

IMPROVISATION SKILLS POSSESSED BY MATHEMATICS TEACHERS IN JUNIOR SECONDARY SCHOOLS IN RIVERS STATE, NIGERIA.

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Abstract

This study investigated the improvisation skills possessed by mathematics teachers in junior secondary schools in Rivers State, Nigeria. Two objectives, two research questions and two hypotheses guided the study. The survey research design was employed and 98 mathematics teachers were sampled using the simple random sampling technique. A validated two part researcher constructed structured questionnaire was the instrument for data collection. The name of the instrument was Mathematics Teachers Improvisation Skills (MTIS). The descriptive statistic (frequency count and simple percentage) were used to answer the research questions while the t-test was used to test the hypotheses at .05 alpha level. The findings of the study revealed that the professional and experienced mathematics teachers possess more improvisation skills than the non-professional and less experienced mathematics teachers respectively. There was also a significant difference between the mean responses of PMT and NPMT, EMT and LEMT with respect to improvisation skills possessed for improvisation of instructional materials. Based on the findings, it was recommended amongst others that improvisation workshops and seminars should be organised to train mathematics teachers on the basic skills needed for improvisation of instructional materials in mathematics.

Keywords: Improvisation, mathematics, skills, teacher.

1.1 Introduction

Mathematics is a subject that has been defined by various authorities. One of the characteristics of mathematics from the various definitions is that it is a subject that is encapsulated with abstractions. It is also a subject that many students dread as a result of the myths that surround the subject (Buckley, 2013, Taylor, 2010). Glenda and Walshaw (2009) posited that many students struggle with mathematics and this makes them to become disaffected. The performance of students in mathematics has persistently continued to be poor. There are learning theories which have been propounded by scholars to support the teaching and learning of mathematics. These learning theories were propounded as a result of the nature and structure of mathematics. Such learning theories include but not limited to Piaget's theory of cognitive development, Skemp's theory of concept formation, Vygotsky's theory of social constructivism, Ladson-Billings culturally responsive teaching theory, Bruner's theory of instruction and Gagne's theory of conditions of learning.

Learning theories are the guiding framework that explains how learning takes place and the implications of such are also outlined. The principles of teaching mathematics are drawn from the different learning theories. Principles of teaching mathematics are the accepted fundamental rules and guidelines used to teach mathematics in order for meaningful learning to take place. In as much as abstraction is involved in the subject matter of mathematics, it implies that it will take a great deal for such abstract concepts to be understood by students when taught. It is therefore advocated that the teaching of mathematics concepts should be concretized. Concretization of mathematics concepts means teaching mathematics from concrete to abstract. This calls for use of available standard instructional resources to carry out instruction in mathematics. But a situation where the standard instructional materials are not available, as a result of inability of government to provide instructional materials for schools, it becomes imperative that the mathematics teacher makes an alternative move to locally produce instructional materials to teach mathematics. This alternative move to produce instructional materials using resources in the local environment is called improvisation. Abolade and Olumorin (2004) in their study reported that most of the standard instructional materials produced in the factory are scarce

and expensive to buy. Abolade (2009) emphasized that it is when the original instructional materials are not readily available for use in teaching and learning that the teacher can come up with other forms of instructional materials.

Mboto, Ndem & Utibe-Abasi (2011) defined improvisation as the act of providing teaching materials from our locality when there is shortage of the standard ones. Improvisation is the ability to take existing pieces of materials from our environment and put them together in a new combination for a purpose. Oxford (2000) in Asokhia (2009) defined improvisation as the use of what is available as a result of lack of what is actually needed. Improvisation of instructional materials for teaching mathematics is the ability of the mathematics teachers and students to create appropriate, adequate and relevant material resources. There are prerequisite skills that mathematics teachers need for the improvisation of instructional materials. In order to effectively produce instructional materials from locally sourced materials, the teacher must have adequate skills which are basic. This acquisition of skill can be made possible through constant practice and observation of the experts. They also must include the knowledge of the basic principles and elements of design. Some of the skills needed in production of instructional materials are cutting, folding, painting, measurement, sorting, assembling and mounting of devices.

