



Effect of Modified Lesson Study Technique on Secondary School Students' Academic Achievement in Mathematics in Obowo Lga of Imo State

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Abstract

The study determined the effects modified lesson study techniques on academic achievement of SS1 students in mathematics in Obowo LGA of Imo State. Two research questions and two null hypotheses tested at 0.05 alpha levels guided the study. The research adopted a quasi-experimental design, specifically, pre-test and post-test non randomized control group design. The population comprised 1926 (964 males and 980 females) students in the seven public secondary schools in Obowo LGA of Imo State. The sample size was 108 students selected through a multistage sampling procedure. Mathematics Achievement Test (MAT) and Teacher Planned Lesson Observation (TPLO) were used as instruments for data collection. The instruments were face and content validated. The reliability co-efficient value for MAT is 0.84 which was calculated using the Kuder – Richardson Formula 20, and the reliability for TPLO is 0.79 which was established using Cronbach Alpha. Experimental group was taught using modified planned lesson mode (MPLM) while the control group was taught with the traditional teaching mode (TTM). Mean and standard deviation were used to answer the research questions while the hypotheses were tested using Analysis of covariance. The results of the study showed among others that students taught mathematics with MPLM achieved significantly higher than those taught with TTM. Gender does not significantly influence the achievement of students taught mathematics using MPLM and TTM. The study recommended among others that curriculum planners should use modified lesson study techniques as integral part of the teaching and learning of mathematics in secondary schools.

Keywords: Mathematics, Achievement, Lesson study, Teaching techniques, Secondary schools.

Introduction

Mathematics is a science of expression studying the relationship between quantities and magnitudes of objects as represented by numbers and symbols. Mathematics is a knowledge that opens up the mind to logical reasoning, analytical thinking and ability for creative thinking, deep focusing and clarity of thought and precision. Meanwhile, without mathematics; science, commerce, industry, the internet, and the entire global economic infrastructure are struck dump. This is because; mathematics is the bases for science and technology which are the in thing in the societal growth and development. Mathematics is regarded as pillar of almost all streams in academics given its importance in tertiary education and most careers, because it was made compulsory for admission into all the courses in the universities and other higher institutions.

The Federal Government of Nigeria, in the National Policy on Education (Federal Republic of Nigeria, 2013) made mathematics one of the compulsory subjects for secondary school students. The reason is that mathematics, being the “queen” of all sciences, lays the foundation for science and technology. Aminu (2014) pointed that mathematics is not only the language of science but essential nutrient

for thought, logical reasoning and progress. Mathematics liberates the mind and also gives individuals an assessment of the intellectual abilities by pointing towards deviation of improvement. Usman (2002), considered mathematics as a subject that encroaches into all aspects of human endeavour and further described mathematics as the life wire in the studies of various disciplines.

Despite the efforts of stakeholders in mathematics, the problem of poor achievement in mathematics (trigonometry) has continued to be noticed in the public examinations like WASSCE. The choice of this topic was because WAEC Chief Examiners (2015) identified trigonometry as the most difficult area for senior secondary school students to comprehend and researchers like Okigbo and Ejikeme (2017) found the same trigonometry the most difficult area in mathematics for students to learn and teachers to teach. According to WAEC Chief Examiner's Report (2015), students failed trigonometry in WAEC results, more than seventy percent (70%) of the candidates did not touch that area. Therefore, efforts should be undertaken to immediately improve the situation. As a result, Oyedeji (2012) stated that the use of sole expository method whereby the teacher talks about the subject while the students remain passive is



a major cause of the poor performance in mathematics. In the expository method, communication flows in one direction-from the teacher to the learners. In other words, it is a teacher- centred method and competition the order of the day.

In our education system, students try to do better than the other students in the classroom to be at the 'top' of their class. According to Akinbobola (2006), Nigerian educational system is based upon competition among students for grades, social recognition, scholarship and admission to top schools. Competition fosters in a win-lose situation where superior students reap all rewards and recognition and mediocre or low achieving students reap none. Hence, the researcher sees the need to investigate the effect of modified lesson study techniques on secondary school students' achievement in mathematics.

Teaching technique is set of unique activities which the teacher employs to implement a particular teaching method. It is also ways of implementing a method (Onyemerekeya, 2004). Therefore, the teaching of mathematics is not about dispensing rules, definitions and procedures- for students to memorize, but engaging students as active participants through discussion and collaboration among students. Learning is meaningful if students are given the opportunities to explain or clarify ideas. That is, instructional techniques that will make mathematics simple, meaningful and at the same time interesting are required. Lesson study is the process of studying a lesson planned to finding out the best way to impact knowledge. It is a professionally and systematically developed process to examine teaching and learning with the aim of making it more effective (Dogo, 2017). Lesson study involves planning, teaching, observing and critiquing a lesson. It could also be seen as a process that involves a group of teachers who cooperatively plan a lesson and any of the members teaches the lesson by interacting with the students, the others observe the lesson, review and reflect on the lesson and revise the lesson planned. According to Easton (2009), lesson study requires teachers to work collaboratively to strengthen a given lesson until it has been refined as much as possible and then teach it to get powerful data about how well the lesson works.

