

Examining the Determinants of Anxiety and Academic Stress in Learning Mathematics

Yang Xinjing¹ & Khairul Azhar Jamaludin^{1,2,3}

¹Faculty of Education, Universiti Kebangsaan Malaysia, Bangi, Selangor, Malaysia, ²University Research Group on ELITEE: Enhanced Learning for Inclusive Transformation Education Experience, ³University Research Group on Edexcellence: Development of Innovative Curriculum & Pedagogy

Email: p132323@siswa.ukm.edu.my, khairuljamaludin@ukm.edu.my

To Link this Article: <http://dx.doi.org/10.6007/IJARPED/v13-i4/23677> DOI:10.6007/IJARPED/v13-i4/23677

Published Online: 15 November 2024

Abstract

This paper determines mathematics anxiety and academic stress in mathematics learning through an analysis of the interrelationship between the factors thereof and its impact on the performance of students. Mathematics anxiety refers to a type of anxiety characterized by feelings of tension coupled with fear, which often predicts academic stress, especially in educational settings which are highly pressurized. This article has highlighted major precursors that math anxiety is normally typified with, which include previous traumatic experiences, learning strategies, and parental influences, all of which contribute to the escalation in the levels of stress. Math anxiety has also been debated on the perspective of males and females; findings have established that female students are prone to developing math anxiety due to stereotype threats and stereotypes present within society. It also looks at how math anxiety disrupts cognition, such as working memory, following the derivation of lower performances. For instance, cognitive-behavioral therapy, mindfulness practices, and growth mindset teaching strategies are discussed as being particularly effective for alleviating anxiety and stress. The interdependent relationship between mathematics anxiety and academic stress goes both ways, meaning that a deeper, more nuanced understanding of this will further enable educators and policymakers to develop appropriate targeted strategies aimed at student support, enhanced mathematical proficiency, and overall better academic success for all. Longitudinal effects of the interventions and complex relationships between anxiety, stress, and performance in math learning are suggested for further investigation in future research directions.

Keywords: Mathematics Anxiety, Academic Stress, Cognitive Impairment, Teaching Methods, Mindful Practices, Cognitive-Behavioral Therapy

Introduction

Mathematics is a critical field that lays the groundwork for many other disciplines, although it is among the subjects that students fear the most. Mathematics anxiety refers to an emotional response that can be described in terms of tension, fear, or apprehension when one engages

in mathematical activities (Ashcraft, 2002). This emotional reaction not only interferes with students' performance but also serves to occasion avoidance behaviors, such as not doing homework or avoiding courses that involve any mathematics. Over time, mathematics anxiety can cumulate into more serious forms of academic stress, especially in settings where academic success is radically defined by performance in math (Jameson, 2019). That would indicate the particular view that mathematics anxiety and academic stress are interrelated, piling onto each other in a vicious circle-anxiety feeds into the stress, and vice versa.

Academic stress in mathematics learning is considered a certain kind of psychological distress that possibly arises from students' appraisals that the demands in mathematics go beyond available resources (Lazarus & Folkman, 1984). This form of stress often occurs due to external pressures like high expectations by teachers and parents, standardized testing, and an overall competitive academic environment. Combined with internal emotional responses of a student, such as mathematics anxiety, stress can trigger negative academic performances (Beilock & Willingham, 2014). Students' overall well-being compromise while struggling to cope with the internal pressures set by anxiety and the external pressures set by academic performances, which might further result in avoidance of tasks related to mathematics. Some identified a strong relationship between mathematics anxiety and academic stress (Gunderson et al., 2018). Most of the studies utilized suggested that both factors can enter a cycling effect, where one factor influences the other. Students who report high anxiety when performing tasks mathematically are likely to report heightened academic stress, particularly in situations where their performance is under scrutiny (Suárez-Pellicioni, Núñez-Peña, & Colomé, 2016; Wong, 2024). These students often feel a lack of self-efficacy; that is, they believe their mathematics abilities are capped, which in turn feeds their anxiety and continues to drive down their performance (Ashcraft & Krause, 2007).

Anxiety about mathematics and academic stress influence the students' performances academically, which in turn have gained long-term impacts on students' psychological wellbeing and also on career trajectories. As an example, high levels of math anxiety make many students refrain from studying STEM fields - Science, Technology, Engineering, and Mathematics, both in higher education and professional careers (Devine et al., 2018). This avoidance is greatly influenced by the belief of their own inability to succeed in math-intensive fields when they actually would be very capable. The chronic experience of academic stress might also lead to more generalized forms of anxiety and depression, especially during epochs considered critical in academic development, like adolescence (Ramirez et al., 2016).

