Teachers' Practices of Creativity in Mathematics Classroom in Basic Education

[a]Inweregbuh Onyemauche C., [b]Ugwuanyi Chika C., [c]Nzeadibe Chinyere A, [d]Egara Felix O., [e]Emeji Ifeoma E.

[a,b,c,d,e]**Department of Science Education, Faculty of Education, University of Nigeria, Nsukka**

inweregbuh@gmail.com

Abstract

The study was carried out to access how teachers practice creativity in mathematics classroom in basic education in Nsukka Education Zone of Enugu State, Nigeria. The study adopted a descriptive survey research design. The population of the study comprised of one hundred and sixty five (165) mathematics teachers in the Zone. The sample size of one hundred and eighteen (118) mathematics teachers was used. A 29-item questionnaire titled "Teachers' Practices of Creativity in Mathematics Classroom'' (TPCMC) was the instrument for data collection. The reliability coefficient of 0.83 was obtained using Cronbach Alpha's method. Data collected were analysed using mean and standard deviation to answer the research questions while the null hypothesis was tested using t- test statistic at 0.05 level of significance. The findings of the study showed that the extent mathematics teachers found creativity in mathematics classroom was at a very low extent; developed and applied creativity in mathematics classroom were at low extent. It was recommended among others that teacher's education programs should include creative teaching of mathematics in their curriculum and teachers should be monitored to ensure they practice creativity in classroom. The findings of the study have implications for teachers and all stakeholders in education that they should ensure they practice creativity in mathematics classroom and only creative teachers can train creative students**.**

Key Word: **Teachers; Practices; Creativity; Mathematics Classroom**

1. INTRODUCTION

Technological advances in today society do not kill creativity, but enhances, enables and nurtures creativity. In other to face 21st century which creativity is fast becoming highly valued traits is seen as most innovative and rapid development in all aspect of life. Education system in this 21st century should be fostering creative persons because new ideas are born through the creative process. Mathematics teachers should have the ability to practice creativity in their various classrooms, thereby, discover, develop and apply creativity in their classroom. Teaching of mathematics demands the ability of students to think critically, analytically, logically and creatively. Teaching and learning basic education mathematics must not be restricted to some textbook, physical classroom or to some single particular learning outcome as set in our curricula, rather the learning and teaching of mathematics should be based on scientific approach which can help to develop student's creativity mind, such scientific leaning approach include different learning models. Mathematics opens the gate to affluence of openings to investigate skills and concepts in a much wider context that is to say in a real-life situation (Elaine, 2015). This however, is the recent viewpoint and pedagogical bearing which directs primary school mathematics teachers into searching innovative and creative ways on how to convey mathematical concepts to students by increasingly making relations to day-to-day mathematics. This method does not only signify creativity from the aspect of the teacher, in terms of segregated learning tasks and variety of resources used, but to foster the presence of creative learning tasks as boarded upon by students themselves. Mathematics is no longer viewed as a subject on its own, but is persistently connected to other disciplines enabling students to explore a variety of concepts and skills while interconnecting mathematics with social, art, language skills etc. Obviously, there are facets about mathematics which remain relevant towards obtaining a solid grasp of number and becoming fluent at mental mathematics. Learners need to form and secure

these important foundations from an early age in order to embark on a successful rise in becoming efficient and effective in mathematics. Eloquence and self-assurance in numbers stresses an element of rote-learning, nonetheless, application of these facts and skills into practice cannot be attained without consistent practice and application in real life. Therefore, exploring mathematics creatively demands a two-way learning means and it enables the teacher to measure the learners' understanding and how they retain important mathematics skills and ideas through hands-on experiences (Elaine, 2015).

Creativity is the generation of a new idea that is both novel and appropriate in a particular situation. Nonetheless, there is not just one way for an individual to be creative, instead, experts think of creativity as a set of skills and attitudes that an individual is capable of tolerating uncertainty, refining old problems, discovering new problems to solve, taking serviceable risks amongst others. Creativity is conventionally linked to art and literature and it is branded as an individual activity envisioned to produce something novel (Bolden, Harries, & Newton, 2010). Creativity is the competence to transcend traditional ideas, patterns, rules, relationships, and to create significant new ideas, forms, methods and interpretations (Lauren, 2018). Creativity has been associated with mathematics as being the ability to generate produce new mathematical insights and ideas (Sriraman, 2009).

