Available online at: http://journal.uny.ac.id/index.php/jpms

Jurnal Pendidikan Matematika dan Sains, 13 (2), 2025, 206–222

Investigating the Interplay of Social and Biological Factors on Mathematics Anxiety among Senior Secondary Students

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Abstract

This study investigates the social and biological factors influencing mathematics anxiety among senior secondary school students in Sagamu Local Government Area, Ogun State, Nigeria. Data were gathered using a descriptive survey methodology, 500 students across five secondary schools using simple random sampling techniques. A standardized questionnaires Social Factor Questionnaire (SFQ, r=0.82), Biological Factors Questionnaire (BFQ, r=0.73) and Abbreviated Math Anxiety Scale (AMAS, r=0.84). Descriptive statistics (mean and standard deviation) and Pearson correlation analysis were used to analyze the data. Results reveal that family pressure, inappropriate teaching methods, the school environment, neurological responses to stress, and age and developmental stage are significantly related to mathematics anxiety among senior secondary school students. Conversely, learners' behaviour, genetic predispositions, and gender do not significantly affect mathematics anxiety. Therefore, the study recommends that schools s implement parent-teacher programs and counselling service to reduce family pressure and foster a supportive home environment for students.

Keywords: *Mathematics anxiety, Family pressure, Environment, Learner's behaviour, Genetic predisposition*

How to Cite: Asanre, A. A., Sandlo, A., & Adekunle, R. A (2025). Investigating the interplay of social and biological factors on mathematics anxiety among senior secondary students. *Jurnal Pendidikan Matematika dan Sains*, *13*(2), 205–222. https://dx.doi.org/10.21831/jpms.v13i2.84085

Permalink/DOI: ***DOI:*** https://dx.doi.org/10.21831/jpms.v13i2.84085

INTRODUCTION

Mathematics is a scientific discipline that investigates numbers, space, structure, quantity, problem-solving, and mathematical operations. It calls for analytical thinking and calculation skills (Roohi, 2012, Kusmaryono, et al., 2020, Onoshakpokaiye, 2021). In Nigeria's elementary and secondary education systems, mathematics is a core topic that demands efficient teaching and learning strategies to foster the abilities necessary for scientific, technological, and national development initiatives, (Asanre & Abiodun, 2025). Mathematics education aims to prepare students possessing the abilities and information required to comprehend, apply, and appreciate mathematical concepts and principles (National Council of Teachers of Mathematics, 2020). One of the foundational subjects that all students from preschool through university must take is mathematics, which plays such a significant role in human existence.

Nevertheless, one of the main subjects in which learners act biasedly and are most terrified is mathematics. Many students find the course uninteresting and challenging to understand (Küçük et al., 2013). Students encounter challenges in learning mathematics, leading to feelings of anxiety and apprehension (Ashcraft & Moore, 2009). According to Asanre et al. (2024a), there are several reasons why students frequently struggle with mathematics, such as the nature of the subject itself, ineffective teaching strategies, communication difficulties, anxiety, and teachers' inability to connect mathematical ideas with students' practical experiences. Many people find "math" to be a frightening four-letter word; they dislike it or don't think they're good at it, according to Asanre et al. (2023). The drop in math proficiency among senior school learners has made them anxious and reinforced the idea that they are not very good at the subject. Also, Fear, worry, and disengagement are caused by the perception among many learners that

mathematics is boring and meaningless, (Asanre et al., 2024b). Anxiety related to mathematics is a sensation of unease or fear that impedes one's ability to perform or engage in mathematical tasks effectively, Hembree (1990).

Mathematics-related anxiety, especially in seniors in high school, has been a topic of significant concern both locally and internationally. This stressed by Asanre et al., (2023) that anxiety related to mathematics has been identified as one of the elements causing academic performance to diminish, career choices, and overall well-being of the students. Mathematics anxiety can manifest as a tense, nervous, or afraid feeling that impairs learning mathematics, (Ashcraft & Krause, 2007). According to Green and Allerton (2019), mathematics anxiety is a mental state brought on by one's own experiences and emotional reaction to those experiences. Various social and biological factors have been identified as determinants of this anxiety, and comprehending these elements is essential to creating effective treatments, (Adekunle, 2024). Family pressure is a significant social element that contributes to students' anxiety in mathematics. In many cultures, academic success, particularly in subjects like mathematics, is highly valued, and parents often have high expectations for their children (Zakaria & Nordin, 2008). These expectations can lead to increased pressure on students to perform well, resulting in anxiety (Vazquez, 2016). For instance, in Nigeria, the competitive nature of academic environments and parental aspirations for their children to excel in mathematics often exacerbate anxiety (Eze, 2016).

The methods employed by teachers can also contribute to mathematics anxiety. Traditional teaching methods that focus on rote learning and memorization rather than conceptual understanding can hinder students' confidence and interest in mathematics (Boaler, 2013). In many Nigerian schools, the over-reliance on didactic teaching approaches rather than interactive and student-centered methods has been linked to increased anxiety levels among students (Iroegbu, 2013). This is stressed by Sheffield and Hunt (2017) that similar to other types of anxiety, students may have a faster or more intense heartbeat, think they are incapable of solving mathematical problems, and refrain from enrolling in mathematics courses. Internationally, similar trends have been observed, where innovative teaching methods have been shown help boost performance and lessen anxiety, (Ramirez et al., 2016). The school environment, including the availability of resources, peer relationships, and teacher support, plays a crucial role in shaping students' attitudes towards mathematics. A positive and supportive school environment can mitigate anxiety, whereas a hostile or unsupportive environment can exacerbate it (PISA, 2012). In Nigeria, the lack of adequate resources and large class sizes often contribute to a stressful learning environment, further increasing students' anxiety (Obodo, 2010).