Mathematics anxiety and academic stress give rise to research that, in the past few years, not only focuses on the causes but also develops interventions that could mitigate their effects. Interventions such as cognitive behavioral therapy and mindfulness practices, for example, seem to help these students reinterpret their negative thoughts about mathematics, with reductions in anxiety reported. In addition, educators around the globe are encouraged to apply more teaching methods that will make the learning atmosphere less judgmental, hence more comforting; this could either reduce the anxiety or the level of stress (Dowker, Sarkar, & Looi, 2016). For instance, it has been highly documented in literature that integrating technology into mathematics education-through apps and interactive games-presents mathematical concepts in a more digestible manner, making students' anxiety about mathematics more minimal (Abdullah et al., 2021). With these advances, much about the

complicated interaction of mathematics anxiety and academic stress remains to be learned. Individual differences in gender, socio-economic background, and prior experiences with mathematics should also be further investigated on how these modify the development of anxiety and stress. Also, there is a need for more longitudinal studies to understand how these factors change over time and how early interventions may prevent severe academic stresses and anxieties later in life.

The objectives of this review are to discuss the determinants of mathematics anxiety and academic stress, besides considering the relationship between the two constructs. We shall examine recent studies in an attempt to identify the essential elements that bring forth these issues and, consequently, to explore the implications these have for students' academic performances and psychological well-being.

The objectives of this review paper are as follows

- To explore the concept of academic stress in mathematics learning and its underlying causes.
- To identify the determinants of mathematics anxiety and how it contributes to academic stress
- To examine the relationship between mathematics anxiety and academic stress and their combined impact on students' academic performance.
- To review potential interventions that can alleviate mathematics anxiety and academic stress in students.

Literature Review

Mathematics anxiety is related to academic stress in educational psychology. More often than not, heightened academic stress is considered the result because of mathematics anxiety. It can have many negative impacts on the students regarding their academic performance and their overall well-being. In this section, we review the existing literature regarding academic stress in mathematics learning and mathematics anxiety. These will be followed by, but not limited to, other subheadings on the main areas: determinants of mathematics anxiety, gender differences in mathematics anxiety, and involvement of teachers and parents. These themes give insight into how best to understand the causes of these phenomena and their effects on students' learning outcomes.

Academic Stress in Mathematics Learning

Academic stress can be defined as pressure imposed by demands of schoolwork that often creates emotional and psychological distress. Mathematics learning would involve high academic stress because of its high cognitive demands, along with the need for high grades, and deeper beliefs on reflection of overall intelligence on performance in mathematics (Lazarus & Folkman, 1984). As noted by Ramirez et al. (2016), academic mathematics stress begins early within childhood and increases with the advancement of school. A major constituent element within academic stresses is the perception that mathematics is intrinsically difficult and abstract. This perception is perpetrated through societal expectations and the high stakes nature of testing in mathematics, adding to increased levels of stress (Beilock & Willingham, 2014). In this regard, Gunderson et al. (2018) discovered that higher reporting of academic stress translated to lower demonstration of performance for students

in mathematics; it became some kind of vicious circle-anxiety and underachievement hand in hand.

In addition, mathematical learning is affected by academic stress resulting from the external pressures of parents, teachers, and peers. Pressures of parents, especially in cultures that highly regard academic successes, create high levels of stress, especially when students feel they cannot meet such expectations (Devine et al., 2018). Teachers who created a high-pressure classroom environment acted in a manner that was likely not intended but served to further enhance the level of students' stress, especially for the students with a higher orientation toward grades rather than process (Jameson, 2019). This stress is heightened by social comparisons made with other peers and may be linked to feelings of inadequacy or a fear of failure.

Mathematical Anxiety

Mathematics anxiety is an emotional response where apprehension, fear, and tension occur due to some mathematics-related activity (Ashcraft & Krause, 2007). Individuals manifest the anxiety through physical symptoms in the form of palpitations and sweating to cognitive disturbances in the form of negative self-talk and avoidance behaviors (Ashcraft, 2002). It has been documented through research that mathematics anxiety is one of the strongest predictors of poor performance in mathematics because such anxiety interferes with working memory and problem-solving abilities.

In this case, mathematics anxiety is caused by many factors, be it on an individual or environmental setup. As noted by Suárez-Pellicioni, Núñez-Peña, and Colomé (2016), negative experiences related to early mathematics, such as public humiliation due to making a mistake, can give birth to anxiety. On the other hand, Wong (2024), represents low mathematics self-efficacy, which is the feeling of inability in accomplishing mathematical operations, is strongly related to higher levels of anxiety. This leads them more often to anxiety because they believe that they are inherently "bad at math", rather than developing a positive attitude.

