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EXTENT OF IMPROVISATION AND UTILIZATION OF INSTRUCTIONAL MATERIALS IN TEACHING MATHEMATICS AMONG SECONDARY SCHOOL MATHEMATICS TEACHERS: A FACTOR IN ENHANCING QUALITY EDUCATION IN NIGERIA.

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Abstract
The purpose of the study was to determine the extent of improvisation and utilization of instructional materials among mathematics teachers in Enugu Senatorial Zone of Enugu State. Two research questions and two hypotheses were used for the study. The study was a survey and used 200 male and female mathematics teachers as samples. A 48 item questionnaire was used in collecting data. Mean and standard deviation were used in answering the two research questions, and t test was used in testing the two hypotheses at 0.05% level of significance. The results showed that male and female teachers each improvised instructional materials in 7 topics and 8 topics respectively out of 24 topics. Males utilized 12 out of 24 instructional materials in teaching mathematics in secondary schools while their female counterparts utilized 11. There was no significant difference between the male and female mathematics teachers on improvisation of instructional materials for teaching and learning mathematics in secondary schools. Similarly, there was no significant difference between the mean scores of male and female mathematics teachers on the utilization of instructional materials for teaching and learning mathematics in secondary schools. It was recommended that the ministry of education should retrain secondary school teachers on improvisation and utilization of instructional materials.

Introduction

Mathematics is a compulsory subject taught in Secondary Schools all over Nigeria. However, it cannot be taught effectively and efficiently unless instructional materials are employed in the classrooms to motivate the students' interest to learn the subject. Obodo (2004) defined motivation as the arousal of tendency to act, to produce one or more effect. A motive is a force that propels or drives a student in a given direction to learn (Chauhan, 1992). It is that which causes a student to act. Hence, Egbo (2011) noted that students should be motivated to learn effectively in order to generate interest in Mathematics and also sustain/maintain such interest.

Interest is essential in effective learning. Therefore, Obodo (2004) defined interest as the feeling of intentness, concern or curiosity about something or objects. Interest is the condition of wanting to know or act (Abugu, 2007). According to Obodo and Abugu (1998), interest can be regarded as the factor that arouses concern or curiosity which holds a student's attention on an object or something. This is why Nwogu (1997) reiterated that interest is a very strong and noted factor in the effective teaching and learning of mathematics.

Obodo (2008) remarked that instructional materials help to generate and sustain interest in students. It also helps them in arousing their tendency to act (motivation) to learning in the students' life. Whittel (2002) indicated that all resources or materials used by teachers of

mathematics in the classroom to promote understanding, quality or value of instruction are known as instructional materials. Obodo (2004) also defined instructional materials as resources, which both the teachers and the students use for the purpose of ensuring effective teaching and learning. Lola (2005) referred to instructional materials as those materials that are used by the teachers to help him communicate his ideas in the classroom. They include those objects or things which the students see, feel, touch, handle and move which help in the comprehension of the concept being taught or consolidated.

Instructional materials are also teaching aids. According to Egbo (2011), instructional materials or teaching aids are to the teacher what salt is to soup. Hence, Nweke (2008) explained that teaching mathematics in secondary schools involves exposing the learners to wide variety of disciplines and this exposure calls for stimulating of various sense organs in the body. This stimulation cannot be effectively achieved without the use of instructional materials.

Lola (2005) consequently pointed out that effective teaching and learning of mathematics is only achieved through proper production and utilization of instructional materials. According to Nweke (2004), instructional materials help in building the interest of the learner, making abstract concepts concrete and sustaining the interest of students in learning. They also open the hall of knowledge, thereby creating the atmosphere for effective learning and also provide a frame reference on which students can key in their attention during classroom activities.

Piotsop (2004) rightly observed that since industrial materials which are employed as instructional materials are not only costly but also limited in supply, it must be considered crucial, relevant and important that mathematics teachers should utilize local materials/resources in improvising for instructional materials which can be used in teaching mathematics.