Students' own behaviours and attitudes towards mathematics significantly influence their anxiety levels. A lack of confidence, negative self-perception, and avoidance behaviours are common among students experiencing mathematics anxiety (Beilock & Maloney, 2015). These behaviours can create a vicious cycle where anxiety leads to poor performance, reinforcing the fear of mathematics. Additionally, Asanre et al., (2023) reported that anxiety can negatively impact senior high school learners by causing stress, anxiety, and abandonment anxiety. Studies have indicated the significance of genetic predispositions and neurological responses in mathematics anxiety. Studies have shown that anxiety can be heritable, with certain genetic markers linked to higher anxiety levels (Wang et al., 2014). Neurological responses, such as increased activity in the parts of the brain linked to stress and terror, also participate in the manifestation of mathematics anxiety (Young et al., 2012). These biological factors underscore the complexity of anxiety, indicating that it is not solely influenced by environmental factors.

The age and developmental stage of students are critical factors in understanding mathematics anxiety. Adolescence is a period marked by significant cognitive, emotional, and social changes, making students more vulnerable to anxiety (Eccles et al., 2013). Senior secondary school students, typically aged 15-18, are at a developmental stage where they face increased academic pressures and begin to make important decisions about their future careers, often heightening anxiety levels (Chiu & Henry, 2010). Gender differences in mathematics anxiety have been widely documented, with studies consistently showing that females have a tendency to be more anxious than male, (Else-Quest et al., 2010). Cultural stereotypes that portray mathematics as a male-dominated field

can discourage females from engaging with the subject, leading to higher anxiety levels (Spencer et al., 2019).

When researching school-related issues, gender cannot be disregarded. Gender variations in mathematics instruction, learning, and accomplishment have been explained using several theories (Rahmon et al., 2021). The phenomenon of mathematics anxiety among senior secondary school students is multifaceted, driven by a confluence of biological and social elements. This corroborates the submission of Bessant (2019) asserts that there are multiple dimensions to mathematics anxiety. Family pressure, inappropriate teaching methods, and a challenging school environment can create a breeding ground for anxiety. Additionally, students' behaviours, genetic predispositions, and neurological responses further complicate the issue. The age and developmental stage of the students, along with gender differences, also play significant roles in shaping anxiety levels.

The purpose of this study is to investigate the factors that influence math anxiety in senior secondary school learners, focusing on both social and biological factors. By understanding the interplay between these factors, we can develop more targeted and effective interventions to reduce anxiety and improve mathematical performance. This research is particularly relevant in the Africa, where educational pressures and resource limitations pose significant challenges to students' academic success.

Statement of Problem

In Nigeria, there is a noticeable trend where a significant majority of students opt for courses unrelated to mathematics while applying to universities. Surprisingly, the proportion of learners enrolling in non-mathematics courses surpasses those opting for mathematics-related fields by more than tenfold. This disparity can be attributed to the prevalence of mathematics anxiety among students. Many people view mathematics as a daunting and challenging topic by a large number of learners, leading to a lack of interest, motivation, and concentration. This perception stems from the belief that mathematics is difficult to comprehend and requires a significant amount of effort to master. Consequently, students allocate minimal time and attention to studying mathematics, opting instead to focus on subjects they perceive as less demanding. These phenomena emphasize the significance of addressing mathematics anxiety among students, particularly at the senior secondary school level. By examining the social factors which include family pressure, Inappropriate Teaching Methods, The environment and learner's behaviour. The biological factors which include genetic predispositions, neurological responses to stress, age and developmental stage and gender that contribute to mathematics anxiety, researchers can gain insights into the underlying causes of students' apprehension towards the subject. Understanding these determinants is crucial for developing support systems to alleviate mathematics anxiety and promote greater engagement and success in mathematics education.

The Role of Mathematics in Education

The role of education in achieving national objectives and fostering positive societal changes is well recognized. One of the academic disciplines that examines amount, structure, space, and problem-solving techniques that call for computation and critical thinking abilities is mathematics (Kusmaryono et al., 2020). Mathematics holds significance across various domains, yet its primary impact is observed within the area of education. Because of its complexity and abstract character, mathematics is viewed as one of the most challenging disciplines to master from an international educational perspective (Azizah & Suhendra, 2020; Haase, et al., 2019). Ifamuyiwa et al., (2024) stated that mathematics is an intellectually stimulating field that influences many aspects of human activity, including politics, economics, science, and technology. As such, it serves as a paradigm for how scientific concepts should be interpreted and applied. Knowledge of mathematics enhances a person's reasoning and problem-solving skills. It serves as the foundation for societal transformation and the transfer of ideas into reality (Abubakar and Afe-Buame, 2011). Researchers have also identified a number of factors that contribute to low achievement among students, including entry level/background, anxiety, attitude issues, lack of interest in mathematics, self-concept, study habits, achievement motivation, disadvantaged exposure, problem-solving strategies, misinterpretation of mathematical symbols and

terms, misinterpretation of word problems, disregard for exam instructions, gender issues, and inadequate preparation for mathematics exams, (Ifamuyiwa et al., 2024). This causes learners to become anxious, afraid, and less motivated to study mathematics in-depth (Yahya & Amir, 2018). Additionally, Adekunle (2024) reported that the interconnected nature of the learning process of the subject, demanding mastery of prior topics, often leads students to encounter challenges throughout their mathematics lessons.