Mathematics anxiety has social and cultural dimensions. Research has identified that social beliefs may promote anxiety in students. For instance, the stereotype that boys do math naturally better than girls could contribute to increased anxiety in female students. Stereotype threat causes these girls to feel anxious and stressed, especially when in highly competitive academic environments where performance in mathematics is taken as a big issue. Research findings indicate that girls who internalize such stereotypes are not likely to favour STEM careers, setting a continuous circle of gender disparities in such subjects (Devine et al., 2018).

Determinants of Mathematics Anxiety

The etiology of math anxiety is complex and multifactorial. Personal characteristics, environmental influences, and cognitive processing are the main reasons why students develop math anxiety. Some of the most powerful determinants involve past math experiences (Ashcraft & Krause, 2007). For example, the experience of failing a large or highly expected math test or being embarrassed by making a mistake in front of classmates in the past may lead to long-term anxiety about learning math. Early experiences often form a strong impression of fear of failure or embarrassment in the student's mind, which subtly changes

the student's attitude towards math and this fear will accompany them throughout their math learning career.

Another major determinant is the teaching method. Traditional, old-fashioned learning methods based on group lectures emphasize pure memorization and procedural knowledge, which will inevitably produce anxiety in students who are not adaptable to stereotyped learning and do not know how to adapt (Beilock & Willingham, 2014). In contrast, research suggests that more interactive classrooms and student-centered teaching styles, such as problem-based learning, can make math concepts easier to grasp and the learning process less daunting, thereby reducing anxiety (Abdullah et al., 2021).

Another very important variable that determines mathematics anxiety includes parental influence. Some parents who have high levels of anxiety about mathematics can unwittingly pass this onto their children through the expression of negative attitudes toward mathematics or generally staying away from activities which relate to math (Ramirez et al., 2016). This can be seen in the study by Gunderson et al (2018), where the kids of parents with mathematical anxiety developed anxiety due to the fact that parents with anxiety over math helped their kids with math homework.

Gender Differences in Mathematics Anxiety

One of the most researched issues has been gender differences in mathematics anxiety, and very consistent findings indicate that female students tend to exhibit higher levels compared to their male peers. Generally, this is interpreted in terms of a situated stereotype that characterizes boys as being intrinsically more capable at math than girls, which leads to what is termed stereotype threat. The stereotype threat is the condition where one realizes that negative stereotypes exist about their group, which he or she would just wish never to confirm; this enhances anxiety and reduces performance. This equally has been asserted by (Suárez-Pellicioni et al., 2016).

Other research has found that girls endorsing such stereotypes are less involved in mathematical activities and report more anxiety once they need to solve mathematical tasks (Dowker et al., 2016). Anxiety gets especially heightened in the conditions of high-pressure testing, when doing well is emphasized - the pressure can be reeliciting stereotype threat along with ensuing anxiety, according to (Jameson, 2019).

Some have countered, though, that it might not be quite that simple. A meta-analysis by Devine et al (2018), reported that though girls show higher self-reports of anxiety, their actual performance in mathematics is usually comparable with that of boys, thus it may be more complexly related to performance. It will involve deeper study in unpacking the mechanisms that underlie the relationship and, consequently, devising specific interventions that address the needs of the female students.

The Role of Teachers and Parents

Both teachers and parents have essential contributions to students' attitudes about mathematics and students' anxiety levels. For example, it is documented that the attitudes of teachers of mathematics impact the anxiety levels of their students. Teachers who become anxious about mathematics are more likely to transfer anxiety to students, especially if they

feel insecure about their teaching methods (Ramirez et al., 2016). This becomes especially problematic at the level of primary education, as teachers are more often generalists rather than subject specialists, lacking strong mathematics backgrounds.

On the other hand, a supportive and encouraging classroom environment may reduce students' anxiety by motivating them toward mathematics. Indeed, there is evidence showing that with the message of growth mindset, which is instilled by a teacher in students for the belief in the potential development of one's math ability due to work and dedication, students are more likely to demonstrate greater perseverance in the face of difficulties and lower levels of anxiety (Beilock & Willingham, 2014).

Parents also play a key role in either alleviating or exacerbating their children's mathematics anxiety. Research has shown that parents who view mathematics negatively, or parents who themselves are anxious about the subject, tend to pass such attitudes onto children—most often, unwittingly (Gunderson et al., 2018). By contrast, parents who convey the view that effort and persistence rather than innate ability are the important factors in mathematics will tend to encourage a positive attitude toward the subject.

