Math Anxiety and Gender Differences in Additional Mathematics among Islamic Residential School Students

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ABSTRACT

Mathematics anxiety is a major psychological barrier to student achievement, especially when students are faced with advanced and high-stakes subjects such as Additional Mathematics. There has been a lot of research on this issue in regular public schools, but little is known about how these emotional pressures play out in specialized educational settings. The objectives of this study were to determine the level of math anxiety and gender differences among students in an Islamic residential school in Terengganu, Malaysia. The sample was based on localized case study design where data was collected from 70 Form 5 students. A subset of 70 fully completed responses was then subjected to descriptive and inferential analyses. The descriptive results reveal an alarming reality, which is that 65.7% of the students suffer from high levels of math anxiety. An item-level analysis revealed a surprising paradox; students reported feeling very comfortable, focused and cooperative during everyday classroom learning but experienced high levels of emotional distress over high-stakes testing, the fear of public inaccuracy and unexpected classroom evaluation. Moreover, the independent samples t-test revealed a statistically significant gender difference, showing that female students suffer from a significantly heavier emotional burden and higher anxiety levels compared to their male counterparts. The high math anxiety in elite, dual-curriculum boarding settings is a psychological roadblock, not a reflection of a student's lack of effort. Educators need to actively shift classroom cultures away from high-stakes tactics like unexpected "cold-calling" and instead focus on normalizing mistakes as a natural part of learning to protect student well-being and ensure equitable participation in STEM pathways.

Keywords: Additional Mathematics, Math anxiety, Islamic residential schools, Gender differences

INTRODUCTION

In Malaysia, Additional Mathematics is often defined within secondary school curriculum as more than an advanced arithmetic course. It is perceived as a critical subject to higher-level STEM (Science, Technology, Engineering and Mathematics) disciplines (Saraswathi & Naidoo, 2024). This elective subject exposes upper secondary students to abstract and conceptually dense domains such as calculus, vectors, trigonometry, and advanced algebraic functions (Tan & Chin, 2022). The syllabus's pedagogical structure focuses on fostering high-order thinking skills (HOTS), analytical precision, and advanced problem-solving abilities essential for transitioning into higher education technical programs like engineering, computer science, and actuarial science (Rico-Bautista et al., 2021).

Additional Mathematics is one of the more difficult and demanding subject areas in the secondary school environment and is perceived by students as a crucial subject in the development of a mathematically literate work force (Mazana et al, 2020). It involves a high level of cognitive flexibility and conceptual abstraction, which is different from core Mathematics that involves a lot of basic calculations and repetitive tasks. Students are no longer able to memorize solutions as they are now expected to be able to interpret multi-layered problem matrices where one question may contain several different mathematical theories (Saraswathi & Naidoo, 2024).

Mathematical anxiety occurs in certain individuals when confronted with a math problem. A positive attitude toward mathematics fosters a favourable perception of it, and the reverse is also true.

This affective scenario is further complicated within the highly specialized context of Islamic residential schools (Mutodi, 2023). Students attending these elite boarding schools are subjected to a rigorous dual-curriculum system that requires mastery of advanced, high-stakes science and mathematics syllabi alongside a heavy load of religious studies and holy text memorization (Hafazan). While these residential ecosystems are designed to foster high academic achievement, they also generate a pressure-cooker environment marked by strict daily routines, elevated parental and institutional expectations, and relentless peer surveillance (van Mier et al., 2023). The psychological stakes of academic performance are considerably amplified within this competitive, closed social structure.

Consequently, when these students encounter the abstract symbolic language of Additional Mathematics, the sudden cognitive strain does not merely present an instructional challenge; rather, it interacts with the intense pressure to maintain a flawless academic profile, triggering acute evaluation panic and a debilitating fear of failure among an elite peer cohort (Orbach et al., 2020; Recber et al., 2022). Math anxiety is characterized as an debilitating emotional and psychological reaction involving feelings of tension, apprehension, and fear when confronted with mathematical tasks. In highly structured academic environments, such as residential boarding schools, students operate under elevated performance expectations. When these high-achieving student cohorts encounter abstract, structurally dense modules like functions, calculus, and trigonometry, the perceived risk of failure can induce severe emotional distress. Rather than reflecting a deficit in raw intellectual capability, this anxiety actively impairs working memory and cognitive processing, creating a restrictive internal bottleneck during high-stakes evaluations.

