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# Mathematics Anxiety and Relationship with Mathematics Achievement of Form Four Students

Ahya Kautsar Ahmad Termizi & Muhammad Sofwan Mahmud

Faculty of Education, National University of Malaysia, Bangi

Corresponding Authors Email: p111145@siswa.ukm.edu.my

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**Abstract**

Malaysia does not want to fall behind other developing nations in the field of STEM (Science, Technology, Engineering, and Mathematics). However, some students avoid science courses or jobs that require mathematics because they have a phobia of the subject. The purpose of this study is to identify mathematics anxiety levels and their relationships with mathematics achievement in form four students. A total of 56 form four students from Sepang district schools were chosen at random to participate in the survey. In this quantitative study, the Mathematics Anxiety Scale-UK (MAS-UK) was used as a questionnaire tool to assess the level of mathematics anxiety and its relationship with students' mathematical achievement. The mean score value was used for descriptive analysis and the Pearson Correlation test was used for inferential analysis. According to the study's results, mathematics anxiety among form four students is moderate. The study also discovered a tenuous link between students' mathematics achievement and their level of mathematics anxiety. Therefore, to be able to take the necessary action to address this problem, teachers and schools must pay special attention to overcome the concerns about mathematics.

**Keywords**: Anxiety, Relationship, Achievement, Mathematics, Secondary School Students

## Introduction

The Fourth Industrial Revolution (IR 4.0) has had a significant impact on many areas of society, including education. The education system of a nation should be modified to satisfy Industry 4.0 standards to meet the demands for human capital in a high-tech economy (Kamsi et al., 2019). Malaysia does not want to fall behind other developing nations in the STEM (Science, Technology, Engineering, and Mathematics) disciplines. Many parties are concerned about the decline in the number of students pursuing STEM careers because until now, there is still no clear answer. The goal established by the Malaysian Ministry of Education (KPM), calls for 60:40 participation of students in STEM subjects (Adam and Halim, 2019). However, the standard has not yet been met as of 2022 (Hasrin and Maat, 2022). As a result, the curriculum has been improved to become the Secondary School Standard Curriculum (KSSM), which has replaced old Integrated Secondary School Curriculum (KBSM), beginning in 2017. A math

phobia, on the other hand, prevents some students from pursuing careers in science or jobs that require mathematics (Yahya and Amir, 2018).

The sense of tension and unsettling anxiousness to manipulate numbers in both everyday situations and educational settings has been defined as math phobia or anxiety (Richardson and Suinn, 1972). Moreover, students are affected by their feelings of tension and anxiety when they solve arithmetic problems and carry out current calculations involving numbers (Hunt and Zakaria, 2018). In addition, anxiety symptoms in students are more obvious when they are required to answer problems using mathematics and mathematical language (Prodromou and Frederiksen, 2018). Students are exposed to more difficult mathematics concepts in high school and college. Negative feelings thus get stronger with age, decreasing students' interest in mathematics (Peng and Rosli, 2021). As a result, the emotional, physical, and mental health of the students is affected as well.

There have been several researches done on how anxious students can be when studying arithmetic. A research was done by Peng and Rosli in 2021 to determine the severity of form one students' mathematics anxiety. The study's results highlight the fact that mathematics anxiety among form one students is at a moderate level. This is consistent with a research by Shishigu (2018), which found that math anxiety among 9th grade pupils in five schools in Ethiopia was moderate. The same is valid of Yahya and Amir's (2018) study, which discovered that math students' anxiety levels of their respondents were also moderate. Students often have a moderate level of math anxiety. According to a study by Husain (2018) who looked at the relationship between math anxiety and math achievement as well as student demographic characteristics, the level of math anxiety is moderate among matriculation students.

However, other researches has indicated that learning mathematics is significantly impacted by students' anxiety. In a study by Hui and Rosli from 2021, it was discovered that form four students who took additional mathematics class had significant level of math anxiety when learning new concepts. Similarly, Luu-Thi et al (2021), who conducted a study in Vietnam, discovered that 12th-grade students also had a significant level of mathematics anxiety. According to Widjajanti et al (2020), a study on 943 Indonesian primary school students revealed that most students in this age group have lower levels of mathematics anxiety. Hasrin and Maat's (2022) descriptive study utilizing frequency and percentage data demonstrates that form four students' levels of math anxiety are similarly low.