The Concept of Mathematics Anxiety

An emotional disorder known as anxiety is characterized by feelings of trepidation, panic, concern, fear, and uneasiness (Jatt, 2019). Human behavior and thought processes will be indirectly impacted by this circumstance. When someone suffers emotional problems or bad emotions as a result of events involving mathematics in learning or daily activities, they are said to have mathematics anxiety (Namkung et al., 2019). Chang and Beilock (2016) claim that those who are math-anxious frequently exhibit psychological symptoms like tension, negativity and avoiding mathematical situations or physiological signs include anxiety, paleness, perspiration, or elevated blood pressure (Namkung et al., 2019). Because of this emotional disconnect, math-anxious people view solving math-related issues and participating in math-related activities as burdens (Haase et al., 2019) and according to Beilock and Maloney (2015), there is a propensity to consider impacts and consequences. The impact on learners' performance or achievement in mathematics is one of the primary areas of research on mathematics anxiety from earlier studies. According to research by Foley et al. (2017), Mutlu (2019), Ramirez et al. (2018), and Namkung et al. (2019), students' performance and mathematics anxiety are negatively correlated; a high level of mathematics anxiety results in subpar mathematics success.

This situation occurred because learners' arithmetic talents or skills are impacted by mathematics anxiety, according to Ramirez et al. (2018). This leads to disruptions in the learning process, lower motivation (Suren & Kandemir, 2020), depression (McDonough & Ramirez, 2018), a decrease in confidence (Namkung et al., 2019), a decrease in interest in mathematics, and ultimately math-avoidance behavior (Mutlu, 2019). Therefore, identifying ways to prevent detrimental effects in the future and to overcome mathematics anxiety through the process of recovery and early intervention, it is crucial to address the issue, particularly at the earlier stages of active learning (Namkung et al., 2019). The main cause of mathematics anxiety, according to Mann and Walshaw (2019), is anxiety during assessments. This is because math-worried learners often have a negative anticipation or perspective of assessment and become extremely anxious when being evaluated. Additionally, Arslan (2020), submitted that anxiety during assessments is one of the circumstances that contributes to a high level of mathematics anxiety. Environmental variables like fierce competitiveness and a high degree of stress in the society are to blame for this (Koçoğlu & Kaya, 2016).

Social Factors Influencing Mathematics Anxiety

Social factors significantly impact students' experiences and attitudes toward mathematics, shaping how they perceive and respond to academic challenges (Ashcraft & Ridley, 2005). These factors include family dynamics, Inappropriate teaching methods, environment and Learner's behaviour. Family plays a crucial role in shaping children's attitudes toward mathematics. Parental beliefs and expectations can significantly influence a child's experience with math. For instance, parents who demonstrate a positive attitude towards mathematics and confidence in their child's abilities can foster a supportive environment, reducing anxiety (Gunderson et al., 2012). Conversely, negative parental beliefs or high-pressure expectations can contribute to increased anxiety and undermine a child's confidence and enjoyment of the subject (Maloney et al., 2015). More so, several parents think that their children must excel in math and take science, technology, engineering, and math (STEM) courses if they want to have well-paying careers. Students are less likely to enroll in STEM-related courses in secondary or post-secondary education if they experience anxiety that is not managed during their early or middle school years (Dunin, 2021).

Educational settings, including teaching methods and classroom environments, also impact mathematics anxiety. Teachers who use supportive teaching strategies and create a nurturing classroom climate can help reduce

anxiety and build students' confidence (Ramirez et al., 2016). On the other hand, negative classroom experiences, such as punitive grading or high-stakes testing, can increase anxiety and fear of failure (OECD, 2019). In the study with a sample of 916 students chosen by convenience sampling, Zanabazar et al. (2023) investigated the factors that contribute to math anxiety in undergraduate students. They found that learner, family, and school-related factors, such as inadequate teaching strategies, poor student-teacher communication, a heavy workload, and the use of out-of-date resources, are to blame. Also, in a review-based study on math anxiety and math learning, Vargas (2021) discovered that environmental factors, including parental education, the home and family setting, parenting style, and technical training, are important. Additionally, mathematics anxiety is influenced by a number of factors, including content, teacher education, and parents' low socioeconomic standing.

Peer interactions further influence students' attitudes toward mathematics. Positive peer support can enhance motivation and reduce anxiety, while negative interactions or peer competition can exacerbate anxiety and feelings of inadequacy, (Ryan, 2001). The nature of peer relationships significantly impacts how students handle mathematical challenges. Siswanti & Djalal (2018) opined that unfavorable self-perception and incapacity to resolve mathematical problem on the part of learner, peer influence, negative emotional reaction to solve mathematical problems were the main contributing factors to mathematical anxiety.