Furthermore, the behavioural manifestation of math anxiety is rarely uniform across student populations, with gender frequently emerging as a complex socio-demographic variable. In residential school ecosystems, internal coping mechanisms, perceived self-efficacy, and academic stressors often diverge between male and female cohorts. Math anxiety manifests in students in a variety of ways, both in terms of behavior and psychological experience. Gender is frequently discussed as a complex socio-demographic variable in educational research. Empirical studies have demonstrated that male and female students have different affective and emotional experiences with mathematics, even when their raw cognitive abilities are comparable. Research from various secondary school grades across the globe indicates that female students score significantly higher on measures of math anxiety, test anxiety, and fear of assessment compared to male students (Carey et al., 2021; Recber et al., 2022). Educational psychologists attribute this gender gap to a complex interplay of internalized academic perfectionism, diminished mathematics self-efficacy, and heightened susceptibility to fear of negative evaluation (van Mier et al., 2023). In high-stakes academic settings, female students tend to internalize academic stressors more readily, interpreting a minor academic mistake or a difficult math formula as a complete failure of their personal competence, rather than as an ordinary component of the learning process (Orbach et al., 2020). This emotional internalization process causes a significant psychological freezing in the tests, temporarily reducing working memory capacity and limiting performance even in historically high-performing female groups (Foley et al., 2024).

It is essential to understand the nature of these gender-based psychological differences in a specialized, dual-curriculum, residential setting to inform interventions designed to protect students' well-being and support equitable participation in STEM pathways. To put this into perspective and test these assumptions empirically within this specific boarding school setting, the following hypothesis was formulated:

H1: There is a significant difference in math anxiety levels between male and female students

Given these academic and emotional pressures, this preliminary study was carried out to better understand the reality of math anxiety within an Islamic residential school setting. Specifically, the research aims to address the following objectives:

a) To evaluate the level of math anxiety experienced by students

b) To investigate whether there is a difference in math anxiety levels between male and female students.

METHODOLOGY

This study adopted a cross-sectional quantitative survey design to explore the psychological dimensions of math anxiety during a localized exploratory phase. This methodology allowed for the systematic collection of attitudinal data within a standardized administrative framework. The target population comprised upper secondary students (Forms 5) enrolled at a residential school in Terengganu. The study used a non-probability convenience sampling technique and the sample consisted of 70 students. To ensure adequate statistical validity for group comparative analysis, the cohort was divided by gender, yielding 30 male students and 40 female students. A structured questionnaire survey that was modified from validated math anxiety psychometric measures was used to collect data. Participation was voluntary, and confidentiality was ensured. All survey questions utilised a 5-point Likert scale. The questions asked participants to rate how strongly they agreed with each statement. Data analysis was conducted using IBM SPSS Statistics. Descriptive statistics were used to summarise the data and an independent t-test *was carried out* on each of the variables to determine whether there is a difference between gender.

RESULTS

The primary objective of the study was to determine the level of math anxiety and whether the psychological burden of math anxiety varies significantly based on student gender within the residential school setting.

The demographic profile indicates that 42.9% of respondents were male, while 57.1% were female. The entire cohort consisted of Form 5 students from various districts across Terengganu.

The internal consistency of the 9 items was tested by using Cronbach's alpha to ensure that the questionnaire was reliable before carrying out the main analysis. The alpha value between 0.80 and 0.90 indicates good internal consistency (Hair et al., 2010). Values above 0.70 are entirely acceptable for exploratory studies (Nunnally and Bernstein, 1994). Based on Table 1, the overall Cronbach's alpha for the instrument was 0.878. This strong result confirms the high reliability, stability and suitability of the survey items for further statistical testing.

Table 1: Reliability Statistics for the Math Anxiety Instrument

Cronbach's Alpha	N of Items
0.878	9

Overall Levels of Anxiety Toward Additional Mathematics

A further descriptive analysis was conducted to assess the overall level of anxiety toward Additional Mathematics among the students. Table 2 shows the breakdown of anxiety level according to the three primary levels: low, moderate, and high. This distinction makes it clear if math anxiety affects a small percentage of students or most of them.Results show that a high level of anxiety towards Additional Mathematics was reported by 65.7% of Form 5 students. However, only 27.1% of them experienced moderate anxiety while only 7.1% showed low anxiety.

Table 2: Overall Anxiety Levels Toward Additional Mathematics Among Students

Anxiety Level Category	Frequency	Percent
Low	5	7.1
Moderate	19	27.1
High	46	65.7
Total	70	100.0

Table 3 shows mean and standard deviation scores for math anxiety items. Each item on the scale was subjected to a descriptive analysis to determine precisely what causes these children the most emotional anguish. It is

possible to determine if students are having difficulty with the actual learning process or the pressure of being evaluated by meticulously examining each student's mean and standard deviation results.

