should bring to the instructional setting his ability, qualifications, teaching experience, motivational properties (professional), attitude, home and community background which are the characteristics that link them to their students in his teaching . They should put their methods of teaching to match the individual differences of students in their classes and give them equal opportunity to learn without any bias of gender and other differences in students at hand.

Parents should always provide their children with all necessary materials and needed in the school and they should try to check their children's daily work and also allow them to read and practice at home.

Students need to know the importance of mathematics in their choice of future career and to understand that mathematics is very important if their various ambitions are to be realized.

The school authority should make provision for a well-equipped mathematics laboratory in the school. There should be provision for textbooks, instructional materials and other items of requirement needed for teaching and learning of mathematics.

Government needs to employ more qualified teachers to remedy the shortage of mathematics teachers in secondary schools and provide all the required materials for the teaching and learning of mathematics.

Comprehensive and compulsory workshops, seminars and in-service training or refresher courses for secondary school teachers should be enforced.

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