Biological factors influencing mathematics anxiety

There is an increasing awareness of the significance of biological factors in shaping individuals' emotional and cognitive responses to mathematics (Ashcraft & Ridley, 2005; Maloney & Beilock, 2012). Understanding the biological underpinnings of mathematics anxiety is crucial, as it provides a more comprehensive framework for addressing this issue and informs the development of effective interventions aimed at alleviating anxiety among students. advancements in neuroscience and psychology have shed light on several biological factors that may influence mathematics anxiety, including genetic predispositions, neurobiological mechanisms, hormonal responses, and developmental factors (Suárez-Pellicioni et al., 2016).

Therefore, in genetic studies suggest that individual differences in mathematics anxiety may have a heritable component, as evidenced by twin studies demonstrating that genetic factors account for a significant proportion of the variance in anxiety levels related to mathematics (Ersozlu & Karakus, 2019). These findings imply that some individuals may be genetically predisposed to experience increased anxiety in mathematics. Additionally, according to Suárez-Pellicioni et al. (2016), between 30 and 40 percent of the variation in math anxiety among people can be attributed to genetic variables. Functional magnetic resonance imaging (FMRI) and other neuroimaging methods have shed light on the distinct areas of the brain involved in both emotional regulation and mathematical cognition. Revealing that individuals with mathematics anxiety exhibit increased activity in the parts of the brain linked to fear and anxiety, particularly the amygdala (Young et al., 2012).

Additionally, this interaction between the emotional and cognitive centers of the brain is a key factor in understanding why students with mathematics anxiety struggle to perform well in math, even when they possess the necessary skills. Considering another factor Barroso et al., (2021) submitted that female tend to exhibit greater concern about mathematics and give oneself a worse rating compared to their male counterpart. Some researchers concluded that one possible explanation for higher math anxiety in women compared to men is the stereotype threat, which suggests that women may feel anxious due to the stereotype that men are better at math (Dowker et al., 2016; Geary et al., 2019). Anxiety related to mathematics tends to rise with age during childhood; this is because as children grow older, they are introduced to more complex mathematical concepts, which can increase the cognitive demands placed on them, (Adekunle, 2024). some studies have discovered that even children in early elementary school experience significant anxiety (Wu et al., 2012).

Theoretical Review

The theory used to explain this research is the Transactional Model of Stress and Coping proposed by Lazarus and Folkman (1984). The idea holds that interactions between people and their surroundings are what lead to stressful experiences. According to the concept, humans

are meaning-making beings who continuously assess everything that occurs and make use of emotional cues from past stressful experiences. Primary and secondary cognitive appraisals were identified as two types of cognitive appraisals. In primary assessment, people consider their interests in a potentially dangerous scenario. Their emotions, nature and intensity are influenced by their response to the query. In secondary assessment, people ask themselves what they can do to deal with the perceived threat, or what their coping alternatives are. The response to this question influences the kinds of coping mechanisms they will use to deal with the demands of the circumstance. While coping reactions are emotionally or problem-focused and impact an individual's short- and long-term results, coping resources include personal characteristics and the environment.

In the context of mathematics anxiety among senior secondary school students, this theory buttressed that some factors could lead to stress thereby pointing ways to anxiety due to some factors such as environmental stressors: social and biological factors, such as family pressure, peer interactions, genetic predispositions, and neurological responses to stress, serve as environmental stressors that contribute to mathematics anxiety among students. These factors create perceived challenges and threats in the academic environment, triggering anxiety responses in students. Additionally, Students engage in cognitive appraisal processes to evaluate and interpret the significance of the environmental stressors in relation to their mathematical abilities and resources. They assess the demands of mathematical tasks, their perceived ability to cope with those tasks, and the potential consequences of failure or success in mathematics leads to anxiety.

Objectives of the Study

The purpose of this study is to ascertain the social and biological factors that contribute to senior secondary school students' anxiety in mathematics. The specific objectives are as follows:

1. To identify the social factors contributing to mathematics anxiety among senior secondary school students, including family pressure, Inappropriate teaching methods, environment and learner's behaviour.
2. To explore the biological factors associated with mathematics anxiety among senior secondary school students, including genetic predispositions, neurological responses to stress, age and developmental stage and gender.

The research question of this study are:

1. What is the mean and standard deviation score of social factors including family pressure, Inappropriate teaching methods, environment and learners' behaviour contribute to students in senior secondary school who suffer from arithmetic anxiety?
2. What is the mean and standard deviation score of biological factors, such as genetic predispositions, neurological responses to stress, age and developmental stage and gender influence Students in senior secondary school who suffer from arithmetic anxiety?

RESEARCH METHOD

A quantitative method was used in this study to look into the social and biological factors influencing students in senior secondary school who are anxious about mathematics. Specifically, a cross-sectional survey design was used. This design was selected because it made it possible to gather information from a sizable sample at one moment, facilitating the investigation of the connections between social and biological factors and mathematics anxiety. Students from senior secondary schools in Sagamu local government area, Ogun State, Nigeria, make up the study's population. Samples for this study consisted of 500 Senior Secondary School students, drawn from five public secondary schools located in Ogun State, Nigeria's Sagamu Local Government Area. A stratified random sampling technique was used to provide a balanced and representative sample. Each selected schools served as a stratum. Within each school, the student population was further divided into relevant subgroups, such as gender and grade level. A random sample of students was then selected from each subgroup to ensure proportional representation of different demographic categories. This approach helped to capture the diversity within each school, ensuring that the findings were reflective of the broader student population. A total 100 learners were chosen at random from each school, resulting in an overall sample size of 500 students. The selected students were informed about the study.

