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# AVAILABILITY, UTILIZATION AND IMPROVISATION OF INSTRUCTIONAL MATERIALS FOR EFFECTIVE MATHEMATICS TEACHING AND LEARNING IN JUNIOR SECONDARY SCHOOLS IN RIVERS STATE, NIGERIA

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## Abstract

*The researchers investigated availability, utilization and improvisation of instructional materials for effective mathematics teaching and learning in junior secondary schools in Rivers State Nigeria. Two objectives guided this study. The research design was analytical survey design. The sample for the study was 12 junior secondary school mathematics teachers in Akuku Toru Local Government Area of Rivers state. Census sampling technique was used. The two instruments used to collect data were titled “Mathematics Instructional Material Availability Inventory” and “Mathematics Instructional Material Utilisation and Improvisation Questionnaire”. Cronbach alpha was employed to establish a reliability coefficient of 0.82 and 0.76 for the instruments respectively. Mean, standard deviation and independent sample t-test were used for statistical analysis at 0.05 significant level. The finding showed that the extent of available instructional materials in schools was low. The result revealed that the experienced and less experienced teachers’ extent of utilization of instructional materials for mathematics teaching and learning in junior secondary schools was also low though with no significant difference. The study also showed that the experienced and less experienced teachers do not improvise instructional materials for the effective teaching of mathematics with a statistical significant difference. It was recommended amongst others that all the stakeholders of mathematics education should avail themselves to support the move of equipping schools with instructional materials and also the mathematics teacher should endeavour to utilize and improvise instructional materials for mathematics teaching and learning.*

**Keywords:** Availability, Mathematics, Utilization. Instructional Materials, Improvisation

## Introduction

Every subject taught in school has its peculiar nature and structure which detects how the subject should be taught and learnt. Mathematics is a school subject which is characterized with the exploration of quantities, patterns, symbols, notations, shapes, patterns and the possible relationships which exist among them. Ramirez (2014) opined that the nature of mathematics make it to hinge on logical reasoning and creativity. This makes it imperative for mathematics to be viewed as a subject of intellectual challenge to students. Abstraction therefore cannot be ruled out in the mathematical endeavour. Mathematical inquiry requires 3 phases in order to solve problems. The three phases are:

1. Abstraction and symbolic representations
2. Manipulation and computation of mathematical sentences and
3. Application to real life problems (Ramirez, 2014).

For students to succeed in their mathematical endeavour, they must satisfy the prerequisite of understanding and mastery of mathematics concepts, skills and processes. It is not an over statement to say that learning with understanding and clarification of concepts makes students to become autonomous in that which they have learnt. Becoming autonomous in learning, positions students to be confident in their ability to explore, figure out and solve mathematics problems. One of the essential qualities of an effective mathematics teacher as outlined by Edusys (2019) is the ability of the teacher to ensure effective impartation of mathematical knowledge to students using effective teaching methods and instructional materials. Mathematics is a subject that is encapsulated in abstraction. Instructional materials therefore, play a crucial role in the teaching and learning of mathematics.

Instructional materials are those things that enable students to have mental picture of what has been taught and to retain the message in their memory for a long time. It can be referred to as materials which the classroom teacher uses to impact knowledge to learners in the classroom in order to achieve the stated objectives. Instructional materials support the teaching and learning process because it improves the transmission and assimilation of knowledge. This implies that the resources for teaching any school subject including mathematics are essential inputs that help to improve teaching and learning (Obidili & Obi, 2020). When the resources for teaching mathematics are adequate by been available and utilized in the right quality and quantity it improve students' achievement in mathematics. Learning mathematics with understanding is very essential. Mathematics today requires not only computational skills but also the ability to think and reason mathematically in order to solve the new problems and learn the new ideas that students will face in the future.

There are various instructional materials that can be employed to teach mathematics. These instructional materials are classified into any one of audio, visuals or audio-visuals, print or non-print, industrially-made or locally made, animate or inanimate, human or non-human, 2D or 3D shapes, projected or non-projected. It is therefore very important for the Mathematics teacher to be conversant with the different instructional materials that can be used to deliver Mathematics contents in the classroom. A further knowledge is the appropriate and adequate instructional material to be used for any given mathematics topic to be taught.