Numerous definitions of mathematical creativity exist, in broad-spectrum, two mutual trends portray it as the generation of new mathematical expertise and bendable problem-solving abilities (Kwon, Park, & Park, 2006). Mathematical creativity according to Despina & Marianthi (2016) is seen on the basis of the four indices of creativity that was proposed by Torrance in Klavir & Hershkovitz (2008). The four indices include the following;

(1) Fluency which refers to the number of correct responses that learner produces.
(2) Flexibility which refers to the number of different mathematical concepts and ideas that learner discovers.
(3) Elaboration which indicates the complexity of mathematical thinking, as learner integrates different pieces of mathematical knowledge.
(4) Originality which illuminates the extent that learner's ideas are insightful, novel and lead to unanticipated and unusual solutions.

At the school level, the main objective of teaching mathematics is to develop thinking. Mathematical thinking encourages the development of creativity since it requires making conjectures and distinguishing opinions to solve a situation set out (Ayllón, Gómez &Ballesta-Claver, 2016). Therefore, one of the important tasks of mathematics educators is to practice creativity in mathematics classroom by discover, develop and apply mathematical creativity. Also, mathematics educators should always have these questions in mind; *do your students regularly display and develop and exhibit their creativity while in your mathematics classroom? And are you in touch with your own creativity as a teacher?* Creativity does not lean to take centre point in many typical mathematics classrooms, though it has been established to have numerous benefits. In tallying all of the brain-based benefits, creativity has the added bonus of fun and relaxation. Learners love to have the occasion to relax and use their creative sides.

Creativity is an important component of teaching and learning and is geared towards improvement of quality classroom learning in basic education. However, encouraging creativity and a more consistent sense of practice of creativity in mathematics classroom in basic education among teachers is needed. The study would access how teachers practice creativity in mathematics classroom in basic education. This is because studies in creativity have been carried out in other subjects; hence, there is the necessary to access teachers' practice of creativity in mathematics classroom in basic education in Nsukka Education Zone of Enugu State, Nigeria. Because creative thinking skills help develop intrinsic motivation and aid basic education students become lifelong students, students should therefore be given the chance to pursue out new experiences and experiment with new ideas. The learners should also be taught to ask questions and to help them develop their critical thinking and problem-solving abilities.

1.1 Purpose of the Study

The major purpose of the study was to access teachers' practices of creativity in mathematics classroom in basic education in Nsukka Education Zone of Enugu State, Nigeria. Specifically, the study seeks to access the extent of teachers' practice of creativity in mathematics classroom during teaching and learning in basic education.

1.2 Research Questions

The following research questions guided the study:

1. To what extent do mathematics teachers discover students' creativity in mathematics classroom?
2. To what extent do mathematics teachers develop students' creativity in mathematics classroom?
3. To what extent do mathematics teachers apply creativity to teach Mathematics?

1.3 Hypothesis

The hypothesis below was formulated and tested at 0.05 level of significance;
1. There is no significant difference in the mean response of male and female mathematics teachers on practice of creativity in mathematics classroom in basic education.

2. METHODOLOGY

Descriptive survey research design was adopted for this study. A survey research design is seen as a group of people or items that is studied by collecting and analysing data from only few individuals or items that is considered to be representation of the entire population (Nworgu, 2015). Descriptive survey research design is appropriate in this study because the researcher is dealing with large population and so needs questionnaire to collect data or information that will be used to answer the research questions and to test the hypothesis. The population of the study comprised of one hundred and sixty five (165) mathematics teachers in Nsukka Education zone, Enugu state, Nigeria (Post Primary School Management Board, PPSMB Nsukka zone, Enugu state, Nigeria 2017/2018). The sample of this study consists of one hundred and eighteen (118) mathematics teachers (57 males and 61 females) randomly selected from thirty nine (39) schools out of the sixty one (61) government owned secondary schools in Nsukka Education zone. A stratified random sampling technique was used in selecting the thirty nine (39) schools. The instrument for data collection was adapted from Schiller, Clements, Sarama, & Lara-Alecio, (2003) was a 29-item questionnaire titled "Teachers' Practices of Creativity in Mathematics Classroom (TPCMC)''. It has a 3-point rating scale of high extent (HE=3), low extent (LE=2) and very low extent (VLE=1). Therefore, items with the mean utilization value ranging from 0.01-1.49, 1.50-2.49 and 2.50-3.00 were rated as follows: very low extent, low extent and high extent respectively. The instrument was face validated by test experts while a reliability estimate of 0.83 was obtained using Cronbach alpha technique. The research instrument was administered to the sampled teachers of the study with the help of a research assistant and was collected at the spot. Mean and standard deviation were used in answering the research questions while the formulated hypothesis was tested using t-test statistics at 0.05 level of significance

2.1 Results

The data collected were analyzed based on the research questions and hypothesis that guided the study.