There is a correlation between students' anxiety and fear levels and their mathematical proficiency (Juniati and Budayasa, 2020). To prevent experiencing fear after answering the questions, students respond to inquiries promptly (Hui and Rosli, 2021). In addition, understanding of mathematical concepts is frequently linked to how challenging it is to master mathematics learning. Aspects of understanding mathematical concepts include errors, misunderstandings, and mathematical mistakes (Peng and Rosli, 2021). Furthermore, students are unable to relate their learning objectives to real-world circumstances. As a result, students who do not understand the root of their math phobia will have difficulty understanding the subject.

Next, a number of previous research looked at the relationship between math exam performance and student anxiety. Hui and Rosli (2021) showed that students who experience high levels of anxiety do poorly in math. In both primary and secondary school students, there was a significant inverse relationship between anxiety and math achievement, based on a meta-analysis by (Namkung et al., 2019). According to Shishigu's (2018) research, there is a similarly clear and negative correlation between mathematics anxiety and student achievement. Al-Shannaq and Leppayirta (2020) conducted a study on university students and found that there was a negative effect between math achievement and anxiety about math. Next, Luu-Thi et al (2021) found that students with a high mean score of 9.0 - 10.0 had a higher level of math anxiety than students with lower scores.

There are, however, studies with conflicting results, such as the one conducted by Hasrin and Maat (2022), who discovered a negative, moderate, and statistically significant relationship between math anxiety and high school students' mathematics learning. A study by Yahya and Amir shows a slightly positive relationship between additional math proficiency and math anxiety (2018). A study conducted by Husain (2018) found that there is a significant positive relationship between matriculation students' math anxiety towards PSPM math achievement and being at a weak level. Thus, according to Peng and Rosli's research in the year 2021, there was no correlation between form one students' mathematics performance and their level of math anxiety.

Particularly for high school students, this mathematics anxiety needs to be overcome immediately. This study of mathematical anxiety is ongoing because of the inconsistent results of another research. However, there is still little research on math anxiety, especially among secondary school students who are in the form four. This is because they are the third batch of students who are learning the new curriculum measure which is KSSM. Thus, there is a need for a holistic study to determine the level of students' anxiety when learning mathematical concepts and questions that require advanced thinking skills. The purpose of this study is to identify math anxiety levels and their relationships with math achievement in form four students.

**Research Objectives**

1. To identify the level of math anxiety of form four students
2. To identify the relationship between form four students' anxiety and math achievement.

**Research Questions**

1. What is the level of math anxiety of form four students?
2. Is there a relationship between form four students' anxiety and math achievement?

**Hypothesis**

$H_0 2$: There is no difference in the relationship between form four students' anxiety and math achievement.

## Methodology

This research uses a survey method to identify the level of math anxiety and its relationship to form four students' mathematics achievement. Inferentially analysing a quantitative study allows for the creation of generalisations about a topic. (Chua, 2014b). 66 students from a daily secondary school in the Sepang district of Selangor made up the population for this study. After reviewing Krejcie and Morgan's Sample Size Determination Table (Krejcie & Morgan, 1970) and considering the potential of respondents dropping out, a total of 56 students were chosen as study respondents (Chua, 2014b). Dropout respondents are defined as those who left the study without being notified or those who switched schools. Peng and Rosli (2021) claim that the decision to choose more respondents was made in order to prevent the lack of data caused on by missing or insufficient instruments after data filtering.

This study employed a method of systematic random sampling to minimise measurement error and bias. This sampling strategy allows researchers to save time on response selection (Peng and Rosli, 2021). The responders also represent the entire research population, which includes people of various racial and gender backgrounds.

The questionnaire is divided into two components, A and B, which are used as research instruments. Part A of the questionnaire contains the respondents' demographic data, whereas Part B of the questionnaire examines the respondents' level of math anxiety. This instrument was modified from a Hunt et al. study (2011). Hunt et al. modified the Mathematics Anxiety Rating Scale (MARS), created by Richardson and Suinn in 1972, to MAS-UK (2011). The three constructs are social anxiety in daily life, anxiety with mathematics observation, and anxiety in math assessment. Each construct contains six to nine items which each use a five-point Likert scale. Mid-year exam results are used, with the average score, to evaluate students' math achievement.

To avoid respondents with limited English proficiency from misinterpreting the meaning of the MAS-UK questionnaire items, the Malay translations of the questions were made. Therefore, the translation results were reviewed by two individuals who were proficient in both languages and mathematics to ensure the instrument's validity. The questionnaire was modified before the pilot study was carried out after the review from the expert. Ten students who had the same characteristics as the survey respondents participated in a pilot study. This study makes use of the range of 0.65 to 0.95 for the Cronbach alpha coefficient that Chua (2014a) suggests. According to the findings of this pilot study, each construct had acceptable reliability. With a coefficient value of 0.93, the reliability of a scale measuring form four students' mathematical anxiety is satisfactory. Table 1 shows the Cronbach alpha coefficient value based on the construct.

