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Mathematics anxiety, achievement, and gender among secondary school students in Kota Kinabalu, Sabah

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Abstract

High levels of mathematics anxiety are known to negatively affect students' learning and academic performance; however, empirical evidence within the Malaysian context particularly among secondary school students in Sabah remains limited. Drawing on prior literature that often reports higher anxiety among female students and a negative relationship between anxiety and achievement, this quantitative study aimed to assess mathematics anxiety levels, examine gender differences, and investigate its relationship with students' mathematics achievement. A total of 300 lower secondary students from a secondary school in Kota Kinabalu, Sabah participated in the study, and data were collected using a modified Mathematics Anxiety Scale (MAS) questionnaire, while mathematics achievement was measured based on students' school-based mathematics examination scores. The findings indicated that the overall level of mathematics anxiety was moderate ($\mu = 3.04$, $2.33 < \mu < 3.67$), suggesting that although anxiety is not at a critical level, it may still hinder optimal performance and confidence in learning mathematics. An independent samples t-test revealed that female students reported slightly higher mathematics anxiety ($M = 3.11$, $SD = 0.07$) compared to male students ($M = 2.97$, $SD = 0.06$); however, the difference was not statistically significant ($p = 0.135$, $p > 0.05$), indicating that gender is not a determining factor. In contrast, a significant difference in mathematics anxiety was found based on students' mathematics achievement ($F(5, 294)$, $p < 0.05$), suggesting that anxiety levels vary meaningfully across achievement groups. These findings imply that even moderate levels of mathematics anxiety warrant attention, as they may still affect students' academic outcomes; therefore, teachers should implement supportive instructional strategies and foster a positive learning environment to reduce anxiety and enhance students' engagement and performance in mathematics.

Keywords:
Gender, Mathematics achievement, Mathematics anxiety, Secondary school

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1. INTRODUCTION

Mathematics explores numbers, quantity, structure, space, and change. It involves logical thinking, problem-solving, and critical analysis. Throughout history, mathematics has developed and provided solutions to complex problems and is crucial for everyday life and success in various professions (Taguinod, 2022). Proficiency in mathematics is important for different career paths, as there are many high-paying job options available for individuals with strong mathematical skills, such as scientists, accountants, engineers, and doctors. Pursuing higher education in mathematics can also lead to well-paying opportunities in both the public and private sectors.

However, many people find mathematics challenging because it deals with complex and abstract concepts, which causes students facing difficulties with mathematics to avoid it as a subject (Azizah & Suhendra, 2020). Mathematics can be difficult for certain individuals, leading to negative emotions, a phenomenon known as mathematics anxiety. This phenomenon refers to feeling worried, frustrated, restless, and uneasy about participating in mathematics-related activities, such as when attending mathematics classes, solving mathematics problems, and taking mathematics exams. According to Ahmed et al. (2012), students' emotions can significantly impact their performance in mathematics. Specifically, feelings of fear, confusion, or helplessness that students experience while engaging in mathematics tasks can worsen their performance, and this indicates the crucial role of emotions in students' academic success.

Mathematics anxiety is widely recognised as a universal issue affecting students across educational systems. A survey by the Organization for Economic Co-operation and Development (OECD) revealed that approximately 30% of fifteen-year-olds worldwide experience varying levels of stress when engaging with mathematics (OECD, 2013). This concern is particularly relevant in the Malaysian context, where recent trends such as declining performance in international assessments like PISA and challenges in post-pandemic academic recovery have raised questions about students' mastery of fundamental subjects, including mathematics. These issues highlight an urgent need to examine underlying factors that may hinder achievement. Empirical studies consistently demonstrate a significant negative relationship between mathematics anxiety and academic performance. For instance, Ho et al. (2000) found that higher levels of anxiety are inversely associated with students' mathematical abilities, suggesting that increased anxiety can impede learning and lead to poorer outcomes. Therefore, addressing mathematics anxiety is not only crucial at a global level but also essential in improving students' mathematical performance and educational outcomes in Malaysia.

The decline in students' mathematics achievements is a pressing issue, whereby the performance of Malaysian eight-grade students in mathematics has consistently declined in successive TIMSS assessments (Mohammadpour & Yon, 2024). In Malaysia, secondary school students need to score well in mathematics to gain admission into top tertiary institutions. Conversely, poor performance in mathematics will limit the students' future opportunities and career prospects. Thus, it is essential to understand the factors contributing to this decline. Research indicates that female students may experience higher levels of anxiety when it comes to mathematics compared to male students. Furthermore, Pourmoslemi et al.