Instrumentation

The research instruments were utilized to collect data on the factors affecting Students in senior secondary school who are anxious about mathematics. The questionnaire was organized into two sections: personal data and the main research instruments. Personal Data Section: This section gathered demographic information from the respondents to contextualize the data collected. The questionnaire on social factors (SFQ) was adapted from the work of Kour & Rafaqi, (2024), who used it to assess factors influencing mathematical anxiety among students. The original questionnaire was validated through Cronbach's alpha, indicating acceptable internal consistency. For our study, the questionnaire was specifically adapted to focus on social factors such as family pressure, inappropriate teaching methods, the environment, and learners' behaviour. It comprised 20 items, divided into four sub-factors, each containing five questions. The instrument was rated according to a four (4) point modified Likert format: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD).

The biological factors questionnaire (BFQ) was adapted from the study by Luttenberger et al. (2018), the spotlight on mathematics anxiety. The study investigated the role of biological factors in math anxiety. This included genetic predispositions, neurological responses, and other biological determinants. The adapted version for our study examined these factors in the context of senior secondary school students. The questionnaire also consisted of 20 items, divided into four sub-factors, each with five questions. The instrument was rated according to a four (4) point modified Likert format: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD).

The Hopko et al. (2003) Abbreviated Math Anxiety Scale (AMAS), was adapted to measure mathematics anxiety. The scale was relevant for the study as it specifically assesses anxiety related to math tasks. Making it highly relevant for our research on how mathematical anxiety interacts with social and biological factors. To fit the senior secondary education context, the scale was modified by adjusting the wording of items and response options. The instrument was rated according to a five (5) point: "low anxiety," "some anxiety," "moderate anxiety," "quite a bit of anxiety," and "high anxiety.".

To ascertain the face validity and content of the instruments, the research instruments were validated by experts in the field to check the content to see whether the instrument measure what is sought to measure. All necessary corrections and modifications were incorporated before the administration of the instrument. The validated questionnaire comprising 50 items (20 items for social factors, 20 items for biological factors and 10 items for The Abbreviated Math Anxiety Scale (AMAS)) was administered to twenty students in Ijebu-Ode Local Government Area of Ogun State, Nigeria, who will not be part of the main study. The questionnaire was administered twice within an interval of one week. Results obtained to determine the instrument's degree of dependability, data from the two administrations were correlated using the Pearson product-moment correlation coefficient. A reliability coefficient of (r) = 0.82 was obtained for the instrument on social factors, Pearson correlation coefficient of (r) = 0.73 was obtained for the instrument on biological factors and (r) = 0.84 for the Abbreviated Math Anxiety Scale (AMAS)). Which indicates good reliability for our research instruments.

Permission was sought from the respective schools to conduct the study, emphasizing the study is for academic purpose. Respondent's consents were sought and were assured that their participation is solely for research purposes and will not have any individual repercussions. The responses from the questionnaire were examined by the use of descriptive statistics, including frequency counts and percentages, to summarize demographic information such as age, gender, and class. This provided an overview of the sample's demographic characteristics. In addition, descriptive statistics, specifically mean and standard deviation, were used to evaluate the study questions, offering insight into the central tendency and variability of the data. Pearson correlation analysis was used to investigate the correlations between the variables and ascertain the direction and intensity of the associations in order to evaluate the hypotheses.

Hypotheses

The subsequent study's hypotheses were investigated at a 0.05 level of significance.

H1: Anxiety in mathematics among senior secondary school learners is not significantly correlated with family pressure.
H2: Inappropriate teaching strategies and math anxiety in senior secondary school learners do not significantly correlate.
H3: Anxiety in mathematics among senior secondary school learners is not significantly correlated with the school environment.
H4: Anxiety in mathematics among senior secondary school learners is not significantly correlated with their behavior.
H5: Anxiety in mathematics among senior secondary school learners is not significantly correlated with genetic predispositions.
H6: Anxiety in mathematics among senior secondary school learners is not significantly correlated with neurological reactions to stress.
H7: Anxiety in mathematics among senior secondary school learners is not significantly correlated with age or developmental stage.
H8: Mathematics anxiety in senior secondary school students is not significantly correlated with gender.

RESULT AND DISCUSSION

Result

Table 1 shows the gender distribution of the respondents. Of 501 respondents, 52.0% (260) are male and 48.0% (240) are female. This indicates a slightly higher proportion of male respondents compared to female respondents. The nearly equal gender distribution suggests a balanced representation, with a marginal difference favoring males. This implies that the close distribution between male and female respondents implies that any analysis or findings from this data will not be heavily biased by gender, providing a relatively balanced view of the opinions or behaviors being studied.