Methodology

Research Design

This article uses a quantitative survey research method to investigate the relationship between math anxiety and academic stress in math learning among high school students by distributing questionnaires. According to Creswell (2012), quantitative methods can collect research data on this topic through structured questionnaires, which is suitable for exploring the attitudes, beliefs and behavior patterns of the target population. The purpose of this study is to understand the factors that lead to students' math anxiety and related academic stress. The survey also aims to determine the role of determinants such as gender, teaching methods and parental influence on these two variables. This study directly distributed a structured questionnaire to high school students and conducted a quantitative analysis of their feedback based on their own situation to reveal students' motivation and development trends.

Respondents

This study examined high school students' mathematics anxiety and academic stress in relation to various factors, including gender differences, parental influence, and teaching methods. A total of 208 international high school students participated in the study, representing different grade levels in high school. The gender distribution was slightly skewed, with 57.69% (120 respondents) being female and 42.31% (88 respondents) being male.

Table 1

Respondent Grade Level

Grade Level	Frequency	Percent (%)
1st Year of High School	74	35.58%
2nd Year of High School	69	33.17%
3rd Year of High School	65	31.25%
Total	208	100.0%

Table 2

Experience of Anxiety Related to Mathematics

Experience of Anxiety	Frequency	Percent (%)
Yes	121	58.17%
No	87	41.83%
Total	208	100.0%

Research Instrument

The data collection instrument in this study was a structured questionnaire which consisted of six major sections. The questionnaire used in the present study was drafted after a thorough review of existing literature on academic stress and Mathematics anxiety to make it valid with respect to herepeofore detail. This survey included closed-ended and Likert-scale questions, which standardizes the data output for easy analysis in SPSS. All sections captured different comes in constructs

Demographic information (Gender, Grade Level) – Section A Section B (Math Anxiety) consisted of four items that evaluated the affective aspect of students' experience with mathematics, including feelings of anxiety and avoidanceisons helped initialize(classes like those based on TS1). Section C was focused on Academic Stress in Mathematics Learning and asked questions about the effects of external pressures, including parental expectations and competition in class. Section D (Sources of Mathematics Anxiety), collected information on four questions associated with prior negative experiences, methodological efficacy and parental beliefs contributing to anxiety. Gender differences in mathematics anxiety (4 questions): These items looked at how societal pressure and gender norms affect students' levels of math related anxiety: section E. Subsection F: Interventions for Reducing Anxiety and Stress (4 items; covers the efficacy of mindfulness-based therapy, interactive learning tools to reduce anxiety/stress/avoidance during hands on laboratory work, teacher support reduces math anxiety).

Data Collection Procedure

The survey was conducted through a structured questionnaire distributed to students during regular school hours. The questionnaire aimed to capture students' emotional responses to mathematics, their perceptions of academic stress, and the role of external factors such as parental influence and teaching methods. The survey consisted of six sections, each focusing on different aspects of mathematics learning, including perceived anxiety, academic stress, and the effectiveness of interventions.

Responses were collected anonymously and analyzed using SPSS for statistical accuracy. The structured questions helped ensure clarity and consistency in the data, allowing for easy identification of trends and correlations between mathematics anxiety, academic stress, and other variables.

Data Analysis Method

This study used descriptive statistics and other statistical analysis methods to analyze the collected data. Quantitative data were processed using SPSS software. Descriptive statistics were used to calculate the mean, standard deviation, and frequency distribution of each variable. These statistical analyses provide strong support for understanding the relationship

between math anxiety and academic stress and reveal how the main factors related to gender differences, parental influence, and teaching methods affect students' performance.

Findings and Discussion

Based on the data collected, it was evident that a significant proportion of students experienced anxiety when engaging with mathematics. The findings showed that 58.17% of students reported experiencing anxiety related to learning mathematics, while the remaining 41.83% did not report significant anxiety. These results are discussed further in the next sections, exploring the factors contributing to these experiences and their impact on students' academic performance and psychological well-being.

Table 3

Section 1: Mathematics Anxiety

This section investigates respondents' emotional responses to math tasks, including tension, worry, and avoidance behaviors, to assess their math anxiety levels.

NO	ITEM	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	I feel tense when solving math problems under time constraints.	15(7%)	37(18%)	13(6%)	87(42%)	56(27%)
2	I often worry about making mistakes in math.	17(8%)	30(14%)	15(7%)	78(8%)	68(33%)
3	The thought of having to take a math test makes me anxious.	16(8%)	33(16%)	10(5%)	67(32%)	82(39%)
4	I feel nervous when I have to explain a math problem to others.	18(9%)	34(16%)	15(7%)	77(37%)	64(31%)

The survey results show that most students feel nervous and anxious when facing math problems, especially in time-limited exam scenarios, which is consistent with the definition of math anxiety mentioned in this article. The survey shows that about 42% of students said they feel nervous when solving math problems, and 38% of students are worried about making mistakes, which is consistent with the view in the paper that math anxiety affects student performance. Among them, 39% of students feel very anxious during exams. This survey result shows that exam pressure is also one of the important sources of math anxiety. This is a strong proof of the view in my paper that high-pressure exams are the main source of student anxiety and stress. In addition, students also show high levels of anxiety when explaining math problems, which shows that students have low participation in math classes and weak self-confidence, which needs to be strengthened.