(2013) found that this anxiety is associated with poorer mathematics performance among female students. This finding suggests that specific interventions may be necessary to address the different needs of male and female students.

The negative impact of mathematics anxiety on students' performance underscores the urgency of addressing this issue. However, there is a relative lack of empirical data on mathematics anxiety among secondary school students in Malaysia, particularly in Sabah. This gap is significant because Sabah, and Kota Kinabalu specifically, presents a unique educational context shaped by its cultural diversity, multi-ethnic student population, and varying levels of access to educational resources between urban and semi-urban areas (Ministry of Education Malaysia, 2020). These factors may influence students' learning experiences and emotional responses to mathematics in ways that differ from those in more developed regions of Malaysia (Jelas et al., 2016). Despite these distinctive characteristics, limited research has explored how mathematics anxiety manifests within this context. Therefore, this study was conducted to assess mathematics anxiety levels among secondary school students in Kota Kinabalu, Sabah, with a focus on potential gender disparities and the relationship between mathematics anxiety and students' mathematics performance. To guide this investigation, the following research questions (RQ) were formulated.

RQ1 : Is the level of mathematics anxiety of lower secondary students below the 'high level' of the MAS score?

RQ2 : Is there a significant difference in mathematics anxiety among lower secondary school students in Kota Kinabalu, Sabah based on gender?

RQ3 : Is there a significant difference in mathematics achievement among lower secondary school students in Kota Kinabalu, Sabah based on their level of mathematics anxiety?

2. METHOD

2.1. Research Design

This study employed a quantitative analysis to study the relationship between mathematics anxiety and mathematics achievement among secondary school students (Barroso et al., 2021; Puteh & Khalin, 2016; Siebers, 2015; Zhang et al., 2019). This approach was chosen primarily due to the use of standardized scale and test, ensuring reliable and comparable data collection that allowed statistical analyses, such as correlation and regression to provide quantitative evidence of the relationship between mathematics anxiety, gender and mathematics achievement. Additionally, the larger sample size in our quantitative study enhanced the generalizability and statistical power of the findings could lead to a better understanding of the relationship and supporting effective interventions and educational strategies (Cohen, 1992; Maloney & Beilock, 2012).

2.2. Research Location

Although there were several studies conducted in Malaysia on the topic of mathematics anxiety (Maamin et al., 2021; Md-Ali et al., 2021; Mohammadpour & Yon, 2024; Omar et al., 2022), there is currently a lack of data from the Malaysian Bornean state of Sabah. Consequently, this research was conducted at a secondary school in Kota Kinabalu, Sabah to

fill this gap in the literature. This school was chosen based on its convenient location near the Universiti Malaysia Sabah (UMS) main campus and having secondary school students from Form 1 to Form 3 enrolled there.

2.3. Participants

In this study, a total of 300 respondents were selected from a secondary school in Kota Kinabalu, Sabah. Prior to data collection, ethical approval was obtained from the relevant authorities, and informed consent was secured from both the students and their parents or legal guardians, in accordance with established guidelines for research involving minors. Participation was voluntary, and respondents were assured of confidentiality and anonymity throughout the study. The sampling method used was stratified sampling, which involved dividing the population into two homogeneous subgroups or strata based on gender to facilitate a more comprehensive understanding of gender-based differences in mathematics anxiety (Asomah et al., 2025). After dividing the population into male and female groups, simple random sampling was employed to select participants from each stratum, enabling the calculation of statistical measures for each sub-population (Futane & Tech, 2021). The sample size of 300 respondents was determined based on recommendations from power analysis to ensure sufficient statistical power for detecting medium effect sizes in comparative and correlational analyses, thereby enhancing the reliability and generalisability of the findings. The final sample consisted of 150 female students and 150 male students, which also closely reflects the gender distribution in Sabah, where females account for approximately 48% and males 52% (Department of Statistics Malaysia, 2022). Figure 1 illustrates the sampling method used in this study.