Thus, the availability and utilization of these instructional materials become pertinent in the educational system. The extent of available instructional materials in junior secondary schools is crucial because it is at this level that most of the mathematical facts and knowledge

are developed in students. A poor background of mathematics at the junior secondary level will hurt the students' academic performance in mathematics at the higher levels of education. It is the responsibility of the government to equip public schools with the required materials to meet their diverse needs (Gangalo, 2016). The federal, state and local government is expected to equip schools with the required instructional materials. Moreover, non-governmental organisations can also show their interest towards mathematical endeavour by donating instructional materials to schools. Instructional materials used to teach mathematics are either industrially made, locally made or collected directly from the environment. This implies that for instructional materials to be available in schools, it is the collective responsibility of the government, non-governmental organizations, school management, teachers and students.

Improvisation of instructional materials is a skill which every mathematics teacher should possess. George and Amadi (2016) stated that teachers must possess improvisation skills that will help them to succeed in the improvisation of instructional materials. Mupa and Chinooneka (2015) opined that there is a dearth of instructional materials in most schools. This therefore, paves room for improvisation of instructional materials. Teachers and students can improvise instructional materials for mathematics teaching and learning. Carpenters can also be detailed to improvise instructional materials though with maximum supervision. The utilization of instructional materials is another variable that teachers of mathematics need to improve on. The performance of students in mathematics when instructional materials are used for instruction is higher compared to when not used. Thus, for a teacher to employ any given instructional material for mathematics instruction, factors such as the topic, class size, adequacy and relevance of the chosen instructional material, age of students and school location must be put into consideration.

The problem of students' poor performance in mathematics at the different educational level still persists. Some research reports have shown among others that this poor performance could be attributed to use of traditional teaching methods (Noreen & Rana, 2019), large class size (Kayode, 2016), job mismatch (Ogunkunle & George, 2015), teacher quality (Barasa, 2020). Chukwuka (2018) posited that other factors such as the availability and utilization of instructional materials could also be a contributing factor to students' achievement in mathematics. Agbamugo (2016) opined that the extent to which instructional materials are available and utilized in schools determine the extent of students performance in mathematics. The availability, adequacy and utilization of instructional materials in schools promote students' performance. The research findings of Oni (2019); Odo and Ezeudu (2018), Fehintola (2017) reported that the instructional materials needed for instruction in schools were inadequate. In like manner, it was also reported that the dearth of material resources plague the teaching and learning of mathematics in most schools. It is against this background that the researchers delved into this investigation to find out the availability, utilization and improvisation of instructional materials for effective mathematics teaching in junior secondary schools in Akuku Toru Local Government Area of Rivers state, Nigeria.

### **Statement of the Problem**

Students learn mathematics through the experiences that teachers provide. To achieve the objectives of teaching Mathematics in the junior secondary schools, the instructional materials for teaching Mathematics must be adequate both in quality, quantity and usage. The nature and structure of Mathematics also demands that the contents be taught with adequate and relevant instructional materials to enhance students' performance in the subject. The performance of students in Mathematics in both internal and external examinations is yet to

improve. The qualification and years of teaching experience of the teacher are possible variables which may impact the utilization and improvisation of instructional materials. The researchers' question whether the instructional materials for Mathematics teaching and learning are available, utilized and improvised by teachers who are qualified, less qualified, experienced and less experienced. It is in the light of the above problem that this study was embarked upon to investigate the availability, utilization and improvisation of instructional materials for teaching and learning mathematics in junior secondary schools.

### **Objectives of the Study**

The objectives were to:

1. Find out the extent of available instructional materials for teaching and learning mathematics in public junior secondary schools with respect to teacher qualification.
2. Ascertain the extent of effective utilization of instructional materials by teachers for teaching and learning mathematics in public junior secondary schools with respect to teacher years of teaching experience.
3. Determine the extent of improvisation of instructional materials for mathematics teaching and learning in public junior secondary schools with respect to teacher years of teaching experience.

### **Research Questions**

**Research Question 1:** To what extent are instructional materials available for teaching and learning mathematics in public junior secondary schools with respect to teacher qualification?

**Research Question 2:** To what extent do teachers make effective use of instructional materials for mathematics teaching and learning in public junior secondary schools with respect to teacher years of teaching experience?

**Research Question 3:** What is the extent of improvisation of instructional materials for mathematics teaching and learning in public junior secondary schools based on teacher years of teaching experience?

