Teachers' Instructional Strategies and Upper Basic Students' Academic Achievement in Mathematics in Essien Udim Local Government Area of Akwa Ibom State

Abasi, Andrew Umo
Department of Science Education
Akwa Ibom State University, Mkpat Enin
andrewabasi@yahoo.com

Abstract
This study investigated the effect of instructional strategies on upper basic students' academic performance in Mathematics in Essien Udim Local Government Area of Akwa Ibom State. The study was guided by three research questions and two null hypotheses. Quasi-experimental pretest posttest research design was adopted for the study. A sample of 120 basic 7 students constituted the study. The instrument used for data collection was Mathematics Achievement Test (MAT) developed by the researcher. The data collected were analyzed using mean standard deviation and analysis of covariance (ANCOVA) using pretest as covariate. The result of analysis showed that there was no significant difference between the general achievement of students in mastery and collaborative group in Mathematics at 0.05 level of significant. Also the result further showed that, there was no significant difference in the achievement of male and female students in Mathematics taught using both mastery and collaboration learning strategies. Based on the findings, it was recommended that mathematics teachers should incorporate the use of mastery and collaborative learning strategies in teaching while government and relevant stakeholders in education should organize workshop for Mathematics teachers in schools.

Keywords: Instructional Strategy, Mastery, Collaborative, Academic Achievement

Introduction

Mathematics is one of the core subjects that is taken very serious in the school system irrespective of country or level of education. It has been described as a model of thinking (Iji 2008), which encourages learner to observe, reflect and reason logically about a problem and in communicating ideas, making it the central intellectual discipline. The literal meaning of mathematic is "things which can be counted" therefore one can think that counting has vital role in our daily life, imagine that there were no mathematics at all, how would it be possible for one to count members of the family number of students in the class, days in a week or in a month or years? On a basic level, one need to be able to count, add, subtract, multiply, and divide. At a psychological level, exposure to mathematics helps in developing an analytic mind and assists in better organization of ideas and accurate expression of thought. Mathematics is an indispensable tool in the study of science, humanities and technology. It is the foundation for any meaningful scientific endeavor and any nation that must develop in science and technology must have strong mathematical bedrock for its youths (Uhumuarbi &Umoru 2008). Mathematics being the rudiment of all science careers like medicine,

pharmacy, engineering etc, it therefore require every individual to have the knowledge of mathematics to function effectively and efficiently in today's world. This is why the National Policy on Education (2007) has it as one of the core subjects in the secondary schools curriculum in Nigeria.

In terms of curriculum relevance, mathematics is compulsory at the post primary school level and a pre-requisite to moving from junior to secondary school as well as a subject required by the Joint Admission and Matriculation Board (JAMB) to gain admission into tertiary institution.

Despite the recognitions accorded to mathematics due to its relevance, Elekwa (2010) remarked that students exhibit nonchalance attitude towards mathematics, even when they know that they need it to forge ahead in their academic pursuit and in life. Such students who have already conditioned their minds that mathematics is the most difficult subject are usually not serious in learning of mathematics and thus perform poorly in mathematics assessment. Analysis of school certificate mathematics examination results show that students' performances are consistently poor. This ugly trend of students' poor performance in mathematics has become a national disaster. Therefore, feasible ways of improving the performance has remained an area of great concern for researchers.

The deplorable state of mathematics achievement is attributed to a number of factors ranging from teachers competency on the subject matter, learners' attitude and perception, the curriculum, instructional strategies and materials. For any successful teaching/learning process, it is pertinent that every teacher should decide the suitable instructional strategy to aid the teaching and learning process. Hence, instructional strategies are the teaching techniques teachers use to help students become independent and strategic learners. These strategies become learning strategies when students' independently select appropriate ones and use them effectively to accomplish tasks or meet goals. These instructional strategies can:

- Motivate students and help them focus attention
- Organize information for understanding and remembering
- Monitor and assess learning

To become successful strategic learners, students need:

- Step-by-step strategy instruction
- A variety of instructional approaches and learning materials
- Appropriate support that includes (modeling guided practice and independent practice)
- Opportunities to transfer skills and ideas from one situation to another
- Meaningful connections between skills and ideas and real life situation
- Opportunities of self-monitor and self-connect

Effective instructional and learning strategies can be used across grade levels and subject areas, and can accommodate a range of student differences. Instructional strategies that are especially effective in the sound education program are: mastery learning approach, collaborative learning, group discussion learning, independent study, inductive and deductive learning, discovery and enquiry learning approach, cognitive organizers etc. instructional strategy adopted by the teacher can be manipulated to bring about improvement in performance of students. Hence teaching and learning of mathematics consistently generates interest among scholars. Over the years, several studies have been shown by researchers that good instructional strategies are capable of improving the performance of students in mathematics and other subjects (Ihendinidu, 2008).