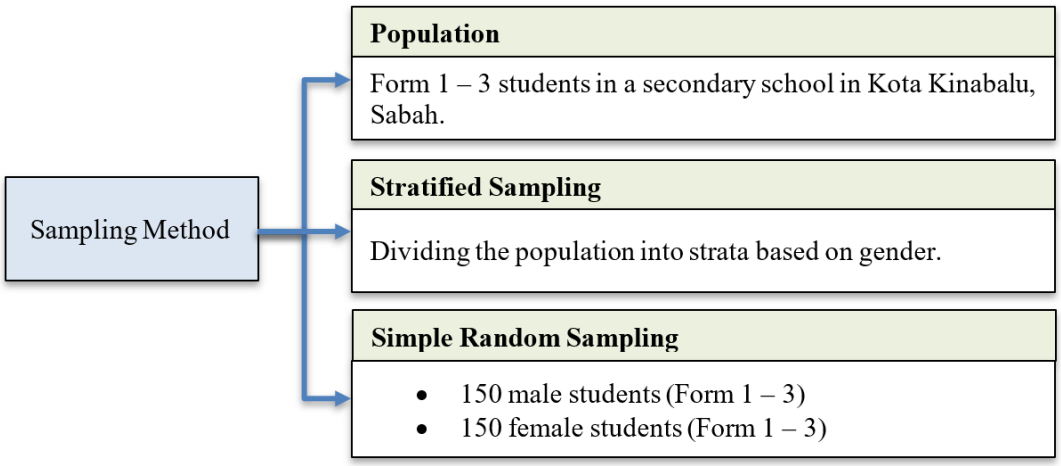

Figure 1. Sampling method in this study

2.4. Research Instrument

A set of questionnaires called the Mathematics Anxiety Scale (MAS) adopted from Mahmood and Khatoon (2011) entitled, "Development and Validation of the Mathematics Anxiety Scale for Secondary and Senior Secondary School Students" was used in this study as the research instrument to assess the level of mathematics anxiety. It consisted of 14 items: 7 items worded positively, and 7 items worded negatively. There were two sections in the

questionnaires: (i) Section A: Demographic profile, and (ii) Section B: Mathematics Anxiety Scale (MAS). The MAS questionnaire is a bi-dimensional scale designed to measure mathematics anxiety in secondary and senior secondary school students. It assesses both positive and negative dimensions of mathematics anxiety using a 5-points Likert scale. Respondents rate each statement on a Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The scale measures concern about doing well in mathematics as well as strong negative emotional reactions to mathematics. The range of possible sum total scores on the MAS questionnaire is from 14 to 70, with higher scores indicating higher levels of mathematics anxiety. Furthermore, the mathematics achievement scores of the students were also obtained from their annual examinations results for analysis of variance (ANOVA).

The MAS questionnaire was administered to the participants in a paper-based physical format. This was done due to participants tending to perceive physical questionnaires as a formal research tool, leading to increased motivation, honesty and seriousness in their responses, thus enhancing the accuracy and quality of the data (Rasinski et al., 2005). Additionally, physical distribution has been found to yield higher response rates compared to online surveys and is often perceived as more anonymous than online surveys, which may lead to increased honesty in their responses (Dommeyer et al., 2002; Nulty, 2008). The implementation of physical distribution also ensures equitable access to the questionnaire, accommodating participants who lack internet connectivity or prefer conventional modes of data collection, including older people, disabled individuals, and children. They are valuable in developing countries with limited technological access.

The evaluation of response ratings was conducted using a Likert scale consisting of five points, ranging from strong agreement to strong disagreement. The grouping of students' mathematics anxiety levels was divided into three categories (Low, Moderate, High) using the formula for the length of the 5-point Likert scale interval class range (Best & Kahn, 2006). Based on this calculation, the interval length was obtained as 1.33 (see Table 1), so that the mathematics anxiety level categories were determined as follows: score 1.00–2.33 (Low), 2.34–3.67 (Moderate), and 3.68–5.00 (High). This mean score division criterion is in line with the empirical classification applied in the mathematics anxiety evaluation research by Mohamed and Tarmizi (2010).

Table 1. Classification of mathematics anxiety based on average MAS questionnaire scores

Range	Level of mathematics anxiety
1.00 – 2.33	Low
2.34 – 3.67	Moderate
3.68 – 5.00	High

2.5. Research Procedure

Upon receiving the approval letter from the Jabatan Pendidikan Negeri Sabah (JNPS), the researcher proceeds to send a proposal and permission letter to the secondary school located in Kota Kinabalu. Subsequently, the collection date was planned accordingly. For the pilot study, the researcher distributed the Mathematics Anxiety Scale (MAS) questionnaire to the Form 1 – 3 students using an online platform to collect data for assessing the questionnaire's

validity and reliability. Afterward, the questionnaire was physically distributed to students for the data collection of this research. To evaluate mathematics achievement, the researcher assessed students' performance from the Annual Examination scores that have been provided by the school data bank. Once the data was collected, it then analyzed using Statistical Package for the Social Sciences (SPSS) software.

