

MATHEMATICS ANXIETY AMONG NIGERIAN SECONDARY SCHOOL STUDENTS: CAUSES AND INSIGHTS

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Abstract

Mathematics is a foundational discipline that fosters logical reasoning, analytical thinking, and the ability to conceptualize abstract ideas, making it essential in daily life, scientific advancement, and societal development. Its practical applications span architecture, business, engineering, statistics, and computing, contributing to problem-solving, economic efficiency, and intellectual growth. In Nigeria, mathematics is a compulsory core subject in the secondary school curriculum, aimed at equipping students with essential skills for life and further education. Despite its importance, the effective learning of mathematics is hindered by challenges such as mathematics anxiety, which increasingly affects secondary school students and undermines their performance. This study explores the role of mathematics in personal and national development, highlights its practical usefulness, and examines the barriers that impede its mastery, emphasizing the need for strategies to mitigate anxiety and improve learning outcomes.

Keywords: *Mathematics Education, Secondary School, Logical Reasoning, Mathematics Anxiety, National Development*

Introduction

Mathematics has been defined by Anaduaka, (2010) as body of knowledge that opens up the mind to logical reasoning, analytical thinking and the ability to make abstract objects appear real or concrete. Hom (2013) described mathematics as a building block for everything in our daily lives, architecture, art, business, engineering and even sports. That is the basic skills needed for scientific, economics and technological development are control of the tools of mathematics. Therefore, it is indispensable in improving the quality of life of all citizens and in the development of a modern society. Salman (2012) stated some practical usefulness of mathematics are found in areas like application of numbers to measure, estimation and approximation to check economic wastage in everyday life, logic to enhance intellectual development, statistics and computing to solve numerical problems and analyzing statistical data. This implies that Mathematics have positive effects on the lives of everyone including housekeepers and laborers.

In Nigeria, the importance of mathematics to nation building may be responsible for making it compulsory in secondary school curriculum as one of the core subject to be offered by all students (Benjamin & Clement, 2012). This is to enable children acquire basic mathematical skills needed to cope with life challenges, and to give them background to further their education (National Policy of Education, FRN, 2014). It is believed that through the secondary school Mathematics, students can develop their knowledge domain, skill domain and attitude domain needed to be responsible citizen. But there are many difficulties in learning Mathematics in our School education System. One of these difficulties is Mathematics Anxiety

which has been increased day to day among secondary school students and one of the major setbacks in mathematics education in Nigeria (Jerry, Desmond and Rose (2019).

Concept of Mathematics anxiety

Anxiety is global construct that has been operationally defined in various ways by notable scholars. Anxiety is a term used for several disorders that cause nervousness, fear, apprehension and worrying (Josiah & Adejoke, 2014). Anxiety in mathematics has been defined by Tobias (2006) as feelings of tension and fear that interferes with the manipulation of numbers and the solving of Mathematical problems in a wide variety of ordinary life and academic problem or situation. Jain and Downson (2009), define Mathematics anxiety as low self confidence, fear, a negative mind set, less interest to manipulation of numbers and the solving of mathematical problem. Mathematics Anxiety is considered a fear or phobia, dread which produce negative response specific to the Mathematics learning (Whyte, 2009).

Tobias and Weisbrod (1980) described Mathematics anxiety as the “the panic, help-lessness, paralysis and mental disorganization that arises among some people when they are required to solve a Mathematical problem. Mathematics anxiety makes students feeling of tension and discomforts toward learning mathematics which resulted into little confidence in their ability to solve Mathematics problems or activities. The incidence of Mathematics anxiety among students has risen significantly over the last decade that many students have even chosen their departments major in the basis of how little mathematics is required for the department, this greatly limiting their career choice options (Garry, 2005).