### **Hypotheses**

**H<sub>01</sub>:** There is no significant difference in the response mean ratings of qualified and less qualified public junior secondary school teachers on the extent of available instructional materials for teaching and learning of mathematics.

**H<sub>02</sub>:** There is no significant difference in the response mean ratings of experienced and less experienced public junior secondary school teachers on the extent of usability of instructional materials for mathematics teaching and learning.

**H<sub>03</sub>:** There is no significant difference in the response mean ratings of experienced and less experienced public junior secondary school teachers on the extent of improvisation of instructional materials for mathematics teaching and learning.

### **Materials and Method**

The analytical survey research design was employed for this investigation. This design was used because hypotheses were tested in the study. The population of the study was made up of 12 mathematics teachers in the six public junior secondary schools in Akuku Toru

Local government Area of Rivers State, Nigeria. A sample of all 12 public junior secondary school mathematics teachers was drawn using the census sampling technique.

Two instruments were used to collect data. The first instrument was titled “Mathematics Instructional Material Availability Inventory” (MIMAI) and the second instrument was titled “Mathematics Instructional Material Utilisation and Improvisation Questionnaire” (MIMUIQ). Both instruments had preliminary section which elicited the biographic information of the sample teachers. MIMAI consisted of fifty selected instructional materials for mathematics teaching and learning. The rating for MIMAI was done on a four point scale of Highly Available (HA = 4), Moderately Available (MA = 3), Rarely Available (RA=2) and Not Available (NA =1). MIMUIQ which had 16 items consisted of sections A and B. Section A measured the extent of utilization of instructional materials for teaching mathematics while section B measured the extent of improvisation of instructional materials for teaching mathematics. The rating for MIMUIQ was done on a four point scale of Strongly Agree (SA = 4), Agree (A = 3), Disagree (D = 2), Strongly Disagree (SD = 1). The criterion mean for each of MIMAI and MIMUIQ was 2.5. Three experts in mathematics education carried out a face and content validation of the two instruments. The Cronbach alpha reliability method was used to establish reliability coefficients of 0.82 and 0.76 for MIMAI and MIMUIQ respectively. The teachers used for the reliability test were not participants in the main study. These reliability indices depicted that the instruments were reliable.

The researchers distributed the instruments to the sample teachers on a face to face mode. The administration and retrieval of the instruments were done on the same day. The reason for doing this was to reduce the risk of loss of instruments to the barest minimum. The statistical tool used to analyze the research questions were mean and standard deviation while the independent sample t-test was used to test the null hypotheses at .05 significant level.

## **Result**

**Research Question 1:** To what extent are instructional materials available for teaching and learning mathematics in public junior secondary schools with respect to teacher qualification?

**Table 1: Mean response of teachers on available instructional materials for teaching and learning mathematics**

S/n	Availability of Instructional Materials	Qualified, n = 3		Less Qualified, n = 9	
		Mean	SD	Mean	SD
1	2D shapes	2.68	0.65	2.71	0.52
2	Abacus	1.43	0.72	1.49	0.38
3	Algebra Tiles	1.77	0.37	1.84	0.44
4	Cardboard papers	3.05	0.34	2.67	0.61
5	Chalk	3.46	0.72	2.85	1.71
6	Chalkboard	3.21	0.39	3.01	0.49
7	Computer	2.62	1.09	2.44	0.65
8	Counters	2.08	0.63	2.36	0.44
9	Cusenaire rods	1.37	0.60	1.84	0.58
10	Dienes base ten blocks	1.52	0.50	1.55	1.53
11	Drawing boards	2.28	0.55	2.48	0.81
12	Ethnomathematical resources	1.92	0.80	2.02	0.46
13	Fraction pie	1.47	0.80	1.59	0.69
14	Geoboard	1.22	0.69	2.31	0.64
15	Geographical maps	2.54	0.93	2.60	0.73
16	Geometrical construction paper	3.72	0.52	2.53	1.84
17	Geometrical models	2.73	0.53	2.67	0.54
18	Geotrigmetric set	1.32	0.43	1.25	0.71
19	Graphboards	2.15	0.38	2.04	0.48
20	Height scale	1.53	0.41	1.39	0.83
21	Instructional cards	1.23	0.65	1.47	0.41
22	Instructional charts	2.04	1.73	1.83	0.68
23	Interactive white board	1.32	0.49	1.44	1.26
24	Internet Browser	1.22	0.75	1.46	0.74
25	Mathematical sets	1.85	0.44	2.52	1.53
26	Mathematics Dictionary	1.36	0.68	1.46	1.88
27	Mathematics games	1.42	0.53	1.43	0.63
28	Mathematics softwares	1.34	0.81	1.40	0.58
29	Mathematics textbooks	2.83	0.46	3.16	0.64
30	Mathematics worksheets	1.36	0.69	1.43	0.41
31	Measuring instruments	2.17	0.73	1.47	0.152
32	Number slide	1.66	0.52	1.86	1.31
33	Pattern blocks	1.43	0.84	1.21	0.74
34	Perigeal dissection	1.86	0.54	1.44	0.71
35	Platonic solids	1.49	0.71	1.08	0.92
36	Pretend money	1.31	0.58	1.35	0.84
37	Probability kit	1.64	0.83	1.02	0.55
38	Projectors	2.01	0.41	1.55	0.63
39	Ready reckoner	1.26	0.87	2.13	0.85
40	Realia	1.14	1.31	1.65	0.72
41	Scientific calculators	1.27	0.74	2.41	0.55
42	Spinner	1.63	0.61	1.63	0.81
43	Statistical tables	1.34	0.55	1.44	0.49
44	Tagrams	1.35	0.74	1.80	0.73

