

Unlocking Students Areas of Difficulties in Mathematics through the Teachers Creativity Fostering Behaviours

¹Chukwuemeka A. Metu, ²Chika C. Ugwuanyi, ³Ngozi M. Nwoye, ⁴Innocent O. Odo & ⁵William C. Nwachukwu

Department of Science Education, Faculty of Education, University of Nigeria, Nsukka

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ABSTRACT

Creativity fostering behaviours of teachers are essential in every teaching and learning environment. It promotes teachers' consistent efforts that are aimed at enhancing independent and flexible thinking. It also equips students with a variety of knowledge and materials for divergent thinking, encourages novel ways of solving problems and helps students cope with obstacles and failures. Unlocking students' academic potential is a priority for many researchers and practitioners within the educational context. Reports on students' academic achievement in mathematics revealed that there are areas of difficulties among the students. It could be that these areas of difficulties have led to poor academic achievement in mathematics over the years. On issues relevant to this study, teachers should give students direct feedback, encourage autonomy, re-word assignments to promote creativity and also create an accepting environment.

Mathematics anxiety, inadequate problem-solving skills, lack of conceptual understanding and language barriers in mathematics were all highlighted as challenges of students' difficulties in mathematics. Theoretically, this study was anchored on Self-Determination Theory. Practically, students, teachers, parents, educational administrators, government and researchers are all expected to benefit from the findings of this study. The ability to be creative, to create something from personal feelings and experiences, can reflect, nurture and unlock students' understanding of mathematical concepts. The educational implications was highlighted and it was recommended among others that teachers should provide opportunities for students to share strengths and weaknesses as this in turn increases students' active participation in the classroom.

Keywords: Mathematics, Creativity Fostering Behaviours, Difficulty, Unlocking.

INTRODUCTION

In many mathematics classrooms, a significant challenge exists: the pervasive notion that only a select few students can excel in mathematics. This belief is held not only by students but also by parents and teachers. The harmful misconception that mathematics prowess is an innate gift possessed by some but not others is a prevailing and detrimental idea within the Nigerian education system and globally. This misconception hinders students' grasp of mathematics. Naturally, mathematics is made up of a set of concepts, facts, principles and operations that are fundamental to the operating of any technology of human endeavour. Rittle?Johnson (2017) defined mathematics as a scientific discipline and a mode of thought characterized by its own set of rules, objectives, and guidelines, akin to a structured game. Obiweluozo (2014) affirmed that success in the subject enhances the quality of certificate. This is to say that mathematics is key in determining ones academic achievement. One of the mediums through which the attainment of students and the nation's educational goals could be achieved is through the teacher's attributes and behaviours (Ekperi, 2018). Teachers' behaviour may be positive or negative, effective or ineffective and these behaviours could increase or hinder students' creativity in the classroom. In other words, mathematics teachers ought to possess certain degree of creativity in teaching the subject to ensure better learning outcomes among

students.

Creativity fostering behaviours of teachers are essential in every teaching and learning environment. Olawale, Adeniyi and Olubela (2010) defined creativity fostering behaviour as a deliberate attempt by the teacher to impart or inculcate creative thinking and process in the learner. Teachers' creativity fostering behaviours have several dimensions, but according to Wolska-Dugosz (2015), motivation and integration help students to respond adaptively to the needs for new approaches as well as having the ability to bring something new and valuable into existence. According to Du, Xie, Zhong, Zou, Law and Yan (2019), these dimensions of creativity fostering behaviours promotes teachers' consistent efforts that are aimed at enhancing independent and flexible thinking. It also equips students with a variety of knowledge and materials for divergent thinking, encourages novel ways of solving problems and helps students cope with obstacles and failures. In the context of this study, creativity fostering behaviours of teachers will be seen as attitude of the teacher towards motivating students to have strong foundations in multi-faceted learning, having an integrative teaching style, regarding students' ideas and questions and unlocking new ideas of solving mathematical problems.

Unlocking students' academic potential is a priority for many researchers and practitioners within the educational context. Academic failure has consequences not only during adolescence, when low academic performance results in feelings of failure and eventually to drop out (Valiente, Swanson, Lemery-Chalfant & Berger, 2014), but also in the future, as adults who did not complete their studies are more likely to have health problems and to need social services (Levpuš?ek, Zupan?i? & So?an, 2012; Blankson & Blair, 2016). Within school subjects, mathematics plays a fundamental role for its implication in other school subjects (Gaspard, Dicke, Flunger, Brisson, Häfner, Nagengast & Trautwein, 2015), importance in future social and labour success (Seaton, Parker, Marsh, Craven & Yeung, 2014), effects on decisions making in a changing and ambiguous society (Meder and Gigerenzer, 2014), and its relationship with the Gross Domestic Product (OECD, 2010).