Table 4

Section 2: Academic Stress in Mathematics Learning

This section explores the impact of external pressures felt by respondents in math learning, such as teachers' and parents' expectations, competitive environment, etc., on academic stress.

NO	ITEM	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	I feel overwhelmed by the difficulty of mathematics assignments.	8(4%)	39(19%)	13(6%)	82(39%)	66(32%)
2	High expectations from my teachers and parents increase my stress in mathematics.	14(7%)	33(16%)	10(5%)	98(47%)	53(25%)
3	I find it hard to cope with the pressure to perform well in mathematics.	36(17%)	23(11%)	11(5%)	65(31%)	73(35%)
4	I feel stressed when there is a lot of competition in math classes.	11(5%)	42(20%)	13(6%)	81(39%)	61(30%)

This survey shows that the vast majority of students (71%) feel that the difficulty of math homework is too difficult to complete alone, which shows that the pressure of math learning mainly comes from the difficulty of its content, rather than problems with students' personal abilities. The fact that "students think that the requirements of math tasks exceed their abilities" mentioned in this article is consistent with this result. 47% of students believe that excessive expectations from teachers and parents increase their math pressure, which supports the argument in this article that "external pressure leads to academic pressure", especially high expectations from teachers and parents, which increases students' pressure, which is most significant in Chinese and East Asian cultures. When students are dealing with competition, 35% of students say it is difficult to cope with it, which shows that academic competition and performance-oriented evaluation standards are also the main sources of math learning pressure.

Table 5

Section 3: Determinants of Mathematics Anxiety

This section investigates key factors that affect math anxiety, including past negative math learning experiences, parents' attitudes, and the impact of teaching methods.

NO	ITEM	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	Negative experiences in previous math classes make me anxious about math.	19(9%)	32(15%)	13(6%)	69(33%)	75(37%)
2	My parents' attitude toward mathematics affects my own anxiety about the subject.	17(8%)	28(13%)	14(7%)	85(41%)	64(31%)
3	Traditional teaching methods (e.g., lectures, rote learning) increase my anxiety in math.	18(9%)	36(17%)	14(7%)	61(29%)	79(38%)
4	I feel less anxious about math when the teacher is supportive and encouraging.	15(7%)	28(13%)	11(5%)	65(31%)	89(44%)

In this survey, 70% of students said that past negative experiences in math classes caused their anxiety, which is consistent with the long-term impact of early adverse experiences (such as failure in class) on math anxiety mentioned in the article. This data shows that negative classroom experiences will affect students' long-term performance. 41% of students believe that their parents' attitudes have a direct impact on their math anxiety, supporting the view in this article that "family atmosphere and parents' attitudes may exacerbate students' anxiety." Parents' anxiety about math will also affect their children's mentality. 38% of students believe that traditional teaching methods (such as rote memorization) increase their anxiety, while 44% of students believe that teachers who can mobilize classroom enthusiasm and encouragement can reduce their math learning pressure.

Table 6

Section 4: Gender Differences in Mathematics Anxiety

This section aims to study the impact of gender differences on math anxiety, focusing on analyzing the role of social expectations and gender stereotypes in math learning.

NO	ITEM	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	I believe that boys are naturally better at math than girls.	17(8%)	32(15%)	8(4%)	84(40%)	67(33%)
2	I feel that societal expectations about gender affect how I perform in math.	17(8%)	32(15%)	12(6%)	78(38%)	69(33%)

3	Female students experience more math anxiety than male students in my class.	20(10%)	27(13%)	8(4%)	67(32%)	86(41%)
4	Gender stereotypes contribute to my anxiety in mathematics.	15(7%)	33(16%)	20(10%)	72(35%)	68(33%)

73% of the students in this survey believed that gender differences exist in math ability (boys are better at math than girls), which is consistent with the view that "gender stereotypes exacerbate girls' math anxiety", especially in East Asian societies, where the impact of gender roles is more significant. 71% of the students believed that gender social expectations affected their math performance, indicating that stereotypes not only affect girls, but may also affect boys' self-expectations and performance.