Table 2 provides a breakdown of the respondents' ages. The largest age group is 15-17 years, accounting for 43.1% (215) of the total respondents. The age range of 12 to 14 years comes next with 29.9% (150) and those aged 17 years and above, comprising 27.0% (135). The distribution implies that a significant number of responders are between the ages of 15 and 17. This age group is likely to be the focus of any analysis, and the results could predominantly reflect the experiences, opinions, or behaviors of mid-teens. The lower percentages for the younger (12-14 years) and older (17 years and above) groups suggest that their perspectives might be underrepresented in comparison.

Table 3 presents the class distribution of respondents. The highest representation comes from SS2 students, with 39.1% (196) of the total respondents. SS3 students follow with 32.6% (163), and SS1 students are the least represented with 28.3% (141). The fact that SS2 students form the largest group might imply that findings related to school class, educational experience, or academic performance will primarily reflect those in SS2. The nearly balanced representation among the three classes suggests that the dataset can provide insights into all three senior secondary school classes but with a slight skew toward the experiences of SS2 students.

Table1. Gender of respondents

Gender	Freq	Percentage (%)
Female	240	48
Male	260	52
Total	500	100

Table 2. Age of respondents

Age (Years)	Freq	Percentage (%)
12–14	150	29,9
15–17	215	43.1
Above 17	135	27.0

Table 3. Class of respondents

Class	Freq	Percentage (%)
SS1	141	28.3
SS2	196	39.1
SS3	163	32.6

Analysis of Research Question

Family Pressure has 2.7860 as the mean score and 0.50809 as the standard deviation. This suggests that on average, students perceive family pressure to be a moderately significant factor contributing to their anxiety in mathematics. The relatively low standard deviation indicates that most students' perceptions of this factor are quite consistent, with not much variation in responses.

Inappropriate Teaching Methods show 2.6834 mean score with a 0.50692 standard deviation. This indicates that students generally consider ineffective or unsuitable teaching methods to be a notable source of anxiety, although slightly less influential than family

pressure. The consistency of responses is similar to that of family pressure, as reflected by the standard deviation.

The Environment, which includes the broader classroom and school setting, has 2.6557 as the mean score, with a 0.54118 standard deviation. This mean score suggests that environmental factors are also perceived as moderately contributing to mathematics anxiety. The standard deviation here is slightly higher compared to the previous factors, indicating a bit more variability in how students perceive the impact of their environment on their anxiety levels.

Learners' Behavior, reflecting how students' own behaviors and attitudes might contribute to their anxiety, has 2.5636 as the average score and 0.53693 as the standard deviation. This factor has the lowest mean score among the social factors, suggesting it is perceived as a slightly less significant contributor to anxiety than the other social factors listed. However, it still indicates a moderate influence.

Overall, the mean scores for these social factors range between approximately 2.56 and 2.79, while the standard deviations range between 0.50 and 0.54. These findings suggest that social factors moderately contribute to mathematics anxiety among senior secondary school students, with students generally expressing consistent views on their impact**.**

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Table 4. Data for the first research question

Descriptive Statistics					
	N	**Min**	**Max**	**Mean**	**Std. Deviation**
Family Pressure	500	1.00	4.00	2.7860	.50809
Inappropriate Teaching Methods	499	.80	4.00	2.6834	.50692
Environment	499	1.00	4.00	2.6557	.54118
Learners' Behavior	500	1.00	4.00	2.5636	.53693
Valid N (listwise)	499				

Genetic Predisposition has 2.5816 as the mean score and 0.53568 as the standard deviation. Score suggests that students perceive genetic factors as having a moderate influence on their anxiety levels regarding mathematics. The standard deviation reflects some variability, though it remains relatively low, indicating that many students share similar views on the impact of genetics.

Neurological Responses to Stress, which considers the physiological reactions to stress that may affect anxiety levels, has 2.6424 as the mean score and 0.54206 as the standard deviation. This factor has a slightly higher mean score than genetic predisposition, suggesting it is perceived as a marginally more significant contributor to mathematics anxiety. The standard deviation is similar to that of genetic predisposition, showing consistent responses among the students.

Age and Developmental Stage has 2.6356 mean score with a 0.50019 standard deviation. The mean score is close to that of neurological responses to stress, indicating that students view their developmental stage as a comparable factor in influencing anxiety levels. The lower standard deviation suggests that perceptions about this factor are quite consistent across the student population.

Gender has 2.5564 as the average score and 0.54924 as the standard deviation. This factor shows the lowest mean score among the biological factors, indicating it is seen as a slightly less significant contributor to mathematics anxiety compared to the others. However, it still has a moderate level of influence, with a slightly higher standard deviation indicating a bit more variability in responses.

Overall, the mean scores for biological factors range from approximately 2.56 to 2.64, with standard deviations between 0.50 and 0.55. This indicates that biological factors also play a moderate role in contributing to mathematics anxiety among senior secondary school students, with students generally showing consistent views on these factors' impacts.

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Table 5. Data for the first research question

Descriptive Statistics					
	N	Min	Max	Mean	Std. Deviation
Genetic Predisposition	500	1.00	4.00	2.5816	.53568
Neurological Responses to Stress	500	.40	4.00	2.6424	.54206
Age and Development Stage	500	.80	4.00	2.6356	.50019
Gender	500	1.00	4.00	2.5564	.54924
Valid N (listwise)	500				

Testing of Hypothesis

Hypothesis 1

Table 6 shows the Pearson correlation analysis reveals a correlation coefficient of -0.190 with a 0.000 for the p-value, which is below the 0.05 alpha threshold. This finding suggests a strong correlation between family pressure and mathematics anxiety. Consequently, the null hypothesis is disproved, confirming that family pressure is significantly related to students' anxiety in mathematics.