Table 3: Mean and Standard Deviation Scores for Math Anxiety Items

No.	Math Anxiety Items	Mean	Std. Deviation (SD)
1.	I feel afraid of failing the Additional Mathematics subject.	4.286	1.193
2.	I feel anxious when thinking about the Additional Mathematics examination.	4.114	1.11
3.	I lack confidence when facing complex calculation questions.	3.829	1.34
4.	I am afraid that I won't be able to answer Additional Mathematics questions correctly	3.586	0.985
5.	My heart races when facing an Additional Mathematics test or quiz.	3.314	1.336
6.	I feel nervous when the teacher asks me to answer an Additional Mathematics question in class.	3.229	1.476
7.	I feel stressed when I need to solve difficult Additional Mathematics questions.	3.186	1.376
8.	I easily lose focus when learning Additional Mathematics.	2.357	1.022
9.	I feel uncomfortable while learning Additional Mathematics.	1.929	0.873

The items that related most highly with anxiety were those that directly related to high stakes evaluation. The highest was Item 1 (I feel afraid of failing the Additional Mathematics subject)(Mean = 4.286) closely followed by Item 2 (I feel anxious when thinking about the Additional Mathematics examination)(Mean = 4.114).In a high-pressure and elite setting like an Islamic residential school, a student's identity and self-worth are closely connected to academic performance (Mutodi, 2023). Failing a subject, or doing badly in a major test, is like a catastrophe, socially and academically. This significant emphasis on excellent performance was also reflected in the results in Item 3 (I am not confident when answering complicated calculation questions, mean = 3.829), and Item 4 (I am afraid that I won't be able to answer Additional Mathematics questions correctly, mean = 3.586). Interestingly, Item 4 has the lowest standard deviation in the whole dataset (SD = 0.985), implying that almost all students universally possess this deep-seated worry of being inaccurate. This constant worry in the background can actively take up the working memory of a student causing a student to freeze in real exams (Foley et al., 2024; Orbach et al., 2020). Items that required immediate, real-time evaluation in front of others reported moderate stress levels. Item 5 (My heart races when facing an Additional Mathematics test or quiz, mean = 3.314) represented the physical symptoms of test panic directly (Ashcraft, 2020). Item 6 (I feel nervous when the teacher asks me to answer an Additional Mathematics question in class, mean = 3.229) had the highest standard deviation in the study (SD = 1.476). The wide spread of data indicated that while some students handled the pressure well, a large number felt incredibly vulnerable when put on the spot by teachers. This kind of public spotlight can generate social anxiety, making students want to avoid participation altogether (Carey et al., 2021; Ramirez et al., 2022).The most encouraging and diagnostic finding comes from the lowest-scoring items: Item 8 (I easily lose focus when learning Additional Mathematics, mean = 2.357) and Item 9 (I feel uncomfortable while learning Additional Mathematics, mean = 1.929). The remarkably low mean for Item 9 (mean < 2.00) combined with a tight consensus (SD = 0.873) tells us something vital about these residential school students. They do not hate the subject, they are not lazy, and they feel comfortable and highly focused during standard daily lessons. They experience more psychological distress in a setting with a threat of failure, public evaluation or high stakes judgment (Dowker et al., 2020; Barroso et al., 2021).This study also provides prompt practical suggestions for modifying the classroom setting to better assist these students. Several measures can be implemented to alleviate the significant anxiety associated with public questioning (SD = 1.476). First, instructors should consider moving away from high-stakes “cold-calling” and toward low-stakes group work or private online questionnaires. This allows teachers to get feedback without pointing out individual students (Picho & Akansha, 2025). Finally, there is an extensive discrepancy in the data between students’ fear of making mistakes (mean = 3.586) and their high levels of comfort on routine learning (mean = 1.929), which implies it is important to change the classroom culture to one that accepts mistakes as normal. Viewing mistakes as normal,

constructive steps in the learning process, not as permanent signs of failure, can be a big help in lifting off this heavy emotional burden (van Mier et al., 2023).

Gender Differences in Math Anxiety

An Independent Samples t-test was conducted to see if there is a difference in math anxiety between male and female students. The results of the differences between gender are highlighted in Table 4. The t-test results reveal a statistically significant difference in math anxiety between the genders (t=-2.18, p.value <0.05). The negative t-value shows that the female students have significantly higher anxiety towards Additional Mathematics than male students

Table 4: Independent Samples t-Test for Math Anxiety by Gender

Gender	N	Mean	Std. Deviation	t-value	Sig. value
Male	30	3.063	0.94	-2.18	0.033*
Female	40	3.5028	0.75		

***Significant level p<0.05**

DISCUSSION

Anxiety Levels for Additional Mathematics among Islamic residential school students