Maleu & Lajoie (2011) stated the need for teachers to possess professional improvisation skills. It is therefore not an understatement to say that teachers' possession of the professional competencies in the improvisation of mathematics instructional materials will guide against improvisation of substandard/poor instructional materials. This is because poorly improvised instructional materials will lead students to misconception. The effect of use of relevant and adequate instructional material (be it standard or improvised) in students' achievement in mathematics should in its ideal sense improve their understanding of mathematical concepts. Olumorin, Yusuf, Ajidagba & Jekayinfa (2010) posited that a teacher must be equipped with the basic improvisation skills to pave way for a successful improvisation of instructional materials from locally sourced materials. To this end Ibaam (2012) asserted that the skills needed for a successful improvisation of instructional materials are cutting, colouring, measurement, folding, sorting, dismantling, assembling,

creative and manipulative. Usman & Adewumi (2006) posited that the ability of a teacher to improvise requires professional commitment, competence, creativity, initiative, mechanical skills and resourcefulness. This implies that the level of improvisation skills possessed by teachers varies from one teacher to another. In the business of mathematics teaching in the classroom, Samandi & Kauri (2014) categorised teachers into the following:

1. The professional mathematics teachers
2. The non-professional mathematics teacher
3. The experienced mathematics teacher
4. The less experienced mathematics teacher

Usman & Adewumi (2006) carried out a study on factors responsible for inability of teachers to improvise instructional materials for teaching mathematics and found out that most mathematics teachers do not possess the required skills needed for the improvisation of instructional materials and that some of the factors responsible for lack of improvisation include non specialization of teachers in mathematics education, excessive teaching load, no improvisation incentives paid to teachers and no in-service training for acquisition of knowledge and skills required for improvisation. In the study of Iji, Ogbole & Uka (2014) on the effect of improvised instructional materials on students' achievement in geometry at the upper basic educational level in Makurdi metropolis, it was found that students who were taught geometry using improvised instructional materials improved upon their mean achievement scores than those students who were taught without improvised instructional materials. Onasanya and Omosewo (2011) carried out a research on the effect of improvised and standard instructional materials on secondary school students' academic performance in physics in Ilorin and the result showed that there was no significant difference in the posttest scores between the students taught with standard instructional materials and improvised instructional materials. Utibe-Abasi (2015) investigated the problems faced by secondary school physics teachers in improvising instructional materials for effective teaching and learning of physics and found that financial constraints, lack of improvisation skills and strategies on improvisation, large class size, lack of exposure on improvisation,

time constraints and unavailability of tools constituted the factors that hinder teachers from improvisation.

1.2 Statement of the Problem

The use of instructional materials in the teaching of mathematics helps to enrich learning. Before now, the Nigerian government used to purchase and supply instructional materials to schools. The present scenario in the educational system reveals that the poor funding of schools has led to the dearth of instructional materials in schools. The mathematics teachers who are expected to improvise instructional materials to carry out instruction in mathematics do not improvise and as such do not teach mathematics with instructional materials. If mathematics is taught without instructional materials, it then bounces back to teaching mathematics by employing the horrible memorization strategy. There are pre-requisite improvisation skills that teachers need to possess in order to improvise instructional materials. This study therefore sought to investigate whether mathematics teachers possess the required skills needed for improvisation of instructional materials.

1.3 Objectives of the Study

The objectives of this study are to:

1. Ascertain the extent to which professional mathematics teachers (PMT) and non professional mathematics teachers (NPMT) possess the required skills for the improvisation of instructional materials.
2. Determine the extent to which experienced mathematics teachers (EMT) and less experienced mathematics teachers (LEMT) possess the required skills for the improvisation of instructional materials.

1.4 Research Questions

The two research questions that were raised and answered are:

1. What is the extent to which professional mathematics teachers and non professional mathematics teachers possess the required skills for the improvisation of instructional materials?
2. What is the extent to which experienced mathematics teachers and less experienced mathematics teachers possess the required skills for the improvisation of instructional materials?

1.5 Hypotheses

Two null hypotheses were posed and tested at .05 significant level.

HO₁: There is no significant difference between the mean responses of PMT and NPMT with respect to improvisation skills possessed for improvisation of instructional materials.

HO₂: There is no significant difference between the mean responses of EMT and LEMT with respect to improvisation skills possessed for improvisation of instructional materials.

1.6 Research Methodology

1.6.1 Research Design

The survey research design was used for the study.

1.6.2 Population of the Study

The population of the study was made up of all the 215 mathematics teachers in all the senior secondary schools in the twenty three local government areas of Rivers State Nigeria.

1.6.3 Sample/Sampling Technique

The simple random sampling technique was used to select a sample of 98 junior secondary mathematics teachers. Two schools were sampled from each Local Government Area.