Hypothesis 2

Table 7 answered hypothesis 2. A p-value of 0.000 and a Pearson correlation of -0.258 are displayed by the analysis. The null hypothesis is disproved since the p-value is less than the value set at 0.05. This means that inappropriate teaching methods significantly contribute to increased anxiety in mathematics among students.

Hypothesis 3

Table 8 answered hypothesis 3. The p-value is 0.000 and the correlation coefficient is -0.301. The null hypothesis is disproved since the p-value is less than 0.05. This finding suggests that the school environment significantly impacts students' anxiety in mathematics.

Hypothesis 4

Table 9 answered hypothesis 4. The Pearson correlation for this hypothesis is -0.035, with a p-value of 0.439, This exceeds the 0.05 alpha threshold. Consequently, the null hypothesis is approved, indicating that learners' behavior does not have a significant relationship with their anxiety in mathematics

Hypothesis 5

Table 10 answered hypothesis 5. The p-value is 0.663 and the correlation coefficient is -0.020. Since the p-value exceeds 0.05, we accept the null hypothesis. This outcome suggests that genetic predispositions do not have a significant effect on mathematics anxiety among these students.

Hypothesis 6

Table 11 answered hypothesis 6. A p-value of 0.001 and a correlation coefficient of -0.145 are displayed by the analysis. The null hypothesis is disproved since the p-value is less than 0.05. This shows neurological responses to stress do significantly influence mathematics anxiety in students

Hypothesis 7

Table 12 answered hypothesis 7. The correlation coefficient is below the 0.05 significance level, with a p-value of 0.000 and a correlation coefficient of -0.195. Consequently, the null hypothesis is rejected, indicating a significant impact of age and developmental stage on students' mathematics anxiety.

Hypothesis 8

Table 13 answered hypothesis 8. The p-value is 0.441, which is higher than 0.05, and the Pearson correlation coefficient is 0.035. As a result, null hypothesis is accepted, showing that gender does not have a noteworthy connection with mathematics anxiety.

Table 6. The result of hypothesis 1

Correlations			
		Family Pressure	**Mathematics Anxiety Scale**
Family Pressure	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	500	
Mathematics Anxiety Scale	Pearson Correlation	-.190**	1
	Sig. (2-tailed)	.000	
	N	500	500

**. Correlation is significant at the 0.01 level (2-tailed).

Table 7. The result of hypothesis 2

Correlations			
		Inappropriate Teaching Methods	**Mathematics Anxiety Scale**
Inappropriate Teaching Methods	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	500	500
Mathematics Anxiety Scale	Pearson Correlation	-.258**	1
	Sig. (2-tailed)	.000	
	N	500	500

**. Correlation is significant at the 0.01 level (2-tailed).

Table 8. The result of hypothesis 3

Correlations			
		School Environment	**Mathematics Anxiety Scale**
School Environment	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	500	
Mathematics Anxiety Scale	Pearson Correlation	-.301**	1
	Sig. (2-tailed)	.000	
	N	500	500

**. Correlation is significant at the 0.01 level (2-tailed).

Table 9. The result of hypothesis 4

Correlations			
		Learners' Behavior	**Mathematics Anxiety Scale**
Learners' Behavior	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	500	
Mathematics Anxiety Scale	Pearson Correlation	-.035	1
	Sig. (2-tailed)	.439	
	N	500	500

Table 10. The result of hypothesis 5

Correlations			
		Genetic Predisposition	**Mathematics Anxiety Scale**
Genetic Predisposition	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	500	
Mathematics Anxiety Scale	Pearson Correlation	-.020	1
	Sig. (2-tailed)	.663	
	N	500	500

Table 11. The result of hypothesis 6

Correlations			
		Neurological Responses to Stress	**Mathematics Anxiety Scale**
Neurological Responses to Stress	Pearson Correlation	1	-.145**
	Sig. (2-tailed)		.001
Mathematics Anxiety Scale	N	499	499
Mathematics Anxiety Scale	Pearson Correlation	-.145**	1
	Sig. (2-tailed)	.001	
	N	499	500
**. Correlation is significant at the 0.01 level (2-tailed).			

Table 12. The result of hypothesis 7

Correlations			
		Age and Development Stage	**Mathematics Anxiety Scale**
Age and Development Stage	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	500	
Mathematics Anxiety Scale	Pearson Correlation	-.195**	1
	Sig. (2-tailed)	.000	
	N	500	500
**. Correlation is significant at the 0.01 level (2-tailed).			