Findings shows that nearly two-thirds of the students fall into the high-anxiety category is a critical insight. In the highly competitive environment of an Islamic residential school, academic success is very much embedded in the student's social and self-esteem (Mutodi, 2023). When students are under pressure to earn excellent grades and simultaneously manage a heavy dual-curriculum workload (STEM subjects on one side, and intensive religious/hafazan commitments on the other), the pressure can become overwhelming (van Mier et al., 2023). These numbers show that the stress students experience in Additional Mathematics is not simply about them "not studying hard enough." Instead, it shows that the dominant emotional climate in the classroom has become one of high anxiety. When 65.7% of a class is highly anxious, the panic of failing or underperforming can actively hijack their working memory during tests (Foley et al., 2024). That emotional freeze makes it very difficult for even the brightest students to retrieve complex formulas or think logically when faced with a tough exam paper (Barroso et al., 2021). Therefore, these descriptive findings clearly demonstrate that the introduction of emotional support and lower-stakes assessments is no longer a luxury, but an urgent need for this residential school.

Mathematics Anxiety by Gender

This statistical finding is in line with the broader research in educational psychology, which has shown that female students tend to bear a heavier emotional burden when confronting advanced mathematics (Barroso et al., 2021; Szczygieł, 2020). The interesting thing about this result is that it takes place in a closed ecosystem of an elite Islamic residential school. Students in these boarding schools do not just study together but also live together 24/7 in a tight and high-pressure routine that balances both STEM subjects and intensive religious commitments (Mutodi, 2023). Psychologists explain that this gender gap is rarely about a difference in actual intelligence or brainpower. Rather, it's often about how students internalize stress. Female students in high-achieving cohorts are more likely to exhibit internalized academic perfectionism and a heightened fear of public mistakes (van Mier et al., 2023). In the context of a residential school with visible peer competition, a difficult subject like Additional Mathematics can leave female students emotionally vulnerable. They may perceive a challenging calculus or trigonometry question not as a normal academic hurdle, but as a threat to their competence, which can trigger acute test panic (Orbach et al., 2020). This anxiety can actively clutter their working memory during high-stakes exams, leading them to freeze up, even if they know the material well (Foley et al., 2024). This finding highlights the importance of residential school educators actively implementing

lower-stakes assessments and collaborative classroom environments to help mitigate this emotional bottleneck, especially for female students.

Limitation of study

Therefore, although this study contributes to the literature on mathematics anxiety, some limitations must be addressed that might influence the interpretation of the results. Firstly, the study was conducted in a particular academic stream in a residential school. The student enrolment in this stream was limited by the school itself, and thus the sample of the study was limited to seventy students. Therefore, the reported results might not be transferable to pupils in other educational settings like conventional day schools or in other geographical areas. In addition, mathematics anxiety is a complex phenomenon influenced by different causes. This study, however, was mainly interested in the relationship between the levels of anxiety and gender differences. Other important features that were not considered are previous achievement in mathematics, educational methods used, socio-economic position, and parental expectations.

CONCLUSION

This study was conducted to explore more than high academic pressure, to truly have an insight into the emotional experience of students who are struggling with Additional Mathematics in an Islamic residential school. Using overall anxiety profiles, individual item triggers, and gender-based differences, the data offers insight into where these students are struggling and how we can be of assistance. They find a strong and worrying inconsistency between the classrooms. On the one hand, according to research, more than half of the students reported high levels of math anxiety, fuelled particularly by fear of failure and the terror of taking high-stakes exams. However, the data shows that these students are not hostile towards the subject; instead, they feel comfortable, focused, and collaborative while learning daily. Their anxiety rises when their performance is publicised and even a mistake is seen as a permanent failure. And the research confirms a statistically significant gender gap, with female students enduring significantly heavier emotional burdens and higher rates of anxiety compared to their male counterparts. These findings ultimately demonstrate that high math anxiety is due to factors apart from a student studying inadequately or lacking intelligence. In an elite, dual-curriculum boarding setting in which academic success is so clearly integrated into how a student perceives themselves, anxiety has rather become a psychological barrier. To shield students from risk for their well-being and future participation in STEM, educators need to actively change classroom culture. To reduce the high-pressure methods, such as unwarranted "cold calling" and to make every effort to normalise mistakes as a part of learning, we can significantly lessen the burden of emotional labour. This study suggests that emotional presence in the classroom is just as important as academic delivery for children who are consistently high performers.

Suggestions for Future Research

First, future studies should recruit larger and more diverse samples of students. The research should be expanded to include various schools in various regions such as regular day schools and technical schools to make the research more accurate and generalisable. Longitudinal studies would also be useful, as following the same group of students over time could allow researchers to explore the development of mathematics anxiety as academic demands increase and whether interventions within schools are effective at reducing anxiety levels.

Future studies should refine the research design and investigate more contributing factors. This study was limited to only some variables. However, more understanding could be gained by exploring the interaction of teaching styles, classroom climate, prior academic achievement, and parental expectations with students' mathematics anxiety.

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