Egbo (2011) stated that there seem to be varied innovations in mathematics education. These innovations, among others are in the following areas:

a. Innovations of mathematics education curriculum
b. Innovations in evaluation of mathematics and
c. Innovations in mathematics teaching by the overwhelming support of government, educational agencies, education parastatals and the Teacher Registration Council of Nigeria (TRCN).

Obodo (2008) noted that there has been another important change. This change is the change in emphasis from method of teaching to method of learning. This new emphasis (method of learning) emphasizes "doing" as the most effective way of learning because it helps the students in better retention of information and promotes effective learning. One Chinese adage illustrates this view of doing as follows, (National Mathematical Centre, Abuja (NMC), 2002):

What I hear, I may forget.
What I see, I may remember
But what I do, I understand.

It is essential to point out clearly that "doing" helps in concretizing the abstract concepts and ideas of the teachers and students, thereby helping them to overcome some physical difficulties, mental barriers and knowledge deficiencies. Considering the above Chinese adage, both teachers and students need to engage themselves in the improvisation of instructional materials and utilization of it in teaching and learning.

Piotsop (2004) remarked that the worst misuse of instructional materials is not to use them at all when they are needed, and the improper use of them when they are used. Consequently, there is need to ascertain the extent to which teachers and students improvise and use instructional materials in the process of teaching and learning mathematics.

Purpose of the Study

The purpose of this study was to determine the extent of improvisation and utilization of instructional materials among mathematics teachers in Enugu Senatorial Zone of Enugu State. Specifically, the study sought to examine the extent to which

1. Male and female mathematics teachers improvise instructional materials for teaching mathematics in secondary schools.
2. Male and female mathematics teachers utilize instructional materials in teaching and learning mathematics in classrooms.

Research Questions

Two research questions guided the study.

1. To what extent do male and female mathematics teachers improvise instructional materials for teaching and learning mathematics in secondary schools?
2. To what extent do male and female mathematics teachers utilize instructional materials for teaching and learning of mathematics in secondary schools?

Research Hypotheses

Two corresponding hypotheses were formulated for the study as follows. They were tested at 0.05% level of significance.

1. There is no significant difference between the mean scores of male and female mathematics teachers on improvisation of instructional materials for teaching and learning mathematics in secondary schools.
2. There is no significant difference between the mean scores of male and female mathematics teachers on utilization of instructional materials for teaching and learning mathematics in secondary schools.

Method

The research design was a survey research design. This study was conducted in Enugu East Senatorial Zone Enugu State. The population of the study was 630 mathematics teachers teaching in all the 81 state government owned secondary schools in Enugu East Senatorial Zone. A sample of 200 mathematics teachers was chosen for the study through stratification, proportionate sampling and balloting techniques. A 48-item questionnaire was used as instrument for data collection. Section A contained personal data information. Section B contained 24 various topics in mathematics which were listed in the questionnaire. Beside each topic were some relevant instructional materials. Teachers were requested to indicate the extent to which they improvise each. Section C contained 24 mathematics instructional materials and the topics each is used to teach. Teachers were requested to indicate the extent to which they utilize each. The response options for each section were very great extent, great extent, low extent and very low extent. They were scored 4, 3, 2 and 1 points respectively. The research questions were answered using mean and standard deviation. The research hypotheses were tested at 0.05 level of significance using t- test statistic.

Results

The results for research questions 1 are shown in table 1

Table 1: Means and Standard deviations of Male and Female Teachers on improvisation of instructional materials.