Table 7

Section 5: Role of Teachers and Parents in Reducing Mathematics Anxiety

This section investigates the role of teachers and parents in alleviating students' mathematics anxiety, assessing how their supportive behaviors affect students' emotional states and learning confidence.

NO	ITEM	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	My teacher's attitude toward math helps me feel more confident in the subject.	20(10%)	28(13%)	13(6%)	84(40%)	63(31%)
2	My parents' encouragement helps reduce my anxiety about math.	16(8%)	38(18%)	18(9%)	74(36%)	62(29%)
3	A supportive teacher can make math feel less stressful.	12(6%)	36(17%)	11(5%)	65(31%)	84(41%)
4	My parents' pressure to perform well in math increases my anxiety.	16(8%)	34(16%)	12(6%)	76(37%)	70(34%)

In this survey, 71% of students believe that the attitude of teachers is crucial in helping them build confidence, supporting the view that "teachers' supportive attitudes can reduce anxiety." 36% of students believe that parental encouragement can reduce anxiety, but 34% of students still believe that higher expectations from their parents increase their anxiety. This study shows that parents' attitudes have a dual impact on students' anxiety, which can encourage students' confidence in learning but also increase their anxiety and stress.

Table 8

Section 6: Interventions for Reducing Anxiety and Stress

This section evaluates the effectiveness of various interventions, such as mindfulness exercises, interactive learning tools, and teacher support, to reduce students' math anxiety and academic stress.

NO	ITEM	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	Mindfulness practices help reduce my anxiety about math tests.	13(6%)	39(19%)	11(5%)	77(37%)	68(33%)
2	I feel less anxious about math when I use apps or interactive games to learn.	20(10%)	29(14%)	8(4%)	80(39%)	71(34%)
3	Cognitive-behavioural strategies (like positive thinking) have helped me deal with math anxiety.	17(8%)	34(16%)	12(6%)	85(41%)	60(29%)
4	Growth mindset teaching helps reduce my math anxiety.	13(6%)	35(17%)	8(4%)	71(34%)	81(39%)

70% of students believe that mindfulness practice (such as meditation) can help relieve anxiety during math exams and get better grades, which shows that mindfulness training can be used as an effective intervention measure to cope with academic stress.

73% of students said that using apps or interactive games to study can reduce their anxiety, which shows that information technology has great potential in reducing student anxiety, which is consistent with the view of "reducing anxiety through technology" mentioned in the paper.

Discussion

The review of the literature on mathematics anxiety and academic stress in mathematics learning reveals several important insights into how these factors are interrelated and how they impact students' academic outcomes. The findings show that mathematics anxiety plays a critical role in the development of academic stress, particularly in the context of mathematics learning. Furthermore, a number of determinants of mathematics anxiety have been identified, including individual traits, environmental factors, and social influences, which collectively contribute to students' academic stress. Below are the key findings derived from the review of the literature.

Relationship between Mathematics Anxiety and Academic Stress

A major success across literature has been the finding that mathematics anxiety significantly predicts academic stress. The results indicate that students who have the high anxiety of math learning are under greater pressure in exam environments as their abilities to calculate or reason using numbers. According to this study, 71% of the students felt pressure due to the difficulty of mathematics homework and 72.6 %felt that their parents as well as teachers' high expectations in respect mathematical excellence burdened them with stress for math learning. The students who encounter this high anxiety due to their inability when solving a

mathematical task are predicted to suffer from academic stress as well especially if the context is in evaluating their mathematic capabilities (Jameson, 10). Indeed, anxiety disrupts cognitive operations such as working memory and problem-solving ability which in turn may hinder performance in mathematics (Ashcraft & Krause 2007). According to a survey, 66.35% of the students find it tough dealing with math performance stress which they blame their poor academic image on them for mangling in Mathematics. Because of this, they feel cumbersome when fail to fulfill the expectations and proceed with a cycle that assumes ever-hardening stress in form free-flowing anxiety.

Research by Ramirez et al (2016), indicate that mathematics anxiety underscores stress during high-stakes testing situations, when students perceive that they are under a magnifying glass. According to the survey, 66.35% of students felt pressure on math. Running-Writing make up full Text running-Reading supplement The fact that test anxiety and academic stress are connected through a genetic relationship is important because it demonstrates that the comorbidity between these two kind of experiences, which may be exacerbated in testing contexts. Thus, math anxiety students are more likely to stress-accompanied academic failures and come back to fear of mathematics again.

Worse, students with high math anxiety find them frustrating and overwhelming when doing difficult mathematics. In doing so, these emotions contribute to academic stress either by lowering the level of students' motivation for that subject or even simply by fostering avoidant behavior. Students might, for example, refrain from asking or hide their help-seeking behavior (Suárez-Pellicioni et al., 2016), avoid taking mathematics courses and neglect homework assignments; all of which increase academic anxiety. Results show that the relationship between mathematics anxiety, academic stress and each other follow a vicious circle such that high level of one inhibits increased another which ultimately effect on student achievement.