2.6. Data analysis

The data collected from the questionnaires and annual examination scores were analyzed using the SPSS Version 21.0. One sample t-test (one-tailed test) was carried out to examine the first research question, which aims to determine the level of mathematics anxiety among lower secondary school students in Kota Kinabalu, Sabah. This analysis involved calculating the average level of anxiety. To test the second research question, focusing on whether there is a significant difference in mathematics anxiety based on gender among lower secondary school students in Kota Kinabalu, Sabah, an independent samples t-test was conducted. To explore the third research question, which examines the potential significant difference in mathematics achievement based on the level of mathematics anxiety among secondary school students in Kota Kinabalu, Sabah, a one-way ANOVA was employed. This analysis allows a comparison of mathematics achievement scores across different levels of mathematics anxiety to assess if there are any notable differences among the groups. Table 2 summarizes the types of analysis used for each research question in this study. A significance level of 0.05 was used in the inferential statistical analyses of this study.

Table 2. Summary of the research questions and the statistical tests used

Research Questions	Analysis
Is the level of mathematics anxiety of lower secondary students below the 'high level' of the MAS score?	One sample t-test
Is there a significant difference in mathematics anxiety among lower secondary school students in Kota Kinabalu, Sabah based on gender?	Independent sample t-test
Is there a significant difference in mathematics achievement among lower secondary school students in Kota Kinabalu, Sabah based on their level of mathematics anxiety?	One-way ANOVA

3. RESULTS AND DISCUSSION

3.1. Results

3.1.1. Analysis of the Level of Mathematics Anxiety Among Lower Secondary Students

Table 3 shows the frequency statistics of the level of mathematics anxiety among the respondents. As shown, the majority of students (53.7%; n = 161) reported a moderate level of mathematics anxiety based on their average MAS scores. This is followed by those with a high level of mathematics anxiety (25%; n = 75) and finally, those who had a low level of mathematics anxiety (21.3%; n = 64).

Table 3. Frequency statistics of the level of mathematics anxiety

		Frequency (Number of students)	Percent (%)
Level of mathematics anxiety	Low	64	21.3
	Moderate	161	53.7
	High	75	25.0
	Total	300	100.0

Table 4 shows the descriptive statistics of the level of mathematics anxiety among the respondents. The average level of mathematics anxiety among the lower secondary students were analyzed as moderate level (M = 3.04, SD = 0.82).

Table 4. Descriptive statistics of the level of mathematics anxiety

	N	Mean	Std. Deviation	Std. Error Mean
Level of mathematics anxiety	300	3.0421	0.81818	0.04724

Inferential statistical analysis was subsequently conducted, with the results of the one-sample t-test (1-tailed) summarized in Table 5.

Table 5. One sample t-test analysis of the level of mathematics anxiety

	Test Value = 3.67					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Average level of mathematics anxiety	-13.291	299	0.000	-0.62786	-0.7208	-0.5349

The finding obtained through the analysis showed that t = -13.291, which is smaller than the critical t-value (299.5%). This means that the first null hypothesis, H_{o1}, failed to be rejected. Thus, the average level of mathematics anxiety ($\mu = 3.04$, $\mu < 3.67$) of lower secondary students in a secondary school in Kota Kinabalu was less than 3.67 which is not at the high level.

3.1.2. Analysis of the Relationship Between Gender Difference and the Level of Mathematics

Table 6 shows the average level of mathematics anxiety for both female and male students in this study. From this table, female students collectively exhibit slightly higher levels of mathematics anxiety compared to that of the male students. The overall average level of mathematics anxiety for female students is 3.11, which is only 0.14 points higher than the overall average for male students.

Table 6. Descriptive statistics of mathematics anxiety by gender

Gender		N	Mean	Std. Deviation	Std. Error Mean
Average level of mathematics anxiety	Male	150	2.9714	0.77503	0.06328
	Female	150	3.1129	0.85592	0.06989

To test if this difference among male and female students is statistically significant, an independent sample t-test was conducted (see Table 7). The Levene's test indicated a significant value above the confidence level of 0.05, suggesting equal variances between the groups.