S/N	TOPICS	INSTRUCT-IONAL MATERIALS	MALE			FEMALE			OVERALL		
			MEAN	SD	Dec	MEAN	SD	Dec	MEAN	SD	Dec
1	Common number system	Abacus	2.11	076	LE	2.31	0.91	LE	2.21	0.83	LE
2	Number bases	Dienes block and punch card	2.26	0.81	LE	2.41	0.68	LE	2.34	0.75	LE
3	Basic Arithmetic Progression	Cuisenaire rods	2.16	0.70	LE	2.36	0.87	LE	2.26	0.80	LE
4	Common fractions	Fraction charts	2.68	0.60	GE	2.59	0.82	GE	2.64	0.72	GE
5	Decimal fractions	Decimal fraction chart	2.71	0.58	GE	2.61	0.69	GE	2.66	0.62	GE
6	Addition of positive and negative integers	Number line on a chart	2.83	0.77	GE	2.70	0.91	GE	2.77	0.83	GE
7	Subtraction of positive and negative numbers	Number line on a chart	2.00	0.96	LE	1.94	0.70	LE	1.97	0.81	LE
8	Approximation values	Chart	1.82	0.90	LE	2.06	0.69	LE	1.94	0.81	LE
9	Simplification in algebra	Chart	1.63	0.70	LE	1.51	0.49	LE	1.57	0.60	LE
10	Expansion in Algebra	Chart	1.98	0.76	LE	1.69	0.97	LE	1.84	0.85	LE
11	Solid Geometric shapes	Shapes of objects of cone, cube, cuboids	1.89	0.88	LE	1.70	0.96	LE	1.80	0.92	LE
12	Roman numerals system	Roman numerals system chart	2.13	0.58	LE	2.42	0.74	LE	2.28	0.63	LE
13	Areas of geometric shapes	Plane shapes e.g. square rectangle, circle	2.96	0.92	LE	3.14	0.82	GE	3.05	0.85	LE
14	Perimeter of shapes	Geo-bard, graph-board	2.41	0.71	LE	1.98	0.80	LE	2.26	0.76	LE
15	Angles	Geoboard, Chart	2.00	0.51	LE	2.16	0.70	LE	2.08	0.59	LE
16	Basic properties of geometric shapes	Geo-board, graph board, geometric shapes	3.16	0.66	GE	3.01	0.48	GE	3.09	0.58	GE
17	Factorization in algebra	Flow chart	1.96	0.58	LE	1.83	0.91	LE	1.90	0.79	LE
18	Linear inequalities	Weighing balance	2.11	0.67	LE	2.58	0.80	GE	2.35	0.76	LE
19	Graphs	Graph board	3.57	0.96	GE	3.41	0.68	GE	3.49	0.85	GE
20	Constructions	Mathematical set	2.75	0.91	GE	2.65	0.99	GE	2.70	0.94	GE

21	Probabilities	Coins, dice, playing cards	2.14	0.67	LE	1.98	0.76	LE	2.06	0.71	LE
22	Demonstration of symmetry	Graph board and Geoboard	1.55	0.48	LE	1.79	0.80	LE	1.67	0.62	LE
23	Mean, median and mode	Histogram	1.54	0.89	LE	1.86	0.76	LE	1.70	0.83	LE
24	Simple equation	Weighing balance	2.00	0.66	LE	1.92	0.59	LE	1.96	0.61	LE
	Grand		**2.26**	**0.70**	**LE**	**2.28**	**0.81**	**LE**	**2.27**	**0.75**	**LE**

Where SD= Standard Deviation, and Dec= Decision

Table 1 shows that male teachers had mean scores of 2.50 and above in 7 items and mean scores below 2.50 in 17 items.

This finding shows that male teachers improvise mathematics instructional materials for 7 out of 24 topics to a great extent. Female teachers had mean scores of 2.50 and above in 8 items and mean scores below 2.50 in 16 items. This means that female teachers improvise mathematics instructional materials for 8 out of 24 topics to a great extent. The grand mean scores for male, female and overall (both genders combined) are 2.26, 2.28 and 2.27 respectively. These show that each gender and even both improvise mathematics instructional materials to a low extent.

In general, the results for research question 2 are shown in table 2.

Table 2: Means and Standard deviations of male and female teachers on utilization of instructional materials.