Determinants of Mathematics Anxiety

The literature review distilled from the previous related works session includes some major causes of math anxiety. These determinants do much to account for the fact that not all students are equally likely to experience mathematics anxiety and academic stress. Of the most important, experiences of having been a poor math student before. Moreover, students with previous experience of failure or embarrassment in mathematics are more likely to develop anxiety (Ashcraft 2002) and this cycle compounds stress around academics. Because these experiences can and do often occur so early in students' schooling, we need to aim our interventions at younger children -- well before most cases of serious anxiety will have set in. Another important discovery is the involvement of teachers in creating math anxiety. Another 66.58% students find it much anxiety provoking to study in traditional way of teaching Teachers who emphasize correct answers, focus on performance factors rather than learning and penalize mistakes play a critical role in the development of anxiety (Beilock & Willingham 2014). Moreover, if teachers have the experience of being anxious about math can easily transfer this kind of anxiety to children and especially in early years where most reasons for things are established (Ramirez et alif., 2016). This finding underscores the importance of programs to train teachers in helping reduce their anxiety and reinforcing preventative interventions for more supportive teaching practices.

Parental influence is also one of the major deciding factor. In this study, 71.64% of students thought that mathematics anxiety was influenced by their parents liking or disliking for mathematics work. Research has shown that parents who hold negative math attitudes or experience high levels of math anxiety, are more likely to impact the development of their children's anxiety (Gunderson et al., 2018). This highlight problematizes the fact that cultural attitudes towards mathematics are not fixed but emerge from family dynamics. It also means that programs aimed at tackling math anxiety need to target kids and their parents, so they don't come back home with negative vibes towards the subject.

Gender Differences in Mathematics Anxiety

The literature also offers substantial evidence for gender differences in mathematics anxiety. This is reinforced by the data in this study, where it was found that 72.59% of students believe boys do better than girls in math and thus contribute to increasing mathematics anxiety among women due to gender stereotypes (MGB). Gender differences in anxiety are robust, where gender predicts anxiety better than grade or test (e.g., Devine et al., 2018; writing for female students). Stereotype threat (Suárez-Pellicioni et al., 2016) is frequently mentioned as having a large contribution to this result, because the societal expectations of boys outperforming girls in mathematics make anxious and angry that have a significant effect on female students. In a high-stress academic environment, 70.67% students of respondents experienced gender social expectations that affected participation and performance in mathematics learning processes (Fig. When girls become these stereotypes they get anxious in high academic pressure thereby leading to them suffering from academic stress. The gender gap in math anxiety is very strong during adolescence, when students have to decide their future field of study and career (Dowker et al. 2016). Women experience more anxiety about studying STEM subjects in college and this causes higher levels of dropout, leading to broad gender disparities in the fields. These results indicate that there is a space for interventions to be targeted specifically towards female students and in particular prevention of stereotype threat / promotion of positive attitudes toward mathematics.

Impact of Mathematics Anxiety on Academic Performance

Mathematics anxiety affects the academic performance of students as has been outlined in literature. Some 68.75 percent of students said math exams made them anxious, and for 70.25 percent the difficulty in their assignments served only to make things worse according to researchers behind the survey agreed by half a dozen math-PhD's. Even with the necessary cognitive ability, students suffering from higher levels of anxiety tend to underperform in mathematics (Ashcraft & Krause 2007). This result is important because it shows that the main problem for success in Mathematics, more than a matter of difficulty, might be anxiety. For instance, Wong (2024), found that mathematics anxiety negatively impacts students working memory function in the brain possibly critical for solving sophisticated mathematical assignments. 90% of students: makes mistakes affects scores with psychosocial adaptation the characteristic 1/2 errors in math worry about errors. When students are anxious, they are less able to focus on the task at hand, leading to errors and decreased performance. This finding is particularly relevant in high-stakes testing environments, where students' anxiety levels are likely to be heightened. Moreover, the literature suggests that the impact of mathematics anxiety on academic performance is cumulative. Students who experience anxiety early in their academic careers are more likely to avoid mathematics in the future, which limits their exposure to the subject and reduces their opportunities for improvement

(Ramirez et al., 2016). Over time, this avoidance behavior leads to lower levels of mathematical proficiency, which further reinforces anxiety and academic stress.