Table 7. Independent sample t-test of mathematics anxiety by gender

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Average level of MA	Equal variances assumed	2.450	0.119	-1.50	298	0.135
	Equal variances not assumed			-1.50	295.11	0.135

The findings obtained in the independent sample t-test analysis showed that the mean score of the male students (M = 2.97, SD=0.06) and female students (M = 3.11, SD=0.07) are not significantly different, t = -1.500, df = 298, sig two-tailed = 0.135, whereby $p > 0.05$. Therefore, the null hypothesis 2, H_{o2}, failed to be rejected. Thus, there is no significant difference in mathematics anxiety based on gender among secondary school students in Kota Kinabalu, Sabah.

3.1.3. Analysis of the Relationship Between the Mathematics Achievement and the Level of Mathematics Anxiety

Table 8 shows the average mathematics anxiety levels categorized by the grades (A to F) achieved by the respondents in their annual mathematics examination.

Table 8. Descriptive statistics of mathematics anxiety level based on the mathematics achievement

Grade	N	Mean of MA	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
A	37	2.3031	0.82691	0.13594	2.0274	2.5788	1.00	4.07
B	40	2.5661	0.71234	0.11263	2.3383	2.7939	1.21	4.00
C	54	2.8810	0.65495	0.08913	2.7022	3.0597	1.93	4.36
D	43	3.0631	0.72058	0.10989	2.8413	3.2848	1.36	4.43
E	49	3.2974	0.77842	0.11120	3.0738	3.5210	1.36	4.86
F	77	3.5835	0.58116	0.06623	3.4516	3.7154	1.86	4.57
Total	300	3.0421	0.81818	0.04724	2.9492	3.1351	1.00	4.86

A cursory analysis revealed that students who failed in their annual mathematics exam exhibited higher average mathematics anxiety levels, indicating greater anxiety compared to other groups. Conversely, those who reported the lowest anxiety in mathematics achieved Grade 'A' in their annual mathematics exam.

Table 9. Test of homogeneity of variances for mathematics anxiety level based on the mathematics achievement

		Levene Statistic	df1	df2	Sig.
Average level of mathematics anxiety	Based on Mean	2.118	5	294	0.063
	Based on Median	2.048	5	294	0.072
	Based on Median and with adjusted df	2.048	5	283.542	0.072
	Based on trimmed mean	2.138	5	294	0.061

To test the relationship between grades achieved and mathematical anxiety, a one-way independent samples ANOVA was conducted. The significant value on the test of homogeneity of variance is 0.0063, where $p > 0.05$, indicating that the homogeneity of variances is assumed (see Table 9).

Table 10. One-way ANOVA test of mathematics anxiety level based on the mathematics achievement

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	56.456	5	11.291	23.101	0.000
Within Groups	143.702	294	0.489		
Total	200.158	299			

Based on the ANOVA findings (see Table 10), the level of mathematics anxiety is significantly different among the mathematics grades achieved, $F(5, 294) = 0.000$, $p < 0.05$. Therefore, the null hypothesis stating that there is no significant difference in mathematics achievement among secondary school students in Kota Kinabalu, Sabah based on their level of mathematics anxiety is rejected. Specifically, students with higher anxiety levels do not necessarily exhibit lower mathematics achievement compared to those with lower anxiety levels.

3.2. Discussion

3.2.1. Level of Mathematics Anxiety Among Lower Secondary Students in Kota Kinabalu, Sabah

The result showed that the average level of mathematics anxiety among secondary school students was at a moderate level ($\mu = 3.04$, $2.33 < \mu < 3.67$). The mean score ($\mu = 3.04$) represents the average response of students on the anxiety scale. The interval $2.33 < \mu < 3.67$ defines the "moderate" category range. Since 3.04 falls within this range, the overall anxiety level is classified as moderate. This result means that, on average, lower form (Form 1 – 3) secondary school students experience a moderate level of mathematics anxiety, not too low and not excessively high. This supported by similar previous studies done in Malaysia (Ching Peng & Rosli, 2021; Omar et al., 2022; Puteh & Khalin, 2016; Rahmah, 2013) that found secondary school students were at the moderate level of mathematics anxiety. Another study also found that students with high levels of mathematics anxiety correlated with low

motivation in mathematics learning (Suren & Kandemir, 2020). Shishigu (2018) stated that mathematics anxiety is the factor that hinders students from being involved in mathematics learning, leading to low achievement in mathematics and creating a negative feedback loop that further increases anxiety. This is consistent with the math anxiety process model (Mitchell, 1984) and other studies that stated math anxiety may influence the career plans of secondary school students, who are in a period crucial for identity development in which vocational interests crystallize (Levy et al., 2021).