Research Question One

To what extent do mathematics teachers discover students' creativity in mathematics classroom?
Table I: Mean and standard deviation of respondents on the extent of mathematics teachers discover students' creativity in mathematics classroom

S/N	Item Statement	Mean	SD	Remark
1.	promotes investigative and problem-solving skills	1.29	0.59	VLE
2.	Empowers pupils to take ownership of their learning as active learner	1.22	0.56	VLE
3.	Presents opportunities for collaborative learning and communication	1.75	0.76	LE
4.	Establishes connections to real life making learning more relevant	1.90	0.81	LE
5,	Fosters initiative, innovation and creative thinking	1.54	0.74	LE
6.	Explores mathematics through technology	1.35	0.63	VLE
7.	Supports pupils with diverse abilities	1.60	0.75	LE
8.	Nurtures mathematical thinking and reasoning	1.25	0.59	VLE
9.	Blurs the boundaries among different curricula areas	1.32	0.68	VLE
10.	Heightens understanding and retention	1.54	0.76	LE
Grand Mean		**1.48**	**0.89**	**VLE**

KEY: High Extent (HE) = 2.50-3.00, Low Extent (LE) =1.50-2.49 and Very Low Extent (VLE) = 0.01-1.49

Table I revealed the extent of mathematics teachers discover creativity in mathematics classroom. Items 3,4,5,7 and 10 had mean rating within the range of 1.50-2.49 (LE). This means the extent mathematics teachers discovered creativity in mathematics classroom was at a low extent. On the other hand, items 1,2,6,8 and 9 had mean rating within the range of 0.01-1.49 (VLE). This means the extent mathematics teachers discovered creativity in mathematics classroom was at a very low extent. Their standard deviations ranged from 0.56- 0.81 shows that their individual responses are relatively not far from one another. The items had a grand mean of 1.48 which falls under the mean rating of 0.01-1.49; indicating that the extent of mathematics teachers discovered creativity in mathematics classroom was at a very low extent.

Research Question Two

To what extent do mathematics teachers develops students' creativity in mathematics classroom?

Table II: Mean and standard deviation of respondents on the extent of mathematics teachers develop students' creativity in mathematics classroom

S/N	Item Statement	Mean	SD	Remark
11.	Be present with students' ideas	1.78	0.72	LE
12.	Create a compassionate, accepting environment	1.64	0.78	LE
13.	Encourage autonomy	1.97	0.81	LE
14.	Re-word assignments to promote creative thinking	2.23	0.65	LE
15.	Help students know when it's appropriate to be creative	1.45	0.64	VLE
16.	Use creative instructional strategies, models, and methods as much as possible in a variety of domains.	1.93	0.79	LE
17.	Channel the creativity impulses in "misbehavior	1.52	0.66	LE
18.	Protect and support your students' intrinsic motivation	1.97	0.73	LE
19.	Make it clear to students that creativity requires effort	1.50	0.70	LE
20.	Experiment with activities where students can practice creative thinking.	2.23	0.78	LE
21.	Explicitly discuss creativity myths and stereotypes with your student	1.58	0.73	LE
	Grand Mean	**1.80**	**0.59**	**LE**

KEY: High Extent (HE) = 2.50-3.00, Low Extent (LE) =1.50-2.49 and Very Low Extent (VLE) =0.01-1.49

Table II revealed the extent of mathematics teachers develops students' creativity in mathematics classroom. Items 11,12,13,14,16,17,18,19,20 and 21 had mean rating within the range of 1.50-2.49 (LE). This means the extent mathematics teachers developed students' creativity in mathematics classroom was to a low extent. Also, item 15 had mean rating within the range of 0.01-1.49 (VLE). This means the extent mathematics teachers developed students' creativity in mathematics classroom was to a very low extent. Their standard deviations ranged from 0.64- 0.81 shows that their individual responses are relatively not far from one another. The items had a grand mean of 1.80 which falls under the mean rating of 1.50-2.49; indicating that the extent of which mathematics teachers develops students' creativity in mathematics classroom is to a low extent.

Research Question Three

To what extent do mathematics teachers applies creativity to teach Mathematics?

Table III: Mean and standard deviation of respondents on the extent of mathematics teachers applies creativity to teach Mathematics

S/N	Item Statement	Mean	SD	Remark
22.	Use of questioning or using open ended questions	1.81	0.82	LE
23.	Use a variety of strategies.	2.07	0.81	LE
24.	Writing Their Own Problems	1.57	0.75	LE
25.	Use play and dramatizations.	2.48	0.66	LE
26.	Doodles and Coloring	2.25	0.77	LE
27.	Use technology	1.87	0.79	LE
28.	Posing problems as problem-solving	1.64	0.77	LE
29.	Number Talks or mental mathematics	1.66	0.74	LE
	Grand Mean	**1.92**	**0.54**	**LE**

KEY: High Extent (HE) = 2.50-3.00, Low Extent (LE) =1.50-2.49 and Very Low Extent (VLE) = 0.01-1.49

Table III revealed the extent of mathematics teachers applies creativity to teach mathematics. All the items 22 - 29 had mean rating within the range of 1.50-2.49 (LE). This means the extent mathematics teachers applied creativity to teach mathematics was to a low extent. Their standard deviations ranged from 0.66- 0.82 shows that their individual responses are

relatively not far from one another. The items had a grand mean of 1.80 which falls under the mean rating of 1.50-2.49; indicating that the extent of mathematics teachers applies creativity to teach Mathematics is to a low extent.