Despite the importance attached to mathematics, students continue to underperform in this subject. Reports on students' academic achievement in mathematics depicts a very unsatisfactory situation. Ugwuanyi (2015) reported a disheartening high failure rate in mathematics at pre-tertiary schools. The West African Examination Council Report (2016-2020) also reported a very poor achievement in mathematics among secondary school students. The percentage of students who got A1-C6 in mathematics includes; 24.38% (2016), 20.09% (2017) and 30.63% (2018) with little improvements in the years 2019 and 2020.

Further enquiry into the students' poor academic achievement in mathematics revealed that there are areas of difficulties in mathematics among the students. The WAEC Chief Examiners report (2016-2020) have highlighted some topics in mathematics such as mensuration, set theory, bearing and distances, circle geometry, inequalities, graphical solutions to quadratic equations, vector, statistics, logarithms, among others as some of the areas of difficulties among students in Nigeria. It could be that these areas of difficulties have led to poor academic achievement in mathematics over the years. Perhaps the reason for students' weaknesses in these areas of mathematics may have been occasioned by students' lack of requisite abilities and creativity in these topics which can culminate to their poor achievement in mathematics. Such lack of creativity in students may be blamed on mathematics teachers' lack of creativity in teaching the subject, since no education system can rise above the quality of her teachers and no nation can rise above the level of her teaching staff (Okoli, 2011). In other words, mathematics teachers ought to possess certain degree of creativity in teaching the subject to ensure better learning outcomes in students.

A great number of empirical works have been carried out in relation to the present study. Troesch and Bauer (2017) in a study revealed that an average of 91% of teachers reports being satisfied with their job. This is in contradiction with Adeyinka, Asabi and Adedotun (2013) whose study revealed that majority of the teachers are not satisfied with their condition of service and not satisfied with salaries being paid. Findings from

Mbugua, Kiboss and Tanui (2015) showed a positive influence on students' academic performance with integrated teaching. Lai, Alias and Foong (2017) also revealed that integrated teaching produces positive impact on academic achievement among students. Another similar study found that an integrated education program has recorded better performance for students with visual impairment than in the specially designed schools for the visually impaired students as perceived by students (Korir, 2015). This is to say that the teachers integrated way of teaching could be essential to unlocking students' mathematics potentials. Literature on teachers' motivation showed that three quarter of teachers (75.0%) under study are not satisfied with the fringe benefits attached to their salaries while majority of the respondents (66.0%) are not satisfied with the condition of service of teachers (Adeyinka, Asabi & Adedotun, 2013). Further findings revealed that the motivation of the teachers helps to unlock areas of difficulties among students (Amrai, Motlagh, Zalani & Parhon, 2011).

While most of the empirical works were on students' general academic achievement in mathematics and in other subject areas, the present study will be centred on students' areas of difficulties in mathematics. Most of these studies were of foreign background. Most of the studies also differed in purposes, research questions, design, instruments, method of data analysis and other variables with the present study. It is also pertinent to point out that all of the reviewed work failed to point out various approaches that could help unlock students' areas of difficulties in mathematics. Hence, this study was necessitated in the need to ascertain how teachers' creativity fostering behaviours could help in unlocking students' areas of difficulties in mathematics.

Issues relevant to the work

Creativity requires a safe environment in which to play, exercise autonomy, and take risks. It is up to the teachers to establish this kind of supportive classroom. According to Davis (2018), here are various ways teachers can foster students' creativity in the classroom;

1. **Give students direct feedback on their creativity.** Lots of students don't realize how creative they are, or get feedback to help them incorporate "creative" into their self-concept. Explore the idea of "creative competence" alongside the traditional academic competencies in literacy and mathematics. When we evaluate something, we value it! Creating a self-concept that includes creativity.
2. **Be present with students' ideas.** Have more off-the-cuff conversations with students. Find out what their passion areas are, and build those into your approach.
3. **Encourage autonomy.** Teachers should not let themselves be the arbiter of what "good" work is. Instead, give feedback that encourages self-assessment and independence.
4. **Re-word assignments to promote creative thinking.** Try adding words like "create," "design," "invent," "imagine," "suppose," to your assignments. Adding instructions such as "Come up with as many solutions as possible" or "Be creative!" can increase creative performance.
5. **Create an accepting environment:** Since being creative requires going out on a limb, students need to trust that they can make a mistake.
6. **Help students know when it's appropriate to be creative.** For example, help them see the contexts when creativity is more or less helpful—in a low-stakes group project versus a standardized state assessment.
7. **Use creative instructional strategies, models, and methods as much as possible.** Model creativity for students in the way teachers speak and the way teachers act. For example, the teacher could say "I thought about 3 ways to introduce this lesson. I'm going to show you 2, then you come up with a third".