S/N	INSTRUCTIONAL MATERIALS	TOPICS	MALE			FEMALE			OVERALL		
			MEAN	SD	Dec	MEAN	SD	Dec	MEAN	SD	Dec
1	Abacus	Common no system	2.96	0.76	GE	2.75	0.91	GE	2.86	0.82	GE
2	Punch cards, dienes block	Number bases	1.36	0.68	LE	1.56	0.59	LE	1.46	0.62	LE
3	Cuisenaire rods	Basic arithmetic	1.87	0.90	LE	2.00	0.81	LE	1.94	0.86	LE
4	Fraction charts-	Common fractions	3.01	0.68	GE	2.91	0.77	GE	2.96	0.73	GE
5	Decimal fraction charts	Decimal fractions	2.69	0.80	GE	2.99	0.69	GE	2.84	0.77	GE
6	Number line charts	Addition of +ve and –ve integers	1.96	0.71	LE	1.89	0.97	LE	1.93	0.87	LE
7	Number line charts	Subtraction of +ve and –ve integers	1.76	0.80	LE	1.68	0.59	LE	1.72	0.69	LE
8	Approximate values charts	Approximate values	2.01	0.69	LE	2.19	0.66	LE	2.10	0.67	LE
9	Algebraic Simplification charts	Simplification in algebra	2.66	0.78	GE	2.59	0.81	GE	2.63	0.79	LE
10	Expansion charts	Expansion in algebra	2.99	0.61	GE	2.74	0.76	GE	2.87	0.70	LE
11	Solid shapes of objects e.g. cones, cubes, cuboids	Geometric shapes	3.26	0.90	GE	3.18	0.80	GE	3.22	0.84	GE
12	Plane geometric shapes e.g. square, triangle,	Areas of geometric shapes	3.42	0.74	GE	3.58	0.49	GE	3.50	0.60	GE

	rectangle										
13	Geo-board, graph board	Perimeter of shape	2.11	0.59	LE	2.22	0.91	LE	2.17	0.73	LE
14	Geo-board	Angles	2.89	0.76	GE	2.48	0.91	LE	2.69	0.83	GE
15	Geo-board	Basic properties of Geometric shapes	3.06	0.68	GE	2.97	0.81	GE	3.01	0.74	GE
16	Flow chart	Factorization in algebra	1.62	0.57	LE	1.88	0.69	LE	1.75	0.65	LE
17	Roman numerals chart	Roman numerals	1.83	0.80	LE	2.00	0.74	LE	1.92	0.78	LE
18	Weighing balance	Inequalities	1.79	0.58	LE	1.64	0.72	LE	1.72	0.66	LE
19	Graph board	Graphs	2.73	0.76	GE	2.91	0.63	GE	2.82	0.68	GE
20	Mathematical set	Constructions	3.76	0.36	GE	3.69	0.48	GE	3.73	0.42	GE
21	Coins, dice and playing cards	Probability	3.28	0.52	GE	3.16	0.84	GE	3.22	0.66	GE
22	Geo-board	Demonstration symmetry	2.31	0.70	LE	2.16	0.64	GE	2.24	0.67	LE
23	Weighing balance	Simple equation	1.97	0.80	LE	1.56	0.62	LE	1.77	0.70	LE
24	Histogram	Mean, median mode	1.76	0.99	LE	1.82	0.85	LE	1.79	0.92	LE
	Grand		**2.47**	**0.79**	**LE**	**2.44**	**0.84**	**LE**	**2.45**	**0.82**	**LE**

Table 2 shows that male teachers had mean scores of 2.50 and above in 12 items out of 24 and mean scores below 2.50 in also 12 items. This means that male teachers utilize 12 out of 24 instructional materials in teaching mathematics. Female teachers had mean scores of 2.50 and above in 11 items out of 24 and mean scores of below 2.50 in 13 items. This shows that female teachers utilize 11 of 24 instructional materials in teaching mathematics. The grand mean scores of 2.47 and 2.44 for male and female teachers' shows that both genders utilize instructional materials to a low extent. Table 3 shows the results for research hypothesis one.

Table 3: Result of t-test for male and female teachers' improvisation of instructional materials.

Gender	Mean	SD	N	t-CAL	t-CRITICAL	DECISION	DF
Male	2.26	0.70	74	0.18	1.96	NS	199
Female	2.28	0.81	126				

Where SD = standard deviation, N = Sample size, df = degree of freedom, NS= Not significant.