Table 1
*Cronbach alpha coefficient value according to construct*

| Instrument | Cronbach alpha coefficient |
|---|---|
| Anxiety in math assessment | 0.779 |
| Anxiety about math in social or daily life | 0.936 |
| Anxiety with mathematics observation | 0.847 |
| Anxiety level (overall) | 0.933 |

When data collecting is conducted in a systematic way, the researcher can easily get feedback from the respondents. Although the face-to-face school session has started last March, the study sample is still having home-based learning and online teaching sessions. This is due to the use of classrooms for SPM repeat exams. So, the researcher had to use Google Form for data collection.

The data collected from surveys was analysed using SPSS version 26 software, which stands for Statistical Package for the Social Science (SPSS). Descriptive statistical analysis and inferential statistical analysis are the two types of statistical analysis that are being used. With reference to the mean score value, descriptive statistics were utilized to measure the level of mathematics anxiety among the form four students. Next, the mean score obtained in the study as well as the mean score from the study used by Yahya and Amir (2018) were compared. Table 2 shows the average score that Yahya and Amir used (2018).

Table 2
*Mean score used by Yahya and Amir (2018).*

| Level | Mean Score Range |
|---|---|
| Very low | < 1.50 |
| Low | 1.50-2.49 |
| Moderate | 2.50-3.49 |
| High | 3.50-4.49 |
| Very High | >4.50 |

The data was inferentially analysed using the Pearson Correlation test to determine the relationship between math anxiety and form four students' math achievement. Before doing the correlation test, the researchers identified the normality of the data distribution. If the data distribution is normal, the Pearson Correlation Test can be used to determine the relationship between math anxiety and form four math achievement (Chua, 2013). This is so that the Pearson Correlation Test can show the cause-and-effect relationship between the study variables.

**Findings**

*Study Respondents*

56 participants were chosen to participate in this study; 16 (27.1%) were male students and 40 (72.9%) were female students. Form four math midterm exam results show that 1 student (1.8%) received a grade of B and C+, 4 students (7.1%) received a grade of C, 6 students (10.7%) received a grade of D, 10 students (17.9%) received an E grade, and 34 students (60.7%) received a grade of G or failed. The analysis of the midyear mathematics examination's findings revealed that students' achievement was poor.

**The Level of Mathematics Anxiety Among Form Four Students**

A descriptive analysis was carried out to assess the level of mathematics anxiety among the form four students. There are three constructs to analyse when evaluating the level of mathematics anxiety among form four students: anxiety in observation, anxiety in math assessment and social anxiety in daily life. With a mean score of 3.47 for the construct of anxiety in math assessments, the level of anxiety is moderate. The construct of mathematics

anxiety in social or daily life had a mean score value of 2.32 at a low level, while the construct of anxiety with mathematics observation had a mean score value of 2.39 at a low level as well. With a mean score of 2.73, form four students' overall level of anxiety is therefore moderate. Table 3 shows a study on the level of math anxiety among form four students according to the construct more specifically.

Table 3
*Value of the mean score according to the construct.*

| Instrument | Mean Score Range | Level |
|---|---|---|
| Anxiety in math assessment | 3.47 | Moderate |
| Anxiety about math in social or daily life | 2.32 | Low |
| Anxiety with mathematics observation | 2.39 | Low |
| Anxiety level (overall) | 2.73 | Moderate |

**The Relationship Between Math Anxiety and Form Four Students' Mathematics Achievement**

A normality tests showed that the data were normally distributed with a significant p-value of less than 0.05. So, using the Pearson Correlation Test, the relationship between form four students' anxiety and math achievement was analyzed. The data findings for the correlation between these two variables are shown in Table 4.

Table 4
*The relationship between the level of math anxiety and form four students' math achievement*

| | | Level of anxiety in math |
|---|---|---|
| Mathematics achievement | Correlation coefficient | -0.228 |
| Mid-year examinations | Sig. (2-tailed) | 0.091 |
| | N | 56 |

For this study (n = 56), the Pearson Correlation test between the level of math anxiety and students' math achievement in the mid-year exam shows that the correlation coefficient is r = -0.228 and this relationship is a negative relationship ($p < 0.05$). This r value indicates that there is a weak and not significant negative relationship between math anxiety and math learning, r = -0.228, p = .091. The researcher rejected the null hypothesis. This is because there is enough data to conclude that there is a relationship between form four students' mathematics achievement and their level of math anxiety. The conclusion that can be drawn from the analysis of this study's findings is that form four students' mathematics achievement is weakly correlated with their level of math anxiety.