According to Asri et al. (2017), excessive homework assignments by teachers may also contribute to the stress in learning mathematics among students. Students often feel burdened and overwhelmed, particularly when the math problems are challenging, which leads to procrastination behavior when doing their homework. Murphy (2018) reported that students experience significant stress and frustration when they struggle to understand math exercises. Meanwhile, some studies found that consistent and manageable math practice is crucial for improving students' math skills. According to Cumhur and Tezer (2019), such consistent math practice helps in overcoming math anxiety, reinforcing the idea that the quality and quantity of homework should be balanced to benefit students. This means that teachers need to strike a balance when assigning homework in mathematics. It is important for teachers to listen to students' feedback and adjust homework loads accordingly, ensuring tasks are meaningful for learning and do not create unnecessary anxiety. Clear explanations and support for challenging concepts are essential to ease students' stress and frustration, creating a positive learning environment that enhances math skills and builds confidence.

However, some studies have stated that a medium amount of anxiety in students' learning process can be beneficial as the moderate stress they are facing helps them focus more on learning. In Suren and Kandemir (2020) study, they state that individuals with a high motivation and moderate levels of anxiety tend to utilize cognitive resources efficiently, which enhances their mathematics performance. Similarly, Wang et al. (2015) pointed out that moderate levels of mathematics anxiety can be beneficial for students who have a strong intrinsic motivation. Instead of being harmful, this level of anxiety can drive students to immerse themselves more in their math studies and find greater enjoyment in the learning process.

3.2.2. Gender Difference in Mathematics Anxiety Among Lower Secondary Students in Kota Kinabalu, Sabah

Our results showed that there is no significant difference in the level of mathematics anxiety based on gender, but female students (M = 3.11) showed a slightly higher mathematics anxiety than male students (M = 2.97). Although female students reported slightly higher mathematics anxiety than male students, the difference was not statistically significant, indicating that gender is not a determining factor in mathematics anxiety among the respondents. This finding is consistent with two previous Malaysian studies (Abd Karim et al., 2023; Puteh & Khalin, 2016) that also showed no significant difference in mathematics anxiety between female and male students of Perak and Kuala Lumpur, respectively. Moreover, Abd Karim et al. (2023) also found that girls showed a slightly higher but not statistically significant level of anxiety. While some previous studies in other countries (Al-Shannaq & Leppavirta,

2020; Amam et al., 2019) have similarly found no gender differences in mathematics anxiety, other research did show that female students often experience higher levels of math anxiety compared to male students (Dungdung & Bankira, 2023; Hill et al., 2016; Mann & Walshaw, 2019).

Our finding of no significant gender difference in mathematics anxiety diverges from extensive research indicating that females often experience higher math anxiety levels than males. The existence of such a stereotype could impact its victims emotionally and mentally, leading to a decreased self-concept in mathematics. For example, Cvencek et al. (2011) found that girls start internalizing the stereotype of being inferior in mathematics as early as elementary school, which adversely affects their developing math self-concept. This self-perception influences motivation, performance, and emotional responses to challenges and tasks in that domain. This is consistent with studies that stated negative self-perception continues to widen among female students compared to male students throughout middle and high school (Lindberg et al., 2013). These stereotypes are pervasive and can lead to a cycle where girls' lower self-concept in mathematics affects their interest, participation, and performance in related mathematics activities. Moreover, mathematics anxiety and gender stereotypes may impact female students' decisions regarding their choice of university studies. Studies indicate that STEM fields are predominantly male dominated, contributing to lower participation rates among women (Makarova et al., 2019).

According to Yip (2016), the detrimental effects of stereotypes are not limited to gender but extend to racial and ethnic identities as well. In a study by Seo and Lee (2021), a similar pattern was observed among Black and Latinx students, who experience higher levels of stereotype threat in high school mathematics classrooms compared to their White peers. In their study, they found that stereotype threat negatively predicts later achievement through the increased anxiety experienced by students who faced the stereotype threat in school. These negative experiences can build up, leading to concerns about being judged on their social identity rather than their individual performance, which in turn negatively affects their self-concept and increasing anxiety in mathematics learning.