Although many instructional strategies have been listed in the background of this study, the present study will be interested in mastery and collaborative learning strategy. Mastery learning strategy refers to such strategy which allows the teacher to organize learning situation following a system of order. It engages the learner in multiple instructional methods, learning levels and multiples cognitive thinking types. This model provides teachers with timely feedback about the progress and deficiencies of students in meeting specific instructional goals and present a curriculum that provide extra time and opportunities for all students to attain mastery. The learning strategy takes care of individual differences in learning due to individual students' characteristics as well as their aspirations.

Mastery learning is based on the principle that all the students can learn a set of reasonable objectives with appropriate instruction and sufficient time to learn. Students cannot advance to subsequent learning objectives until they demonstrate proficiently with the current one. Students who do not achieve mastery receive remediation tutoring, peer monitoring, small group discussions or additional homework. Some scholars have studied the efficacy of mastery learning as an instructional strategy (Samuel 2007, Wambugu & Changeijwo 2008, Olumtumin 2010 and Akinsola 2011) and reported in their respective studies that mastery learning approach (MLA) is effective in improving the performance of students in science.

Another instructional strategy worthy of consideration in this study is collaborative learning strategy. This learning strategy provides a situation in which two or more people learn or attempt to learn something together. Collaborative learning strategy refers to any instructional strategy in which students work together in groups for the purpose of achieving a common academic goal. Collaborative learning allows students to receive more feedback from their peers. It allows them to gain mastery experiences and various experiences that help to build self-efficacy to bring about a desired effect (Woolfolk, 2011). It also provides students' with helpful models which would foster their understanding.

According to Barkley, Cross & Major (2014), collaborative learning is defined as students' centered learning. Unlike individual learning, students engaged in collaborative learning capitalize on one another's resources and skills (asking one another for information, evaluating one another's ideas, monitoring one another's work, etc.) more specifically collaborative learning is based on the model that knowledge can be created with a population where members actively interact by sharing experiences and takes on asymmetry roles. Therefore, this learning strategy is commonly illustrated when team of students work in unison to search for understanding, meaning or solution or to create an artifact or product of their learning.

Collaborative learning activities includes: collaborative writing, joint problem solving, group project, debate, study teams and other activities. The approach is closely related to cooperative learning. It is based on this background that the researcher is interested in investigating the efficacy of mastery and collaborative learning strategy, whether it will improve mathematics performance of secondary school students in Essien Udim Local Government Area of Akwa Ibom State, Nigeria.

Statement of the Problem

The lack of understanding of concepts in mathematics has caused discouragement leading to lack of interest and poor performance among upper basic students. This has given concern to both mathematicians and mathematics educators because no mathematics teacher in Nigeria can assert that all is well in the teaching of the subject. The positive impact of

instructional strategies in teaching and learning process in the world today cannot be overemphasized especially in the contemporary world. There are lots of findings on the instructional value of employing instructional strategies such as mastery, collaborative, guided discovery, think-pair-share etc in teaching and learning process particularly in advanced countries. The trend today in the world is chain towards applying appropriate instructional strategy in classroom instruction to enhance teaching and learning. The question therefore arises: Will the use of instructional strategies such as mastery and collaborative teaching strategy enhance students' academic performance in mathematics?

Purpose of the Study

The main purpose of this study is aimed at determining the effect of instructional strategies on upper basic students' academic performance in mathematics. Specifically, the study sought to;

1. Determine the mean gain difference in the academic performance of mathematics students when taught using mastery and collaborative learning strategies.
2. Determine the mean gain difference in the academic performance of mathematics students male and female when taught using mastery and collaborative learning strategies

Research Questions

The study sought to provide answers to the following research questions:

1. What is the mean gain difference in the academic performance of mathematics students when taught with mastery and collaborative learning strategies?
2. What is the mean gain difference in the academic performance of mathematics students male and female when taught with mastery and collaborative learning strategies?