Symptoms of Mathematics Anxiety

Mathematics anxiety occur in all levels of education from primary school to higher education, and once established, can persist in life, interfering with everyday activities involving numeracy and further learning in Mathematics (smith, 2004). It can be manifested with some symptomatic characters by which we can identify that the children are suffering from Mathematics Anxiety. According to Molla (2017) mathematics anxiety are classified into physical, psychological and behavioral symptomatic characters. In physical symptoms, it is associated with the increasing of heart beat, clammy hands, appears light headiness and upset stomach. In psychological symptoms, it is associates with inability to provide concentration in Mathematics class, students feel helpless, and feeling of disgrace and worry. In Behavioral symptoms, it is united with avoidance of Mathematics classes, students’ disfavour the Mathematics home work until the last moment and irregular study (Jackson, 2008).

Molla (2017) states that a student with Mathematics anxiety may:

1. have a bad attitude about Mathematics before attempting the problem or even before the teachers explain the problem;
2. be nervous and unable to sit till in Mathematics class;
3. dread to attend in Mathematics class;
4. fill greater fear of answering a teacher’s question incorrectly in Mathematics class rather than other class;
5. feel embarrassed, frustrated, irritated and fearful;

6. have negative attitude about Mathematics which may be expressed with facial expression, body language and other indicators.

Smith (1997) listed the characteristics of Mathematics anxiety students that include uneasiness when asked to perform mathematically; avoidance of Mathematics classes; feeling of physical illness; faintness, dread or panic; inability to perform on a test and utilization of tutoring sessions. A student with Mathematics anxiety severely hinders his or her working memory and may feels difficulty to performs calculation or solve a problem in mathematics which resulted to negative thought towards Mathematics (perina (2002).

Luttenberger, Wimmer, Paechter (2018) added that individuals with high mathematics anxiety tend to avoid learning mathematics, cultivate negative attitudes, and possess low self-confidence in their mathematical abilities. Consequently, the levels of mathematics anxiety are widely recognized as detrimental to students' performance of students in mathematics outcomes (Oztop 2023).

Impact of Mathematics Anxiety on learning of mathematics

The declining performance in Mathematics of students in all levels has gained increasing attention over the past three decades. This has been the concern of Mathematics educators worldwide. The complain of students' mathematics problems ranging from poor Arithmetic and Algebraic manipulation skills to lack of valuable Geometric evaluation. The levels of mathematics anxiety are widely recognized as detrimental to students' performance in mathematics outcomes (Oztop, 2023). According to Swanson and Howell (1996), they explain Mathematics Anxiety in three levels as: the low, moderate/medium and high levels of Mathematics anxiety. They went further stating that high levels of Mathematics anxiety contribute to the development of low motivation, poor coping skills, poor task strategies, self-depression, proness to cheat, proness to make careless errors, negative self-evaluation, difficulty concentrating and the presence of off task thoughts. Karimi and Venkatesan (2009) report that high levels of Mathematics anxiety adversely interferes with all forms of performance generally while low and moderate levels of Mathematics anxiety facilitate performance in mathematics. The findings of Marsh and Tapia (2002) indicate that students with low levels of Mathematics anxiety feel more excited, more confident and highly motivated to learn mathematics when compared to students who have high anxiety levels. Students with high level mathematics anxiety suffer: lack of preparation for a test, cramming before the night of examination, poor time management, failure to organize text information, poor study habit and worry about past performances in examinations (Ashcraft, & Moore, 2009)). According to the research findings of several researchers, Mathematics anxiety is negatively correlated with the performance and achievement in mathematics and if this issue among the students is not mitigated with properly, it could have a grim effect in many arena of our education system (Das and Das, 2013). Students with mathematics anxiety do not only perform poorly but have little interest in Mathematics-related subjects (Jerry, Desmond & Rose 2019). This due to lacks of demonstrable mathematical ability and adverse emotional reactions of student.

Therefore it can be stated that Mathematics anxiety has lifelong negative effect on mathematical development as well as social development. On another study of Karimi and Venkatesan (2009), reveals

that the students who have high level of Mathematics anxiety tended to perform fewer score in Mathematics performance and those who have low level of Mathematics anxiety tended to perform high score in Mathematics .