3.2.3. Relationship Between Mathematics Achievement and Mathematics Anxiety Among Lower Secondary Students in Kota Kinabalu, Sabah

Our result showed that there is a significant difference in mathematics anxiety level based on mathematics achievement. Students with higher levels of mathematics anxiety score better than students with lower levels of mathematics anxiety in their latest mathematics exam. This means the anxiety truly affects the performance of the students in their mathematics performance. Multiple studies (Al-Shannaq & Leppavirta, 2020; Ching Peng & Rosli, 2021; Diponegoro et al., 2024; Donolato et al., 2020; Dungdung & Bankira, 2023; Kundu & Kar, 2018; Listiawati et al., 2025; Mohammad, 2017; Zanabazar et al., 2023; Živković et al., 2023) similarly found mathematics anxiety had a significantly negative effect on mathematics performance, though a study conducted by Omar et al. (2022) did not find a significant relationship between mathematics anxiety level and mathematics achievement. According to Falk and Fischbacher (2006), mathematics anxiety and math achievement are interlinked in a self-reinforcing cycle. High levels of math anxiety can lead to lower achievement in math, and

conversely, poor performance in math can increase anxiety levels. Students who have experienced high levels of mathematics anxiety will be trapped in this vicious circle that leads to decreased self-confidence in any mathematics situation.

In the study conducted by Živković et al. (2023), it was found that mathematics performance negatively correlated with mathematics anxiety but positively correlated with mathematics enjoyment and self-efficacy. This indicates that students who score higher on mathematics exams tend to have lower levels of math anxiety and higher levels of enjoyment and self-efficacy in mathematics. Enjoyment in mathematics fosters positive emotions when dealing with math-related tasks, boosting self-confidence and leading to greater success in mathematics. They also found that there is a negative correlation between mathematics anxiety and mathematics self-efficacy, which is consistent with Bandura's Social Cognitive Theory. According to Bandura (1986), self-efficacy, or belief in one's ability to succeed in specific tasks, significantly influences academic performance. High self-efficacy boosts motivation and persistence, resulting in better achievement. In contrast, low self-efficacy, often a result of repeated failures or negative experiences, can increase anxiety and lead to avoidance of math tasks

According to Musa and Maat (2021), mathematics anxiety is attributed to students' perception that math becomes increasingly difficult at the secondary school level. This belief leads to avoidance of math learning, resulting in poorer performance. Teachers also play a key role in improving their students' performance. The behavior and speech of a teacher will impact students' performance in mathematics. According to Ismail et al. (2022), the teachers' behavior and speech, including rushing through lessons, assigning excessive notes and exercises, and using punishments or embarrassing statements, significantly contribute to increasing mathematics anxiety. Moreover, parents' assessments of their child's competence can influence the child's self-concept and confidence in mathematics. For instance, Putnick et al. (2020) found that parents' beliefs about their children's abilities were significant predictors of later performance. Therefore, teachers and parents are crucial in reducing students' math anxiety to enhance their performance in mathematics.

4. CONCLUSION

This study showed that mathematics anxiety among lower secondary students in Sabah is at a moderate level and, insignificantly different between genders, is clearly associated with students' mathematics achievement. These findings emphasize the need for teachers to cultivate supportive, low stress learning environments and implement strategies that help students manage anxiety to improve learning outcomes. Future research is recommended by increasing the sample to include diverse school settings across Malaysia, explore additional contributing factors such as teaching practices or parental influence, and consider longitudinal or mixed methods designs to gain deeper insights into how mathematics anxiety develops and affects students over time.

One potential limitation to consider is the students' level of interest and willingness to take part in the study. Their level of engagement and honesty when completing the questionnaire could influence the accuracy of data collection. If students choose not to

participate or provide incomplete or inaccurate information, it could undermine the reliability of the findings. Hence, it becomes of utmost importance to establish a supportive atmosphere that fosters students' enthusiastic and genuine engagement. Besides, time constraints contributes to the limitation of study. The limited duration available for data collection may restrict the amount of time available for observation. This constraint can potentially lead to a short observation period, resulting in less comprehensive and detailed findings. With less time to observe and gather data, there is a risk of missing out on important nuances and variations within the research topic. It is crucial to make the most of the available time by carefully planning and organizing the data collection process.

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