Preparing a lesson involves planning for teaching. Planning for teaching is a very important task for the teacher in the education of children. Onyemerekeya (2004) maintained that planning enables the teacher predicts the course of events during teaching. A plan is a blue-print for action. Planning is

anticipatory decision making and involves the teacher in making decision on what to do, how to do it, and when to do it. Meanwhile, planning for teaching goes beyond merely writing a lesson notes, but is rather a systematic attempt to foresee the scope and sequence of courses, the content within courses, the units to be taught, the activities and resources required for every phase of teaching and learning of a given content prepared in the advance of teaching (Onyemerekeya, 2004). Using this technique in the teaching of mathematics may help improve the teaching and learning of mathematics in secondary schools, which may lead to improved achievement in the subject.

Achievement is the feeling of getting things done as desired or getting things expected. Okafor (2011) described achievement as the act of accomplishing or finishing something, something accomplished successfully, especially by means of exertion, skill, practice or perseverance. It is not only reaching greater heights but also getting something after a bit of struggle, the extent to which a student, teacher or institution achieved their short or long-term educational goals is called academic achievement. Meanwhile, Academic achievement is determined by the level of accomplishment of a given task evaluated by the teacher through achievement test, assignment, etc. Adeyemi (2008) describes academic achievement as the scholastic standing of a student at a given moment which states the individual's intellectual abilities. Achievement in mathematics therefore identifies how good or poor students have accomplished a given mathematics task or test. In this study, achievement is measured using Mathematics Achievement Test (MAT).

Thus, achievement in mathematics may not necessarily take place unless teachers form solid foundation for solid instruction through effectively planned lesson and activity- oriented techniques. Here, modified lesson study involves planning, teaching, observing and critiquing a lesson. That is, group of teachers cooperatively plan a lesson and any of the members teaches the lesson by interacting with the students, the others observe the lesson, review and reflect on the lesson and revise the lesson planned for modified lesson to emerge. The control group was critiqued and modified to form the modified lesson. This will in no small measure foster achievement, retention and mastering of the concepts in mathematics. However, improved achievement could aid the achievement of mathematics concepts taught. The use of lesson study techniques could also help



both genders (male and female secondary school students) to achieve mathematics concepts taught.

Gender is referring to the social roles that the men and women play and the power relations between them, which usually have a profound effect on the use and management of natural resources. Gender is a socially constructed definition of men and women (Orabi, 2007). According to Mankumari and Ajay (2017), scholars, policymakers, and practitioners have observed and seem to agree upon socially constructed differences between male and female and its significant effects in their lives. Studies conducted across the world among the students studying in different levels found a significant gender difference in academic performance. Gender is not only based on sex, or the biological differences between men and women, it is being shaped by culture, social relations and natural environment (Orabi, 2007). Gender issue in science education has been a subject of discourse and concern to science educators. According to Okereke (2006), Mathematics teachers also come to class loaded with a high dosage of sex related stereotypes, which make them treat boys and girls differently. Due to sex role stereotyping, it is generally believed that mathematics is suitable for boys and not for girls. On the contrary, Etsu and Ahmad (2018) reported that there is no significant difference in the academic achievement and retention of students in mathematics when taught with laboratory based approach. The result agreed with Ogoke (2018) and Shafi (2018), who reported no significant difference in the academic achievement and retention of students in mathematics. Several studies have reported that female students outperform their male counterparts (Orabi, 2007). Ghazvini & Khajehpour (2011) further argued that even gender difference exists at the level of cognitive functioning in the academic environment. Girls are likely to be more adaptive in learning in a different environment. However, Wangu (2014) in a study conducted among the students of secondary schools in Kenya observed boys passing more than girls. By implication, the method of teaching may encourage both male and female students. Thus, modified lesson study technique as designed for this study could also encourage students at different achievement levels in mathematics. The present researcher is motivated to find out the effects of modified lesson study techniques on academic achievement of male and female students in mathematics.

In light of the issues raised, the purpose of this study was to determine the effect of modified lesson study techniques on academic achievement of secondary school students in mathematics in Obowo LGA of Imo State. Specifically, this study was designed to determine the:

1. Differences between the mean achievement scores of students taught mathematics with modified planned lesson mode (MPLM) and traditional teaching mode (TTM).
2. Differences between the pre-test and post-test mean achievement scores of male and female students taught mathematics with MPLM and TTM.