1.6.4 Instrumentation

The instrument used for the study was a researcher constructed structured questionnaire named Mathematics Teachers Improvisation Skills “MTIS”. The preliminary part of the instrument elicited information that guided the researchers to categorise teachers into professional, non-professional, experienced or non-experienced. The main part of the instrument elicited information that guided the researchers to ascertain the level of mathematics teachers’ improvisation skills. The rating of MTIS was on a 2-point scale of Possess Skill = 2 and Do Not Possess Skill =1. The decisive factor for each item was 50%.

1.6.5 Method of Data Collection

The instrument was administered to the teachers by the researchers with the help of three trained research assistants. The instruments were administered and retrieved on the same day from the teachers.

1.6.6 Method of Data Analysis

The descriptive statistic (frequency count and simple percentage) were used to answer the research questions while the t-test was used to test the hypotheses at .05 alpha level.

1.7 Results

Research Question 1: What is the extent to which professional mathematics teachers and non professional mathematics teachers possess the required skills for the improvisation of instructional materials?

Table 1: Extent of improvisation skills possessed by PMT and NPMT.

S/N	IMPROVISATION SKILL	NO OF PMT THAT POSSESS THE SKILL n = 59	NO OF NPMT THAT POSSESS THE SKILL n = 39
1	Accurate Measurement	59 (100%)	39 (100%)
2	Drawing	31 (53%)	15(39%)
3	Paper or cardboard folding	45 (76%)	21(54%)
4	Moulding with clay	20 (34%)	5(13%)
5	Lettering & Numbering	45 (76%)	20 (51%)
6	Colour application	35 (59%)	29 (74%)
7	Plotting points	59 (100%)	37 (95%)
8	Cutting of paper/wood/metal	36 (61%)	24 (62%)
9	Marking of paper/wood/metal	24 (41%)	10 (26%)
10	Device mounting	10 (17%)	2 (5%)
11	Driving nails	8 (14%)	2(5%)
12	Filing blades/cutters	35 (59%)	14(36%)
13	Clay collection	15 (25%)	6 (15%)
14	Grinding of clay	12 (20%)	4 (10%)
15	Hole boring in wood/plastic/metal	40 (68%)	20 (51%)
16	Assembling of paper/wood/metal/tool	43 (73%)	15(39%)
17	Joining paper/wood/meta/plastic	39 (66%)	20 (51%)
18	Smoothing of wood	37 (63%)	18 (46%)
19	Greasing	40 (68%)	21 (54%)
20	Gluing	42 (71%)	11 (28%)
21	Collection	38 (65%)	19 (49%)
22	Tool identification	39 (66%)	12 (31%)
23	ICT	25 (42%)	14 (36%)

Criterion percentage = 50%

Table 1 showed that the professional mathematics teachers possess 16 improvisation skills out of the 23 improvisation skills listed in the questionnaire while the non-professional mathematics teachers possess 9 improvisation skills out of the 23 improvisation skills listed

in the questionnaire. This implies that the professional mathematics teachers possess more mathematics laboratory improvisation skills than the non-professional mathematics teachers.

Research Question 2: What is the extent to which experienced mathematics teachers and less experienced mathematics teachers possess the required skills for the improvisation of instructional materials?

Table 2: Extent of improvisation skills possessed by EMT and LEMT

S/n	Improvisation skill	No of EMT that possess the skill n = 67	No of LEMT that possess the skill n = 31
1	Accurate Measurement	67 (100%)	31(100%)
2	Drawing	52 (77%)	14 (45%)
3	Paper or cardboard folding	67 (100%)	19 (61%)
4	Moulding with clay	28 (42%)	8 (26%)
5	Lettering & Numbering	65 (97%)	25 (81%)
6	Colour application	62 (92%)	28 (90%)
7	Plotting points	66 (99%)	20 (65%)
8	Cutting of paper/wood/metal	52 (77%)	9 (29%)
9	Marking of paper/wood/metal	46 (69%)	17 (55%)
10	Device mounting	35 (52%)	5 (16%)
11	Driving nails	32 (48%)	11 (35%)
12	Filing blades/cutters	52 (77%)	20 (65%)
13	Clay collection	30 (45%)	7 (23%)
14	Grinding of clay	29 (43%)	3 (1%)
15	Hole boring in wood/plastic/metal	34 (51%)	6 (19%)
16	Assembling of paper/wood/metal/tool	30 (45%)	15 (48%)
17	Joining paper/wood/meta/plastic	37 (55%)	12 (39%)
18	Smoothing of wood	48 (72%)	8 (26%)
19	Greasing	42 (63%)	23(74)
20	Gluing	51(76%)	27 (87%)
21	Collection	62 (92%)	22 (71%)
22	Tool identification	67 (100%)	19 (61%)
23	ICT	29 (43%)	13 (42%)