Importance of the Creative Process

All that's required for children to tap into their innate creativity is the freedom to fully immerse themselves

in their endeavors, embracing each activity as their own. The essence of any creative endeavor lies in the journey of self-expression. These creative experiences serve as a valuable outlet for children to articulate and manage their emotions. Moreover, a child's creative pursuits enable educators to gain insights into their inner thoughts and emotions. Furthermore, fostering creativity in children promotes their cognitive development by encouraging the exploration of novel ideas and problem-solving approaches. Engaging in creative activities not only celebrates the unique qualities and diversity of children but also presents exceptional opportunities for tailoring instruction to each child's individual needs.

Opportunities for Creativity

Children require ample opportunities for engaging in imaginative play and fostering their creative thinking skills. To initiate this, offer activities that align with the children's interests and concepts. This necessitates actively listening to their expressions and thoughts. Recording and transcribing their conversations, along with sharing notes and discussing with fellow educators, can be incredibly beneficial. It's crucial to present children with a diverse array of materials and experiences to fuel their creativity. Creativity encompasses more than just drawing or painting; it encompasses photography, music, field trips, manipulating wire, clay, paper, wood, water, and even exploring shadows. The potential is boundless. Allowing children substantial time to experiment with materials and delve into their ideas is paramount. This involves dedicated time for contemplation, planning, designing, constructing, experimenting, and refining project concepts.

Varieties of Experience

Seek opportunities to offer diverse cultural and community experiences to children. These can include organizing field trips, celebrating various holidays and traditions with different ethnic groups, and promoting interactions with visitors from diverse backgrounds at school. These activities enrich the creative development of children. The greater the diversity of experiences in a child's life, the broader their scope for creative expression. When children engage with people and situations beyond their immediate surroundings, they gather more inspiration to infuse into their imaginative play. Educators should not feel overwhelmed by the array of artistic expressions in the classroom but instead embrace and encourage this diversity.

Challenges of students difficulties in mathematics

1. **Mathematics Anxiety:** Many students experience math anxiety, which can lead to decreased performance in mathematics. A recent study by Ahmed, M. (2020) found that math anxiety can significantly impact students' confidence and achievement in mathematics. Many children and adults experience feelings of anxiety, apprehension, tension or discomfort when confronted by a maths problem. Maths anxiety is common, and although it can limit performance in certain situations and contexts, it's not linked to intelligence or ability.
2. **Lack of Conceptual Understanding:** Students often struggle to grasp fundamental mathematical concepts, making it difficult for them to apply math in various contexts. A study by Mills (2016) emphasizes the importance of deep conceptual understanding in mathematics education. Conceptual understanding is a strand of achieving mathematical proficiency that involves making sense of the main ideas of mathematics. When students understand a mathematical concept, they can see their knowledge as part of a coherent whole.
3. **Inadequate Problem-Solving Skills:** Many students struggle with problem-solving, which is a crucial aspect of mathematics. Santos-Trigo (2020) highlighted the importance of developing problem-solving skills in mathematics education. Problem-solving skills are essential in mathematics education and have far-reaching implications for students' overall cognitive development. Effective teaching strategies, assessment methods, and a supportive learning environment are crucial for helping students overcome inadequate problem-solving skills and become confident, capable problem solvers in

mathematics and beyond.

4. **Limited Math Resources and Technology Access:** Some students lack access to quality math resources and technology, which can hinder their learning. Initiatives such as providing low-cost or free technology to underserved students, improving internet connectivity in rural areas, and promoting open educational resources can help mitigate these challenges and promote equitable math education (Reys, Lindquist, Lambdin, & Smith, 2014).
5. **Language Barriers in Mathematics:** Language can be a barrier for students, especially when mathematical concepts are expressed using complex terminology. Language barriers in math education can pose significant challenges for students. Teachers should employ strategies that emphasize clarity, visual aids, and real-world examples to help students overcome these barriers and develop a strong understanding of mathematical concepts. Additionally, providing language support and being culturally sensitive can contribute to a more inclusive math learning environment (Banerjee, 2016).

SIGNIFICANCE OF THE STUDY

The findings of this study have both theoretical significance and practical significance.