Null Hypotheses

The following null hypotheses were formulated to guide the study.

1. There is no significant differential effect in the academic performance of mathematics students when taught with mastery and collaborative learning strategies.
2. There is no significant differential effect in the academic performance of mathematics students male and female when taught with mastery and collaborative learning strategies

Methodology

This study adopted the pretest-posttest control group design. This design was adopted because the researcher intended on making comparison between the experimental and control groups in other to draw conclusion on the effectiveness of the teaching strategies used for the study. The study was conducted in Essien Udim Local Government Area (LGA) of Akwa Ibom State. The population of the study consisted of 4036 upper basic 7 students of 2016/2017 academic session in all the public co-education schools in Essien Udim Local Government Area. The simple random sampling technique was used in selecting the two schools. The sample selected consisted of 120 students in basic 7 from two schools. In each of the schools selected, one arm of basic 7 intact classes was drawn. One school was assigned to experimental group while the other school to control group. The experimental group school had 58 basic 7 students and control group school had 62 basic 7 students. After the administration of the test, the collected script shows there were 56 male and 64 female.

The instrument used in the study was Mathematics Achievement Test (MAT) on the concept of plane shape. MAT, had 2 sections: A and B. Section A contained students'

demographic information while Section B initially was a 36 multiple choice item questions of four options each having the correct answer among them. The instrument was subjected to face and content validation by three expert in mathematics education and three in psychology. Their comments, suggestions and corrections were adhered to, which resulted to the reduction of MAT to 25 items. The instrument was trial tested on 30 students who were not part of the study but had homogenous qualities as those in the study. The data collected from the trial test were used to ascertain the reliability of the instrument. The Kuder Richardson Formula KR-21 was used to calculate the reliability of MAT, and a reliability coefficient of 0.81 was obtained.

The regular teachers of the two schools were used as research assistance. A one week training programme was organized for the teachers before the commencement of the study. The exercise was based on the purpose of the study, the content area to be taught, the general conduct of the study. After the training sessions, they were issued with the lesson package for both mastery learning strategy and collaborative learning strategy. The MAT pretest was administered and collected back before the lesson commence for both groups. The experimental group I was taught using mastery learning strategy on the concept of plane shapes and their properties while the experimental group II was taught using collaborative teaching strategy on the same concept of plane shapes and their properties. The instructional period lasted for two weeks of single periods of 40mins. This period was the specified period by the scheme of work. The teacher administered the MAT posttest at the end of the study for both groups. The scripts well collected and scored by the teachers using the marking guide of the researcher. The MAT was scored 4 marks for any correct item.

Results

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

Research Question 1 What is the mean gain difference in the academic performance of mathematics students when taught with mastery and collaborative learning strategies?
This research question was answered using Means.

Table 1: Summary of mean and mean gain of pretest and posttest scores of students taught with mastery and collaborative learning strategies.

Group	N	Pretest	SD	Posttest	SD	Mean Gain
Mastery	58	53.3	11.4	67.4	14.5	14.1
Collaborative	62	55.2	17.4	64.8	15.0	9.6

Table 1 revealed that the mean gain of mastery strategy group is 14.1 while that of collaborative group is 9.6. This implies that students taught using mastery learning strategy performed better than those taught using collaborative learning strategy. In order to ascertain if this difference is statistically significant, the data were further subjected to Analysis of covariance statistical test as shown in Table 3.

Research Question 2: What is the mean gain difference in the academic performance of mathematics students male and female when taught with mastery and collaborative learning strategies?

Table 2: Summary of mean and mean gain of pretest and posttest score of male and female students in mathematics when taught using mastery and collaborative learning strategies

Group Mastery	N	Pretest	SD	Posttest	SD	Mean Gain
Male	26	54.6	11.04	68.0	15.24	13.4
Female	32	52.2	11.84	66.9	13.97	14.7
Group Collaborative	**N**	**Pretest**	**SD**	**Posttest**	**SD**	**Mean Gain**
Male	28	54.3	16.87	62.9	15.43	8.6
Female	34	52.9	18.11	66.4	14.70	10.5

As shown in Table 2, the mean gain of male students is 13.4 while that of female students is 14.7. This indicates that female students performed better than their male counterparts when taught using mastery learning strategy. Table 2 further revealed that the mean gain of male students when taught using collaborative learning strategy is 8.6 while that of female student is 10.5. This implies that female students performed better that their male counterparts when taught using collaborative learning strategy. In order to further ascertain whether this difference is statistically significant, the data was further subjected to ANCOVA statistics as shown in Table 5.