Criterion percentage = 50%

Table 2 showed that the experience mathematics teachers possess 17 improvisation skills out of the 23 improvisation skills listed in the questionnaire while the less experience mathematics teachers possess 11 improvisation skills out of the 23 improvisation skills listed in the questionnaire. This implies that the experience mathematics teachers possess more mathematics laboratory improvisation skills than the less experience mathematics teachers.

H_{O_1} : There is no significant difference between the mean responses of PMT and NPMT with respect to improvisation skills possessed for improvisation of instructional materials.

Table 3: t-test analysis of improvisation skills possessed by PMT and NPMT.

Respondents	N	Mean response	SD	Df	Std Error	t-cal	t-crit	Decision
PMT	59	35.24	16.40	96	2.64	9.42	1.98	Reject
NPMT	39	12.83	13.27					

Table 3 showed that the t-calculated is 9.42 and t-critical is 1.98. Since the t-calculated is greater than the t-critical H_{O_1} was therefore rejected. The rejection of H_{O_1} implies that there is a significant difference between the mean responses of PMT and NPMT with respect to improvisation skills possessed for improvisation of instructional materials.

H_{O_2} : There is no significant difference between the mean responses of EMT and LEMT with respect to improvisation skills possessed for improvisation of instructional materials.

Table 4: t-test analysis of improvisation skills possessed by EMT and LEMT.

Respondents	N	Mean response	SD	Df	Std Error	t-cal	t-crit	Decision
EMT(>5 yrs)	67	37.31	19.05	96	2.82	9.51	1.98	Reject
NEMT(<5 yrs)	31	13.37	8.34					

Table 4 showed that the t-calculated is 9.51 and t-critical is 1.98. Since the t-calculated is greater than the t-critical H_0 was therefore rejected. The rejection of H_0 implies that there is a significant difference between the mean responses of EMT and LEMT with respect to improvisation skills possessed for improvisation of instructional materials.

1.8 Discussion of Findings

All the 23 spelt out improvisation skills needed by mathematics teachers in this study are important for a successful production of relevant instructional material to teach mathematics. The findings of this study showed that all the four categories (professional, non-professional, experienced and less experienced mathematics teachers) of mathematics teachers possess some of the skills required to improvise instructional materials, although in varying extent. This study has shown that the professional mathematics teachers and the experience mathematics teachers possess improvisation skills. This could be as a result of the training they had in mathematics methodology and mathematics laboratory practical during teacher training. This finding is in line The non- professional and less experience mathematics teachers on the other hand do not possess improvisation skills. This is in line with the findings of Usman & Adewumi (2006) who found out that most mathematics teachers do not possess the required skills needed for the improvisation of instructional materials. This is also in line with the result of Utibe-Abasi (2015) which revealed that one of the factors responsible for teachers inability to improvise instructional materials for effective teaching and learning was lack of improvisation skills. It is very important that mathematics teachers, no matter the category (PMT, NPMT, EMT, LEMT), to develop the skills needed for improvisation since the research finding of Onasanya and Omosewo (2011) has shown that there was no significant difference in the posttest scores between the students taught with standard instructional materials and improvised instructional materials. This implies that the standard instructional materials produced in the factory has the same effect of improving students achievement just as locally improvised instructional material would have on students achievement. There is therefore need for teachers improvisation skills to be developed to avoid improvisation of poor instructional materials in mathematics.

1.9 Conclusion

This study therefore concluded that the professional and experienced mathematics teachers possess more improvisation skills than the non-professional and less experienced mathematics teachers respectively. There was a significant difference in the improvisation skills possessed by the professional experienced mathematics teachers and the non professional less experienced mathematics teachers.

2.1 Recommendations

The following recommendations were made based on the findings of this study.

1. Improvisation workshops should be organised by the Ministry of Education.
2. The professional and experienced mathematics teachers should endeavour to guide the non professional and less experienced mathematics teachers on improvisation skills.
3. Every school (pre-primary, primary, post primary and tertiary) should have a mathematics laboratory since mathematics laboratory activities help to develop and boost improvisation skills.

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