45	Teacher Lesson plan	3.22	1.05	3.17	0.44
46	Time(Clocks and stopwatches)	1.38	0.83	2.59	0.78
47	Weighing balance	2.36	0.89	2.18	0.93
48	Word wall	1.42	0.61	1.34	0.55
49	World globe	2.61	0.54	2.88	1.54
50	White Board	1.74	0.78	1.56	0.80
	Grand Mean	1.89	0.77	1.94	0.79

**Criterion Mean =2.5**

Table 1 showed the mean response of qualified and less qualified teachers on the extent of available instructional materials in junior secondary schools for mathematics teaching. The table revealed that the mean rating for the qualified and the less qualified teachers on extent of available instructional materials for mathematics teaching were 1.89, SD = 0.77 and 1.94, SD = 0.79 respectively. Since the mean for qualified and less qualified teachers were less than the criterion mean of 2.50, it indicated that the extent of available instructional materials for mathematics teaching in junior secondary schools is low.

**Research Question 2:** To what extent do teachers make effective use of instructional materials for mathematics teaching and learning in public junior secondary schools with respect to teacher years of teaching experience?

**Table 2: Mean response of teachers on the extent of effective use of instructional materials for mathematics teaching based on years of teaching experience**

S/N	Usability of Instructional Materials	Experienced, n=5		Less Experienced, n=7	
		Mean	SD	Mean	SD
1	I use textbooks for teaching mathematics in my school most times	2.85	0.64	3.15	0.83
2	I always use probability kits to teach mathematics in my school	2.04	0.81	1.59	0.61
3	I use television sets and radio tapes in my school for teaching mathematics concepts	1.08	0.37	1.80	0.58
4	I use computers in my school for multi-media instruction in Mathematics most often.	1.14	0.64	2.25	0.64
5	I use overhead projectors to teach Mathematics in my school always.	1.68	0.89	1.80	0.58
6	I use manipulatives in my school to teach students mathematics regularly.	2.30	1.24	2.15	1.42
7	I often use charts to teach mathematics in my school	2.43	0.58	2.67	0.83
8	I use geometrical construction kits to teach geometrical construction	1.68	0.73	2.00	1.16
	<b>Grand Mean</b>	<b>1.88</b>	<b>0.74</b>	<b>2.05</b>	<b>0.84</b>

**Criterion Mean = 2.50**

Table 2 showed that the experienced teachers responded that the most utilized instructional material was textbooks with mean = 2.85, SD = 0.64 while the less experienced teachers responded that the most utilized instructional material was also textbooks with mean = 3.15, SD = 0.83. The grand mean and standard deviation on the extent of utilization of instructional material for mathematics teaching in junior secondary schools with respect to teachers' years of teaching experience were 1.88, SD = 0.74 for the experienced teachers and 2.05, SD = 0.84 for the less experienced teachers respectively. Since both grand mean were less than the criterion mean of 2.50, it then implies that the extent of utilization of instructional materials for mathematics teaching in junior secondary schools in Akuku-toru is low.