Based on the purpose of the study, the following **research questions** were formed:

1. What are the differences between the mean achievement scores of students taught mathematics with modified planned lesson mode (MPLM) and traditional teaching mode (TTM)?
2. What are the differences between the mean achievement scores of male and female students taught mathematics with MPLM and TTM?

The following **hypotheses** guided the study:

1. There is no significant difference between the mean achievement scores of students taught mathematics with modified planned lesson mode (MPLM) and traditional teaching mode (TTM).
2. There is no significant difference between the mean achievement scores of male and female students taught mathematics with MPLM and TTM.

Method

The research adopted a quasi-experimental design, specifically, pre-test and post-test non randomized control group design. Intact classes were used in this study to avoid randomization because randomization disrupts normal class activities. The population comprised 1926 (964 males and 980 females) students in the seven public secondary schools in Obowo LGA of Imo State. The sample size was 108 students obtained through a multistage sampling procedure. Mathematics Achievement Test (MAT) and Teacher Planned Lesson Observation (TPLO) were used as instruments for data collection. MAT was used as pre-test (before teaching) and post- test (after teaching) to



collect data. It was made up 50 multiple choice questions, with four options formulated through the help of table of specification. TPLO was used for evaluation by the teachers who observed the lesson taught which helped in the modification of the traditional teaching mode lesson. The TPLO instrument was made up 15 items for only control group.

Camera was mounted in the traditional teaching mode class to capture every activity of the teacher and the students to avoid error in teachers' attitudes and teaching. Also, the class teacher and the students were not aware of the mounted camera to avoid alteration or reactivity by the participants of the study due to their awareness of being observed. The researcher mounted the camera with the permission of the principal of the school and the school prefect who was used to mount it. The researcher told them the importance of keeping it a secret. This tool was responded to by the teachers at the end of each traditional lesson. The responses were used during reflection section after the presentation of each traditional planned lesson in order to plan for modified lesson.

Lesson plans served as instructional tools. The dependent variable in this study is students' achievement while modified planned lesson study

technique is the independent variable. Gender is the intervening variable that may confound the outcome of the study. To reduce hawthorn effect, the contact teaching periods of the study scheduled within the schools' normal time-table and the tests were administered during the summative test periods of the schools. Also, their class teachers taught them normally.

The instruments were face and content validated by experts. The content validation was done through the help of table of specification. The reliability co-efficient value for MAT is 0.84 which was calculated using the Kuder – Richardson Formula 20, and the reliability for TPLO is 0.79 which was established using Cronbach Alpha. Experimental group was taught using modified planned lesson mode (MPLM) while the control group was taught with the traditional teaching mode (TTM). Mean and standard deviation were used to answer the research questions while the hypotheses were tested using Analysis of covariance.

Results

Table 1: Mean and Standard Deviation of achievement scores in Pre-test and Post-test of the Treatment groups

Group	N	Mean Pretest Score	SD Pretest Score	Mean Posttest Score	SD Posttest Score	Mean Gain Score
MPLM	49	32.41	8.74	57.89	10.66	25.48
TTM	31	30.58	7.96	46.58	8.36	16.00

From Table 1, MPLM group has a mean gain score in achievement of 25.48 while TTM has mean gain score of 16.00. This shows that the students in MPLM group

achieved higher than TTM group. In general, the table reveals that the standard deviation score for each group is very high in both pre-test and posttest.

Table 2: Mean Achievement scores of male and female Students taught with MPLM and TTM

Group	N	Mean Pre-test score	SD Pre-test score	Mean Posttest Score	SD Posttest Score	Mean Difference.
MPLM						
Male	23	32.00	8.80	51.40	10.80	2.10
Female	26	31.70	9.70	49.30	13.10	
TTM						
Male	15	31.74	8.22	50.44	10.00	2.77
Female	16	31.68	8.32	47.67	12.62	

From Table 2, the male students taught mathematics with MPLT had mean achievement score of 51.40 while the female students had 49.30 given a mean

difference of 2.10 in favour of the male students. Table 2 further reveals that female students had higher standard deviation (SD) score before than their male



counterparts in the use of MPLM. In general, male students achieved higher than their female counterparts when taught with MPLM. Also, from Table 2, the male students taught mathematics with TTM had mean achievement score of 50.44 while the female students had 47.67 given a mean difference of

2.77 in favour of the male students. Table 2 further reveals that female students had higher standard deviation (SD) score before than their male counterparts in the use of TTM. In general, male students achieved higher than their female counterparts when taught with TTM.