Testing of Null Hypotheses

Research hypotheses were tested using Analysis of Covariance (ANCOVA).

Null Hypothesis 1

There is no significant differential effect of mastery and collaborative learning strategies on students' academic performance in mathematics.

Table 3: Covariance analysis result on the differential effect of mastery and collaborative learning strategy on students' academic performance in mathematics. (N = 120)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	440.999[a]	2	220.499	1.015	.366
Intercept	30201.345	1	30201.345	138.997	.000
METHODPRETEST	227.665	1	227.665	1.048	.308
GROUPS	240.926	1	240.926	1.109	.295
Error	25421.801	117	217.280		
Total	550168.000	120			
Corrected Total	25862.800	119			

Table 4 showed that the calculated probability value (P-value) of 0.295* is greater than the declared probability value (alpha level of .05). Therefore, the null hypothesis one is accepted or retained. This implies that there exists no significant differential effect of mastery and collaborative learning strategies on students' academic performance in mathematics. Hence, the mean difference observed earlier is not statistically significant @ 0.05 probability level.

Null Hypothesis 2

There is no significant differential effect of mastery and collaborative learning strategies on male and female students' academic performance in mathematics:

Table 4: Covariance analysis result on the differential effect of mastery and collaborative learning strategy on male and female students' academic performance in mathematics. (N = 120)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	250.119[a]	2	125.060	.571	.566
Intercept	30535.789	1	30535.789	139.489	.000
METHODPRETEST	202.783	1	202.783	.926	.338
GENDER	50.047	1	50.047	.229	.633
Error	25612.681	117	218.912		
Total	550168.000	120			
Corrected Total	25862.800	119			

As shown in table 5, the calculated P-value f 0.633* of gender is greater than the declared alpha level of 0.05. Therefore the null hypothesis earlier stated cannot be rejected rather retained. The result of this finding implies that there is no significant difference between the performance of male and female students taught using mastery learning strategy. Though there is a mean difference between the scores of the two groups but such difference is not statistically significant. The null hypothesis is retained at 0.05 probability level.

Discussion of Findings

Results obtained from research question one and hypothesis one showed that students taught using mastery learning strategy and collaborative learning strategy performed equally in mathematics achievement. The calculated p–value of 0.295 was greater than the declared p–value of 0.05. This means that there was no significant differential effect of mastery learning strategy and collaborative learning strategy on students' academic performance in mathematics. The finding is similar to the findings of Akinsola (2011) who reported that students taught using mastering learning strategy gained more advantage in mathematics than those taught using conventional approach. This finding is also similar to that of Awoderu and Oludipe (2012) whose study revealed that collaborative learning strategy was more effective in enhancing students' academic performance in sciences more than the conventional strategy.

Results in research questions two, three and hypothesis two revealed that there was no significant differential effect of mastery and collaborative learning strategies on male and female students' academic performance in mathematics though the performances of male students were better in mastery learning strategy while female students took the lead in collaborative learning strategy. This indicated that both male and female students performances were enhance equally, disagreeing with the saying that mathematics is a masculine subject.

Conclusion

The use of mastery and collaborative learning strategies is found to arouse students' interest and improve their performance as well as bridge the gap between male and female students performance in mathematics. These strategies help students in such a way that students are able to appreciate the relationship between abstract and applied mathematics when taught the concept of plane shapes. Finally, these strategies can be conveniently used to

promote and foster students' motivation to learn and consequently improve their academic performance in mathematics irrespective of their gender stereotype.

Recommendations

Based on the findings of this study, the following recommendations were made;

1. Mathematics teachers should be encouraged to incorporate the use of mastery and collaborative learning strategies as this will help students to learn independently as well as share ideas among themselves for better achievement.
2. Government and other relevant stakeholders in education should provide in service training for mathematics teachers on how to use good instructional strategy in teaching and learning to enhance students' cognitive ability in mathematics.

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