Theoretical Significance

Theoretically, the teachers' creativity fostering behaviour lends credence to Self-Determination Theory (Ryan and Deci, 2000). The proponents stated that people are active organisms, with the growing tendencies geared towards mastering ambient challenges, and integrating new experiences into a coherent sense of self. They stressed that these natural development tendencies do not operate automatically, but rather requires ongoing social nutrients and supports. According to the propounders, the social context can either support or thwart the natural tendencies towards active engagement and psychological growth furthermore can catalyze to lack of integration, defence, and fulfilment of need-substitutes. The proponents remarked that the dialectic between the active organism and the social context is the basis for predictions about behaviour, experience, and development.

The theory is applicable to this study, based on the fact that individuals or groups need to integrate new experiences into a coherent sense of self and also to be self-determined to achieve a set goal. The integrating new experiences into a coherent sense of self is related to teachers' integration way of teaching, while self-determination is related to teachers' motivation. These dimensions of teachers' creativity fostering behaviour could contribute to unlocking students' areas of difficulties in mathematics.

Practical Significance

Practically, it is expected that the results of this study will be of great benefit to students, teachers, parents, educational administrators, government and researchers alike.

The students through the findings of the study could be enlightened on better ways to be creative during academic work for a better academic achievement in mathematics. The findings of the study could reach the students through an organized conference, seminars and workshops on creative ways of understanding mathematical concepts.

The students can also access the result of these findings through educational radio broadcasting programs, television, university library and when it is uploaded on the internet.

For the teachers, the findings and information of this study will be utilized by teachers on ways to foster students' creativity so as to unlock areas of difficulties in mathematics. They would access the result of this

study when published through mass media like journals and the internet, conferences, seminars and workshops for the teachers where the work can be presented.

The findings of this study will be of great value to the parents. Parents, like the teachers play their own part in students' academic pursuit. In this sense, parents will become fully aware of the behaviours expected of the teachers in fostering students' creativity. They will thereby create a favourable home environment that will enable the children to develop, exhibit and improve on their academic success. They will access the findings in journals and the internet.

In the same vein, designing a better curriculum to be used by teachers and the students for improved students' understanding of mathematical concepts. The educational administrators can do this by setting up seminars and workshops for teachers. They will access the findings of this study in journals and the internet.

Also, the result of this study can inform the government on the importance of teachers' creativity fostering behaviours. Therefore, government will be poised in funding and supporting an educational system that will enable students display a great level of creativity in different subject areas.

Finally, the findings of this research work will be of great benefit to future researchers and scholars in education enterprise, especially in the areas of difficulties in mathematics and ways to foster creativity among students. This is because relevant materials and information will be made available online and in the library.

SUMMARY, CONCLUSION AND RECOMMENDATION

This chapter deals with the summary, conclusion and recommendation for further study. The discussion is carried out under the following headings.

Conclusion

Creativity is the freest form of self-expression. There is nothing more satisfying and fulfilling for students than to be able to express themselves openly and without judgment. The ability to be creative, to create something from personal feelings and experiences, can reflect, nurture and unlock students' understanding of mathematical concepts. The experiences children have can significantly enhance the development of their creativity. Teachers who can model creative ways of thinking, playfully engage with content, and express their ideas, will beget creative students. Students need to see teachers who have passions, whether it's drawing, mathematics, painting, biology, music, politics, or theatre. That contagion of passion and positive emotion is a hotbed for creative thought. Creatively fulfilled teachers may also be happier teachers. This positive state of mind will sustain the teacher, and spread to the students.

Educational Implications

Based on the findings of this study, it is therefore concluded that encouraging students to make their own choices is important. Students should be permitted frequent opportunities – and lots of time – to experience and explore expressive materials. The teachers on the other hand should use different activities in the classroom to maintain students' interest. The teachers should also allow students make discoveries on their own as this increases and enhances students' creativity. Parents on their part can make the home as conducive as possible for learning to enable their children/wards develop, exhibit and achieve maximum academic success. What students learn and discover about themselves is vital to their development. Teachers should show support for the creative process by appreciating and offering support for student's efforts. Independence and control are important components in the creative process.

Recommendations

On the basis of the findings of this study, the following recommendations were made.

1. Teachers should provide opportunities for students to share strengths and weaknesses as this in turn increases students' active participation in the classroom.
2. The educational administrators in the education system should formulate and implement different kinds of educational programmes for teachers on ways to facilitate students' creativity when dealing with different topics in mathematics.
3. Parents or caregivers should learn to build up positive relations with the children, their problems, their development, their mindset and create such conducive environment which can help the children enhance their creative abilities.
4. The knowledge of the dimensions of teacher creativity fostering behaviours will help educational administrators in designing a better curriculum to be used by teachers and the students for improved understanding of mathematical concepts.

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