**Discussion**

The purpose of the study was to determine the level of math anxiety and its relationship to students' math achievement in the fourth grade. Anxiety in observation, anxiety in math assessment, and social anxiety or general anxiety are the three constructs for the level of anxiety that has been studied. The study's findings indicate that math anxiety in social environments or daily life as well as anxiety related to math observation are both at a low level. The mathematics assessment causes moderate levels of anxiety. It was determined that the level of math anxiety is moderate based on the overall mean score. The results of this

study are consistent with those of previous studies by Peng and Rosli (2021); Shishigu (2018); Yahya and Amir (2018); Husain (2018), which revealed that math anxiety is at a moderate level (2018). This indicates that student math anxiety is still under control.

In contrast, Hui and Rosli (2021); Luu-Thi et al (2021) found that the anxiety levels of students were high. Research by Widjajanti et al (2020); Hasrin and Maat (2022) also revealed that students' anxiety levels decreased into the low category. Students in secondary school have a moderate level of anxiety because they already have a phobia of mathematics at a higher level. This is due to increasingly difficult to understand mathematical topics and issues requiring advanced level reasoning skills (Peng and Rosli, 2021). Research results vary depending on several variables, including the respondents' backgrounds, learning styles, and geographic locations.

The study also discovered that form four student's mathematics achievement is negatively correlated with their level of math anxiety. This result is similar with research by Hui and Rosli (2021); Namkung et al (2019); Shishigu (2018); Al-Shannaq and Leppayirta (2020); Luu-Thi et al (2021) who identified a negative relationship between student anxiety and math achievement. According to Hasrin and Maat's (2022) research, there is a negative, moderate, and significant correlation between secondary school students' mathematics learning and their level of math anxiety. According to this researcher, when mathematics anxiety is strong, it has a negative impact on academic achievement at all levels of study.

This finding contradicts the findings of Peng and Rosli's (2021) study, which concluded that students with low mathematics achievement do not necessarily have a high anxiety level. According to OECD (2013), there is no relationship between Albanian students' achievement in mathematics and their level of mathematics anxiety. A study by Yahya and Amir has shown a weak positive relationship between math anxiety and additional math achievement 2018. A study conducted by Husain (2018) shows that there is a significant and slightly weak positive correlation between matriculation students' math anxiety and PSPM math achievement. Since each country's educational system is unique, the conclusions of this study cannot be extended to all countries.

Even though 34 students (60.7%) received a G score on the form four midterm mathematics exam, the level of students' math anxiety was moderate. The perception and interest of the student affects their performance (Peng and Rosli, 2021). The syllabus gets tougher in the upper secondary and higher education levels as well. They need extra time to understand the mathematical ideas being taught. Their phobia of mathematics increases because of this. On the other hand, Hunt and Zakaria (2018) argue that insufficient reading skills, memory, motivation, and test anxiety are the fundamental causes of poor achievement. Outstanding students also struggle with math anxiety. Due to their decreasing interest in mathematics, students struggle to concentrate while they are learning (Peng and Rosli, 2021). Therefore, individuals with varying levels of achievement will experience anxiety during mathematical tasks.

In addition, students require tremendous support from their parents, teachers, and peers to succeed. Parents are the closest members of a student's family and are constantly aware of any behavioural or academic changes (Peng and Rosli, 2021). According to Husain's study from 2020, students who do not have parental support find it more difficult to learn. The different needs of students must also be taken into consideration by teachers if they are to help their students improve their mathematical skills. Indirectly, with cooperation from all stakeholders, mathematics anxiety among students can be reduced.

Implications from the study conducted and the findings of previous studies, the research needs to take a longer period. This is to help researchers collect more precise data and identify trends in the anxiety levels of students. Schools can use the study's findings to help them develop programmes that aim to reduce students' mathematics anxiety and to improve their mathematics achievement. In addition to a significant number of study samples, the researchers recommend that boarding schools, government religious schools, and vocational colleges are also involved in the study's respondents. Rural areas and schools may also be used for research. Furthermore, the teacher's method of teaching before the exam or test can also be included in this study.

**Conclusion**

Based on the study's findings, mathematics anxiety among form four students is moderate. The study also discovered a tenuous connection between students' mathematics achievement and their level of math anxiety. Due to decreasing student interest and an increasingly tough curriculum, mathematics achievement is at a low level. Anyone who participates in math-related activities will experience anxiety, but it can be reduced with everyone's help. Thus, it is important for teachers and schools to address math-related problems in order to be able to implement the necessary solutions to this problem.

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