**Research Question 3:** What is the extent of improvisation of instructional materials for mathematics teaching and learning in public junior secondary schools based on teacher years of teaching experience?

**Table 3: Mean response of teachers on the extent of improvisation of instructional materials for mathematics teaching based on years of teaching experience**

S/N	Improvisation of Instructional Materials	Experienced, n=5		Less Experienced, n=7	
		Mean	SD	Mean	SD
9	I always improvise instructional materials to teach all mathematics topics.	2.36	0.65	2.05	0.78
10	I rarely improvise instructional materials because of insufficient time.	2.46	0.91	2.34	1.03
11	The creativity involved in improvisation makes me to improvise instructional materials always.	1.85	0.87	1.53	0.74
12	I have never improvised any instructional material to teach mathematics	1.34	0.85	2.27	0.68
13	I sometimes use my students to improvise instructional materials for mathematics classroom delivery	3.72	1.03	2.33	0.57
14	I sometimes use local carpenters and welders to improvise instructional materials	2.98	0.72	2.04	0.52
15	I improvise instructional materials once a term	1.28	0.54	2.14	0.64
16	I do not embark on improvisation due to the cost involved	2.58	0.81	2.55	1.83
<b>Grand Mean</b>		<b>2.29</b>	<b>0.78</b>	<b>2.12</b>	<b>0.62</b>

**Criterion Mean = 2.50**

Table 3 showed that the grand mean and standard deviation on the extent of improvisation of instructional materials for mathematics teaching in junior secondary schools with respect to teachers' years of teaching experience were 2.29, SD = 0.78 for the experienced teachers and 2.12, SD = 0.62 for the less experienced teachers respectively. Since both grand mean are less than the criterion mean of 2.50, it then implies that the extent of improvisation of instructional materials for mathematics teaching in junior secondary schools in Akuku-toru is low.

**H<sub>01</sub>:** There is no significant difference in the response mean ratings of qualified and less qualified public junior secondary school teachers on the extent of available instructional materials for teaching and learning of mathematics.

**Table 4: Independent sample t-test on the mean response of qualified and less qualified teachers on the availability of instructional materials for teaching and learning of mathematics**

Item	Availability of Instructional Materials	Qualified N=3		Less Qualified N=9		df=10	
		Mean	SD	Mean	SD	t	p-value
1-50	Grand Mean	1.89	0.77	1.94	0.79	1.64	0.12

Table 4 showed the independent sample t-test on the mean response of qualified and less qualified teachers on the extent of available instructional materials in junior secondary schools for mathematics teaching. The result of the independent sample t-test showed that there is no significant difference in the mean ratings of the qualified and less qualified teachers on the extent of available instructional materials for mathematics teaching and learning in junior secondary schools ( $t = 1.64$ ,  $df = 10$ ,  $p = 0.12 > 0.05$ ). The null hypothesis one was retained at 0.05 significant level.

**H<sub>02</sub>:** There is no significant difference in the response mean ratings of experienced and less experienced public junior secondary school teachers on the extent of usability of instructional materials for mathematics teaching and learning.

**Table 5: Independent sample t-test on the mean response of the experienced and less experienced teachers on the utilization of instructional materials for mathematics teaching**

Item	Variable Utilization of Instructional Material	Experienced n=5		Less Experienced n=7		df=10	
		Mean	SD	Mean	SD	t	p-value
1-8	Grand Mean	1.88	0.74	2.05	0.84	-9.64	0.00

Table 5 showed that the result of the independent sample t-test showed that there is a significant difference in the mean ratings of the experienced and less experienced teachers on the utilization of instructional material for mathematics teaching in junior secondary schools ( $t = -9.64$ ,  $df = 10$ ,  $p = 0.00 < 0.05$ ). The null hypothesis two was rejected at 0.05 significant level.

**H<sub>03</sub>:** There is no significant difference in the response mean ratings of experienced and less experienced public junior secondary school teachers on the extent of improvisation of instructional materials for mathematics teaching and learning.