Table 3: ANCOVA Test of significant difference between the mean achievement scores of students in the treatment groups

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	15692.385a	8	923.081	37.285	.000	.840
Intercept	16273.157	1	16273.157	657.299	.000	.845
Pre-test	267.971	1	267.971	10.824	.001	.082
Method	826.267	2	413.134	16.687	.000	.216
Gender	116.144	2	116.144	4.691	.032	.037
Error	2995.673	99	24.758			
Total	405016.000	108				
Corrected Total	18688.058	107				

Table 3 reveals that significant difference exists between the achievement scores of students taught mathematics with modified planned lesson mode (MPLM) and traditional teaching mode (TTM), $F(2, 121) = 16.687, P = 0.000 < 0.05$. Thus, there is a

significant difference between the mean achievement scores of students taught mathematics with modified planned lesson mode (MPLM) and traditional teaching mode (TTM).

Table 4: ANCOVA test of significant difference between the mean achievement scores of Male and Female students taught with MPLM and TTM

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	12781.544a	12	1065.129	43.891	.000	.847
Intercept	15888.456	1	15888.456	654.720	.000	.873
Pretest	114.588	1	114.588	4.722	.032	.047
Method	125.267	2	125.267	5.162	.025	.052
Gender	39.375	2	39.375	1.623	.206	.017
Ability	6658.861	2	3329.431	137.197	.000	.743
Method * Gender	9.404	1	9.404	.388	.535	.004
Method * Ability	46.935	2	23.467	.967	.384	.020
Gender * Ability	73.230	2	36.615	1.509	.226	.031
Method * Gender * Ability	5.769	2	2.884	.119	.888	.002
Error	2305.419	95	24.268			
Total	335656.000	108				
Corrected Total	15086.963	107				

From the result of the ANCOVA test as shown in Table 4, the statement of hypothesis 2 is not rejected; implying that there is no significant difference in the mean achievement scores of male and female students taught mathematics using both MPLM and TTM, $(1, 95) = 1.623, P = 0.206 > 0.05$.

The result of the study revealed that students taught mathematics with MPLM achieved more than those taught with TTM; showing that MPLM is very effective on students' achievement in mathematics. That is to say, the modified lesson study which involves planning, teaching, observing and critiquing a lesson was very effective. It could also be seen that

Discussion



the group of teachers who cooperatively plan the lesson really did a good work and the interaction with the students was supper. In the modified lesson study, there was an effective preparation, since a plan is a blue-print for action. Planning for teaching is a very important task for the teacher in the education of children. Onyemerekeya (2004) maintained that planning enables the teacher predicts the course of events during teaching.

On the other hands, this lesson study that requires teachers to work collaboratively to strengthen a given lesson until it has been refined as much as possible and then teach it to get powerful data about how well the lesson works was not there in TTM. The findings of this study are in line with Ibraheem (2011), Ozofor (2015) and Sufiyanu and Mustapha (2017) who maintained that two modes of lesson study are effective in achievement in mathematics. Also, the result of the study corresponded with the findings of Dogo, Kyeleve and Kurumeh (2018) who recommended among other things that the two modes of lesson study should be used in the planning and implementing lessons for the various topics in mathematics because it improves students' achievement in mathematics.

This study further revealed that there is no significant difference in the mean achievement scores of male and female students taught mathematics using both MPLM and TTM. This means that achievement of students in relation to both MPLM and TTM is not influenced by gender of the students. Yet, Etsu and Ahmad (2018) reported that there is no significant difference in the academic achievement of students in the use of laboratory based approach in mathematics. The result agreed with Ogoke (2018) and Shafi (2018), John, Benjamin and Imoko (2015) who reported no significant difference in the academic achievement of students in mathematics. On the contrary, Abba and Habu (2014) discovered the existence of significant difference between male and female performance in Geometry achievement test. The finding of Ezeudu (2005) and Anaekwe (2007) also supported that there was a significant gender influence on achievement scores of students.

This study has shown that the MPLM has significant positive effect on students' achievement in mathematics irrespective of their gender. The MPLM is more effective than the TTM, an indication that the teachers prepared the lesson collaboratively, everybody bringing his or her best without

reservations.

Conclusion

The result of the study revealed that students taught mathematics with MPLM achieved more than those taught with TTM; showing that MPLM is very effective on students' achievement in mathematics. Also, the study further revealed that there is no significant difference in the mean achievement scores of male and female students taught mathematics using both MPLM and TTM. This means that achievement of students in relation to both MPLM and TTM is not influenced by gender of the students. The two strategies are gender friendly

Recommendations

Based on the findings, the following recommendations were made;

- i. The researcher recommended that modified lesson study should be an integral part of the teaching and learning of mathematics
- ii. Mathematics teachers should adopt the use of modified lesson study in the teaching so as to allow the students participate in the activities of the classroom.
- iii. Curriculum planners should integrate the use of modified lesson study when revising mathematics curriculum for secondary schools.

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