2.2 Hypothesis

1. There is no significant difference in the mean response of male and female mathematics teachers on practice of creativity in mathematics classroom in basic education.

Table IV: t – test analysis of significant difference in the mean response of male and female mathematics teachers on practice of creativity in mathematics classroom in basic education.

Gender	N	Mean	SD	df	t-cal	Sig (2-tailed)	Mean Difference
Male	57	2.12	0.65	116	.062	.083	0.04
Female	61	2.16	0.62				

Table IV shows that there is no marked difference as indicated by a mean of 2.12 and standard deviation of 0.65 for male teachers and a mean of 2.16 and standard deviation of 0.62 for female teachers. As observed that the difference in the mean achievement score of male and female teachers in favour of the female teachers is not statistically significant. This shows that there is no significant difference in the mean response of male and female mathematics teachers on application of creativity in mathematics classroom in basic education because the probability associated with the t-calculated value (.083) is greater than 0.05 level of significance. Therefore, Ho_1 which states that there is no significant difference in the mean response of male and female mathematics teachers on application of creativity in mathematics classroom in basic education was retained.

3. DISCUSSION

Findings from as seen from research question one revealed that the extent of mathematics teachers discover creatively in mathematics classroom during teaching and learning is to a very low extent. That is to say, mathematics teachers are not often discovering creatively in mathematics classroom during teaching and learning. The response may be as the result suggested by Crosswhite as cited in Mann (2009) that if problem-solving is taught through bottom-line-teaching, where the learner is held liable for the approach of problem-solving posed by the teacher, then obviously, an environment that daunts creativity is fashioned.

The aspect of the extent mathematics teachers develops students' creativity in mathematics classroom; the finding revealed that the extent mathematics teachers develop students' creativity in mathematics classroom is to a low extent. That is, mathematics teachers are not consistent in developing creativity during teaching and learning of mathematics. Which contradict the findings of Hashimoto cited in Maharani (2014) that the development of creativity in mathematics should be consistent and the types of problem that have potential to develop student's creative thinking ability are open ended problems. Plucker and Beghetto (2004) projected a conceptual model of creative development domain of specificity that runs from an artificial level of creativity at low levels of experience to a fixed perspective within the domain as high levels of experience are added. Still in the model, a level of interest and experience is required for creativity to occur. Plucker and Beghetto held the believe that the optimal condition for creative production drops within a flexible region between generality and specificity.

Again, on the aspect of the extent to which mathematics teachers apply creativity to teach Mathematics, the finding revealed that the extent mathematics teachers apply creativity to teach Mathematics is to a low extent. That is, mathematics teachers are not consistent in applying creativity during teaching and learning of mathematics. The findings also revealed that significant difference does not exist in the mean response of male and female mathematics teachers on application of creativity in mathematics classroom in basic education which disagreed with Suripah (2019) that based on gender, the result showed that there a difference exist in mathematical creative thinking between male and female students in solving problems that involves square root and complex equation.

4. CONCLUSION

The findings so far from this study revealed that the extent mathematics teachers discover, develop and apply creativity in mathematics classroom is at low and very low extent. This implies that there is need for proper awareness of mathematics teachers in terms of selecting tasks that promote mathematical creativity in students. Creativity plays a major role in mathematics learning, so mathematics teachers should be proactive, vigilant and strive to offer learners appropriate

learning opportunities that is always requiring creative thinking and it could be a way to discover, develop and apply creativity in students. Teachers' practice of creativity in mathematics classroom is important in basic education because it encourage their students to look for many ways of seeing, explain what they visualize and think creatively.

5. IMPLICATION

The findings of the study have implications for mathematics teachers and all shareholders in education that they should ensure the practice of creativity in mathematics classroom and only creative teachers can train creative students.

6. RECOMMENDATIONS

The findings of this study make the following recommendations:

1. Teacher's education programs should include creative teaching of mathematics in their curriculum
2. Teachers should be monitored to ensure they practice creativity in classroom.
3. Teachers through seminars and workshops should be provided the opportunities to be trained and retrained in mathematics creativity teaching.

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