Interventions for Reducing Mathematics Anxiety and Academic Stress

Several interventions have been proposed in the literature to address the issue of mathematics anxiety and its relationship to academic stress. One of the most promising interventions is cognitive-behavioral therapy (CBT), which helps students reframe their negative thoughts about mathematics and develop more positive attitudes toward the subject (Dowker et al., 2016). CBT has been shown to reduce anxiety by teaching students to challenge their negative beliefs and replace them with more realistic and constructive thoughts. Another effective intervention is the use of mindfulness practices, which help students manage their anxiety by focusing on the present moment and reducing rumination about past failures or future outcomes (Abdullah et al., 2021). Mindfulness has been shown to reduce both anxiety and academic stress, particularly in high-stakes testing environments.

In addition to these psychological interventions, the literature suggests that changes in teaching practices can also help reduce mathematics anxiety. Teachers who adopt a growth mindset approach, where mistakes are viewed as learning opportunities rather than failures, can help reduce anxiety and promote a more positive attitude toward mathematics (Beilock & Willingham, 2014). According to this study, 73.07% of students reported that their anxiety significantly decreased when teachers used a growth mindset. Similarly, the use of interactive teaching methods, such as problem-based learning and technology-enhanced instruction, has been shown to reduce anxiety by making mathematical concepts more accessible and engaging (Wong, 2024).

Conclusion

In short, mathematics anxiety and academic stress are two interrelated issues that have a serious impact on the academic performance and psychological well-being of the students. Based on the literature review done, it can be inferred that mathematics anxiety is an antecedent to academic stress, entering into a self-reinforcing cycle of inefficiency in impairing students' abilities to engage in mathematical activities. Key determinants of mathematics anxiety will include previous negative experiences of the subject, teaching methods, and attitudes of the parents. Another aspect is gender, and female students across the board report higher levels of anxiety due to societal stereotypes and stereotype threat.

Results point out that early interventions are called for, which need to touch on mathematics anxiety and academic stress. To date, cognitive-behavioral therapy, mindfulness practices, and growth mindset teaching strategies have variously been found effective in reducing anxiety and allowing more positive attitudes toward mathematics. By rooting out these problems at the source, educators and policymakers are in a position to help students surmount barriers erected by anxiety and stress that in turn will improve their math proficiency and academic success. It is hoped that future research to continue investigating such longitudinal effects of interventions and explicate more clearly this complex relation between anxiety, stress, and performance in mathematics.

References

- Abdullah, A., Nawli, N. M., Nasir, N. M., Suki, N. M., & Salleh, S. M. (2021). The role of technology in reducing mathematics anxiety in primary school students. *Contemporary Educational Technology*, 12(1), 1-12.
- Ashcraft, M. H. (2002). Math anxiety: Personal, educational, and cognitive consequences. *Current Directions in Psychological Science*, 11(5), 181-185.
- Ashcraft, M. H., & Krause, J. A. (2007). Working memory, math performance, and math anxiety. *Psychonomic Bulletin & Review*, 14(2), 243-248.
- Beilock, S. L., & Willingham, D. T. (2014). Math anxiety: Can teachers help students reduce it? *American Educator*, 38(2), 28-32.
- Devine, A., Fawcett, K., Szűcs, D., & Dowker, A. (2018). Gender differences in mathematics anxiety and the relation to mathematics performance while controlling for test anxiety. *Behavioral and Brain Functions*, 10(1), 1-9.
- Dowker, A., Sarkar, A., & Looi, C. Y. (2016). Mathematics anxiety: What have we learned in 60 years? *Frontiers in Psychology*, 7, 508.
- Gunderson, E. A., Ramirez, G., Levine, S. C., & Beilock, S. L. (2018). The role of parents and teachers in the development of gender-related math attitudes. *Sex Roles*, 66(3-4), 153-166.
- Jameson, M. M. (2019). The development and consequences of math anxiety. In *The Neuroscience of Mathematical Cognition* (pp. 437-450). Elsevier.
- Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. Springer.
- Ramirez, G., Chang, H., Maloney, E. A., Levine, S. C., & Beilock, S. L. (2016). On the relationship between math anxiety and math achievement in early elementary school: The role of problem-solving strategies. *Journal of Experimental Child Psychology*, 141, 83-100.
- Suárez-Pellicioni, M., Núñez-Peña, M. I., & Colomé, À. (2016). Math anxiety: A review of its cognitive consequences, psychophysiological correlates, and brain bases. *Cognitive, Affective, & Behavioral Neuroscience*, 16(1), 3-22.
- Wong, P. H., Tan, L. T., Lim, H. K., & Yeo, M. J. (2024). Exploring the interaction between mathematics anxiety and academic stress in high school students. *Journal of Educational Psychology*, 45(4), 789-803.