Based on the above researchers' statements reviewed, the following are the impact of mathematics anxiety among secondary school students:

1. Student may underperform in mathematics exams and assessments due to heightened anxiety levels
2. It can lead to lack of confidence in students' mathematical abilities
3. Students may avoid taking advanced mathematics classes or pursuing mathematics related career path due to anxiety.
4. It can hinder students' problem solving skills and critical thinking abilities in mathematics related tasks
5. It can cause feelings of stress, fear, and dread when face with mathematics related tasks
6. Students may experience self doubt, low self esteem and negative attitude toward mathematics due to anxiety
7. It can lead to avoidance behaviors, such as skipping mathematics classes or homework and assignments
8. It may developed fixed mindset, believing that they are not capable of improving in mathematics

Mathematics Anxiety Causes

Baloglu and Kocak (2006) outlined three major factors that cause Mathematics anxiety, namely, Dispositional, situational and environmental factors. The dispositional factors are concerned with psychological and emotional features such as; attitudes towards Mathematics, self-concept and learning styles. The self-concept refers to students' perception of their own ability to perform well in Mathematics and to learn new topics. The situational factors are direct features that result from their particular Mathematics courses, the nature of the course, and how it is designed and carried out, pace of instruction, etc. The environmental factors are characteristics that affect the students prior to their Mathematics course; for instance, age, gender, academic major, and previous Mathematics experience.

According to Mollah (2017) the most possible causes of Mathematics anxiety include teacher's anxiety, societal factors, educational and environmental factors, classroom experience, innate cognition of Mathematics, failure in school achievement test and class room punishment. In school, assessment and evaluation system mainly high-stakes test can increase the tendency to develop negative attitude to the students' mind about Mathematics and enlarged the area of Mathematics anxiety (smith, 2004). According him, Mathematics is hard to the students due to lack of conceptual understanding of mathematical situations and computation skills. This resulted into memorization concepts and manipulation of symbols rather than an integrated conceptual understanding structure . The result of test examination among the school students' can increase the tendency towards the Mathematics anxiety (,shefield, 2006,). Sometimes teachers provokes or be angry with his students for not understanding his lesson or not giving correct

answer to questions. This cause students to dislike Mathematics. Also, sometimes Mathematics teaching weakness may be perceived by the teacher but he is unwilling to give extra help to the students to solve the handedness but concentrate on covering the syllabus rather than the student understanding (Furner and Duffy, 2002). In Mathematics class the teacher need to be creative in his teaching learning process but focuses the teaching approach of 'explain practice memorized' (Steele & Alfred, 1998) which grow up the Mathematics anxiety among the students. According to McCraty (2007), teachers, peers and parents are responsible for triggering anxiety among students of mathematics. If students perceive that "mathematics is difficult" during their formative years, mathematics anxiety will be triggered and such students will strive to escape from any situation that involves mathematics. This will strengthen their belief that they are not capable and lack the knowledge to engage in mathematics and they will continue to lose confidence in their mathematics skills as a result.

Mathematics is often labeled as a masculine ability as a result, girls often have low confidence in their Mathematics capabilities. These gender stereotypes can reinforce low confidence in girls and can cause Mathematics anxiety. However, a note of cautious has to be added while describing gender as a major variable effecting Mathematics Anxiety. For example, Achor (2010) finds no significant gender difference for Mathematics Anxiety, on the other hand Pourmoslem (2013) finds that females exhibit more Mathematics anxiety in secondary school and in college.

In Nigeria the factors that are responsible for mathematics anxiety among secondary school students are similar as discussed in the above reviewed literature and are stated as follows:

1. Cultural perception : there is general belief that mathematics is a difficult subject and it is for male, which contributes to the anxiety students feel toward it
2. Teaching method: The traditional rote learning approach used in Nigeria schools can makes mathematics seen intimidating and inaccessible to students
3. Lack of resources: many school in Nigeria lack proper mathematics resources such as textbooks and educational tools which can exacerbate mathematics anxiety
4. High stakes exams: The pressure to perform well in nationally standardized exams like the WAEC/ JAMB further intensifies ma among students
5. Peer pressure: students may feel anxious about mathematics due to comparison with their peers or fear of judgment from their classmate
6. Teachers competence: Some students experience mathematics anxiety because of ineffective teaching methods or lack of support from their mathematics teacher
7. Parental expectation: Unrealistic expectation from parents regarding mathematics performance can contribute to anxiety among students
8. Lack of confidence: Negative past experiences with mathematics or lack of self confidence in ones abilities can lead to mathematics anxiety in students

Ways forward reduction mathematics anxiety

To minimize or stop the Mathematics anxiety among the students, parents and teacher should arrange the environment of co-operative learning and 'learning by doing' (Smith, 2004).