**Table 6: Independent sample t-test on the mean ratings of experienced and less experienced mathematics teachers on improvisation of instructional materials for mathematics teaching**

Items	Improvisation of Instructional material	Experienced n=3		Less Experienced n=9		df=10	p-value
		Mean	SD	Mean	SD		
9-16	Grand Mean	2.29	0.78	2.12	0.62	1.85	0.17

The independent sample t-test in table 6 showed that there is no significant difference in the mean ratings of the experienced and less experienced teachers on the extent of improvisation of instructional materials for mathematics teaching in junior secondary schools ( $t = 1.85$ ,  $df = 10$ ,  $p = 0.17 > 0.05$ ). The null hypothesis three was retained at 0.05 significant level.

### Discussion of Findings

The first finding of the study revealed that the extent of available instructional materials in the junior secondary schools for the teaching of mathematics is low. There abound many instructional materials that are expected to be in place in schools for the teaching and learning of mathematics concepts. The researchers enumerated fifty of such instructional materials. Out of the fifty instructional materials, the qualified mathematics teachers responded that it was only eleven that were available (2D shapes, cardboard papers, chalk, chalkboard, computers, geographical maps, geometrical construction paper, geometrical models, mathematics textbooks, teacher lesson notes and world globe) in high quantity. The less qualified teachers on the other hand responded that all the same eleven instructional materials which the qualified teachers responded to be available were actually available with an addition of mathematical sets and clocks. From this finding, it can be deduced that the instructional materials for teaching and learning of mathematics were available in low extent. The low extent of available instructional materials in junior secondary schools indicated that the various means such as government supplies, donations by non-governmental organisations, collection by the students and improvisation by which instructional materials are made available in schools are not functional. When subjected to statistical test, it was found that there was no significant difference between the mean response of the qualified and less qualified teachers on the extent of available instructional materials for mathematics teaching and learning in junior secondary schools. This is finding agrees with that of Oni (2019); Odo & Ezeudu (2018); Fehintola (2017). However, the finding of Ali, Kura, Abdu and Aliyu (2020) revealed the contrary.

The second finding of this study revealed that the extent to which mathematics teachers utilize instructional materials to teach mathematics is low. This low extent of utilization of instructional materials will impact negatively on the performance of students in mathematics.

The major role which instructional materials play in the teaching and learning scenario is to demystify the abstract and difficult aspects of mathematics. Instructional materials also help to make clearer some of the mathematical facts and ideas which students have already developed misconceptions in. The teaching of mathematics when intertwined with the use of instructional materials, it makes the teaching more effective. This finding is in consonance with findings of Fehintola (2017) which revealed that teachers do not use available instructional materials to teach mathematics. It also agrees with the findings of Sam-Kayode, Akuche and Mustapha (2020) ; Umuhoza and Uworrwabayeho (2021) which found that teachers do not utilize instructional materials to teach students mathematics.

Lastly, the finding of this study showed that mathematics teachers do not improvise instructional materials that will be employed to teach mathematics in junior secondary schools. When subjected to statistical test, it was revealed that there was no significant difference in the mean ratings of the experienced and less experienced teachers on the extent of improvisation of instructional materials for mathematics teaching in junior secondary schools. Improvisation is an aspect of education that more credence should be laid. This is because where the required instructional materials are not available or insufficient; the alternative option of improvisation saves the day. It lies in the onus of the mathematics teacher to initiate and monitor the improvisation of instructional materials. A wrongly improvised instructional material leads to misconception of the taught mathematical concepts. Teachers are therefore expected to possess the necessary improvisation skills required for improvisation. This finding of lack of improvisation of instructional materials agrees with the results of Okori and Jerry (2017).

### **Conclusion**

This study concluded that instructional materials for teaching and learning mathematics are of low extent with respect to availability and usability by teachers at the public junior secondary school. It was also concluded that mathematics teachers who are supposed to be at the helms of affair of improvisation of instructional materials in schools, do not improvise these instructional materials.

### **Recommendations**

The findings of this study led the researchers to recommend the following:

1. All those concerned with mathematics education should endeavour to play roles which will improve the available instructional materials that will be employed to teach and learn mathematics in junior secondary schools.
2. Mathematics teachers should be encouraged to utilize instructional materials to teach mathematics since it helps to make clearer the understanding of mathematical concepts and processes.
3. Mathematics teachers should attend seminars, workshops and conferences related to mathematics and education in general because it is in such gatherings that improvisation skills can be taught to teachers.

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