Table 3 shows that the calculated t value of 0.11 is less than the t-critical value of 1.96. Hence, the null hypothesis of no difference is accepted. This means that there is no significant difference between the mean scores of male and female teachers on improvisation of mathematics instructional materials for teaching and learning of mathematics in secondary schools.
The result for research hypothesis is presented in table 4.

Table 4: Results of t test for male and female teacher's utilization of Instructional materials

Gender	Mean	SD	N	t-CAL	t-CRITICAL	DECISION	DF
Male	2.47	0.79	74	0.25	1.96	NS	199
Female	2.244	0.84	126				

Table 4 shows that the calculated t- value of 0.25 is less than the t-critical value of 1.96. Thus, the researcher fails to reject the null hypothesis of no significant difference. This means that there is no significant difference between the mean scores of male and female teachers on utilization of mathematics instructional materials for teaching and learning mathematics in secondary schools.

Discussion

The findings of the study show that mathematics teachers do not improvise instructional materials for mathematics teaching and learning in majority of the topics taught in secondary schools. They claimed that they improvise in only 7 topics out of 24 topics. This means that they improvise instructional materials to the tune of approximate 29% (i.e. 7/29 x 100/1 = 29.17%). Thus, the level at which they improvise instructional materials is very low and unsatisfactory. Where teachers are not able to make use of available local resources in improvisation, there is no doubt that students will not learn mathematics effectively. Similarly, the retention of what they have learnt will also be very poor. Obodo (2004) observed that improvisation of mathematics instructional materials goes a long way to facilitate effective teaching and learning and enhances achievement and retention. Where instructional materials are not improvised, the quality of mathematics teaching and learning must below.

One of the reasons proffered by some teachers for not improvising mathematics instructional materials is non-existence of mathematics laboratory where such materials can be properly improvised, used and kept. Again, most teachers do not seem to know or appreciate the importance of such materials. Some think it wastes their time to improvise such materials. The above findings agreed with the findings of Piotsop (2004) and Nweke (2008) who found out that most teachers could not improvise and that most secondary schools do not have mathematics laboratories.

The findings show that male and female mathematics teachers utilize mathematics instructional materials to a low extent. This is portrayed by their mean scores of 2.42 and 2.44 respectively for male and female teachers. It is very appalling to note that teachers do not utilize available materials for teaching. If they do not utilize instructional materials in teaching and learning, how can the student learn and retain effectively? It seems embarrassing in this 21st century that teachers neither improvise nor use instructional materials in teaching such a dreaded subject like mathematics. Something urgent should be done by relevant authorities to reverse this trend in our secondary schools. The above finding is in line with those of Obodo (2008) that mathematics teachers do not utilize instructional materials in the classrooms.

Implications for Quality Education in Nigeria

The fact that mathematics teachers (male and female) do not improvise mathematics instructional materials neither do they use them effectively shows that the quality of teaching and learning of mathematics is very poor. Such mathematics teachers have fallen short of what the society expects from them in secondary schools. Their inability to improvise and use instructional materials is an index of poor quality education in mathematics. The federal and state governments and their relevant agencies such as ministries of education and their parastatals should endeavor to change this trend. Poor quality mathematics education in Nigeria suggests poor scientific and technological development. The nation can never meet up with the challenges of industrialization in the presence of poor mathematics instruction in secondary schools.

Recommendations

Based on the findings in this study, the researcher recommends as follows:

1. The Ministry of education and/or its relevant agency should carryout a retraining programme for mathematics teachers on improvisation and utilization of mathematics instructional materials.
2. Teacher training institutions such as university faculties of education, colleges of education and polytechnics should insist on ensuring that their students learn how to improvise and use many of the instructional materials in teaching and learning mathematics.

Conclusion

Mathematics teachers, both male and female, improvise mathematics instructional materials to a low extent. They also use such instructional materials to a low extent. This suggests that the quality of mathematics teaching and learning is poor or low.

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