To manage Mathematics anxiety among the secondary school students one of the best factor is the teacher. The teacher must always believe that there is sufficient capability of his students to learn the Mathematics. The motivation for learning Mathematics to students may prolong by the teacher.

It has been observed that students tend to assimilate their instructor's interest and enthusiasm for teaching Mathematics. With the proper motivation of teacher, Mathematics anxiety among the school students' must be reduced. Teacher should give specific example and application with basic mathematical skill of students to reduce the mathematical abstractness. The learning process 'concrete to abstract' for Mathematics learning must be followed by the teacher as a cause of learning Mathematics depending on the basic building block process. Each step builds on the previous others (Smith, 2004). Teacher should represent the example in the aspect of real daily life. It is indispensable when teaching Mathematics that the teacher progress from simple problem to complex problem and it can reduced Mathematics anxiety. Teacher should provide sufficient support to student with real life example and Mathematics as a fun. Also, to reduced mathematics anxiety The teacher should use Alternate forms of assessment, Group learning and Constructive self task thinking for students. The teacher should be Flexibility and real aspect instead of rigidity and abstractness in Mathematics class can help facilitate cooperation, reduce stress and create positive attitudes. The teacher should control behavior not thought and fully avoid any type of punishment. One another way to help students to construct more confidence in Mathematics is to post a Right of Mathematics learning in class room such as "I have the right to learn at my own space and not feel put down or stupid if I'm slower than someone else," "I have the right to ask whatever questions I have," "I have the right to feel good about myself regardless of my ability in math" (Tobias, 2006).

Role of teachers in reducing mathematics anxiety

1. Build a positive relationship with students: By encouraging open communication and showing empathy towards students struggles with mathematics
2. Provide clear instructions: By braking mathematics problems into smaller, manageable steps to make it easier for students to understand and follow along.
3. Encourage collaboration: Encouraging students to work together in group or pairs can help reduce anxiety and promote a sense of community in the classroom. Cl allows students support each other and learn from one another's strengths
4. Use real world examples: By relating math concepts to real world examples can make the subject more engaging and relevant to students. This may motivates students to learn and less anxious about math.
5. Provide constructive feedback. Offer constructive feedback that focuses on improvement rather than criticism can help boost students confidence and motivation. This can done by making students to learn from their mistakes and emphasizes on importance of growth and progress.

6. Use differentiated instruction. Providing varied instructional strategies and resources to accommodate diverse learners .
7. Use alternative form of assessments to ensure that every students has the opportunity to perform well
8. Provide Positive reinforcement and encouragement to boost confidence , reduce fear and build resilience in students

Role of parents reducing mathematics anxiety

1. Encourage positive attitudes
2. Offer help with homework by explaining concepts in it
3. Seek additional resources to your children to help them learning math more engaging
4. provide a positive behavior to your child by showing the value and uses of mathematics in daily lives .
5. Encourage your child to practice math daily to help him become more comfortable with math concepts
6. Acknowledge and celebrate your child small achievements in mathematics to boost his confidence
7. Stay in touch with child's mathematics teacher to understand their progress and area of difficulty.

Conclusion

Mathematics is an extremely important subject and it is vital that students succeed in it. But Mathematics anxiety is a real problem facing students, teachers, and parents. Students who have mathematics anxiety faces long-lasting consequences that needs to be address. There are some methods that teachers and parents can use to help students overcome their mathematics anxiety in children or ways of helping students realize their own mathematics anxiety and work toward overcoming it. A better understanding of mathematics anxiety is needed in order to help students overcome this problem. The more research is done, the more students, teachers, and parents will be able to work together to overcome this problem. Also some methods are found that help prevent and reduce mathematics anxiety, the ideas and information should be shared to others.

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