Table 13. The result of hypothesis 8

Correlations			
		Gender	**Mathematics Anxiety Scale**
Gender	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	500	
Mathematics Anxiety Scale	Pearson Correlation	.035	1
	Sig. (2-tailed)	.441	
	N	500	500

Discussion

The finding revealed a significant relationship between family pressure and senior secondary school students' anxiety in mathematics. To back this up, family expectations and pressure are pivotal factors that contribute to mathematics anxiety among senior secondary school students. Families often have high expectations regarding their children's academic performance, particularly in subjects like mathematics, which is widely regarded as a key indicator of academic prowess. When students are subjected to excessive pressure from parents to excel, it can lead to heightened anxiety levels (Ahmed et al., 2012; Odiri, 2023). This pressure creates an environment where the fear of failure becomes a predominant thought, affecting students' confidence and emotional well-being, ultimately resulting in mathematics anxiety (Marks, 2022; Kavak & Coşkun, 2023). The second finding of the research discovered that inappropriate teaching methods would significantly increase mathematics anxiety among senior secondary school students. To support this finding, the methodology adopted by educators in teaching mathematics significantly impacts students' anxiety levels. Teaching methods that emphasize rote memorization, speed in solving problems, or lack adequate explanation can exacerbate anxiety among students (Ramirez et al., 2016; Odiri, 2023). Studies show that more interactive and student-centered teaching approaches, such as problem-based learning or collaborative learning methods, help reduce mathematics anxiety by allowing students to engage with the material more comfortably and understand it deeply (Wang et al., 2018).

Thirdly, it was discovered that the school environment significantly affects students' anxiety levels in mathematics. In support of this finding, the school environment, including the attitudes of teachers and peers towards mathematics, can either mitigate or exacerbate mathematics anxiety. Schools that foster a supportive and non-judgmental atmosphere towards students who excel in mathematics are more likely to have reduced anxiety levels. Conversely, a competitive and unsupportive environment can lead to higher anxiety levels (Ashcraft & Krause, 2007). Factors such as teacher expectations, peer pressure, and the general attitude towards mathematics in the school play crucial roles in influencing students' anxiety levels (Kim et al., 2015). Additionally, the study revealed that learners' behaviour is not significantly related to their anxiety in mathematics. Contrary to some expectations, individual learner behaviors, such as classroom participation or attentiveness, do not significantly impact mathematics anxiety. This finding suggests that while classroom behavior may affect immediate learning outcomes, it is not a primary factor in long-term anxiety development regarding mathematics (Dowker et al., 2016). This negates the findings of Zanabazar et al., (2023), they submitted that learners related factors are strongly correlated with mathematics anxiety.

Furthermore, it was found that genetic predispositions will not significantly affect mathematics anxiety among senior secondary school students. To back this up, Stein et al., (2017) found out that genetic factors do not significantly affect mathematics anxiety among senior secondary school students. While there is some literature suggesting a genetic component to general anxiety disorders, (Vargas, 2021). The specific context of mathematics anxiety seems to be more influenced by environmental and situational factors rather than hereditary predispositions (Wang et al., 2014). Also, it was discovered that neurological responses to stress will significantly influence mathematics anxiety in senior secondary school students. To support this, research has established that stress responses contribute significantly to the growth of mathematics anxiety. Neurological research shows that when students experience stress in learning environments, particularly in subjects they find challenging like mathematics, there is an activation of areas of the brain linked to fear and anxiety, For example, the amygdala, (Young et al., 2012). This physiological response can inhibit cognitive functioning, making it harder for students to process mathematical concepts effectively, thus perpetuating a cycle of anxiety and poor performance (Maloney et al., 2014).

It was also found that age and developmental stage have a big influence on mathematics anxiety in senior secondary school students. Age and developmental stage have also been found to significantly impact mathematics anxiety. During adolescence, which coincides with the senior secondary school period, students undergo various cognitive, emotional, and social changes that can heighten their anxiety levels (Hill et al., 2016). Adolescents are more susceptible to anxiety due to the pressures of academic

achievement, peer influence, and self-esteem issues, all of which can exacerbate their fear of failure in subjects like mathematics (Meece et al., 2006; Pramana et al., 2020). Finally, it was revealed that gender and senior secondary school students' anxiety in mathematics do not significantly correlate. Gender differences have often been cited in the context of mathematics anxiety, with a prevailing belief that female students experience higher anxiety levels than males. However, recent studies have challenged this notion, revealing that when controlling other factors such as self-efficacy and previous performance, gender does not have a significant direct effect on mathematics anxiety (Else-Quest et al., 2010). This finding suggests that any perceived differences may be more related to societal expectations and stereotypes rather than inherent gender differences.

CONCLUSION

The findings reveal that various factors significantly contribute to mathematics anxiety, providing important insights for educators, policymakers, and stakeholders in the educational sector. It is therefore concluded that both social and biological factors are significant determinants of senior secondary school learners' mathematics anxiety in Sagamu Remo, Ogun State, Nigeria. These factors create psychological and environmental contexts that exacerbate students' fears and anxieties related to mathematics, hindering their general well-being and academic achievement. Therefore, it is crucial for educators and school administrators to implement effective intervention strategies that address these issues. Such strategies should include reducing family-induced stress through parental education programs, enhancing teaching methodologies to make mathematics more engaging, and fostering supportive school environments that alleviate anxiety. Some limitations were observed such as time constraints, limited scope of factors, fear on the part of student and the population may not represent all senior secondary schools in the State. Notwithstanding these drawbacks, the study offers insightful information about the intricate variables affecting senior secondary school learners' anxiousness in mathematics.

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