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# Descriptive Insights into Mathematics Attitudes Among University Students

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ABSTRACT

This study provides a comprehensive descriptive analysis of university students' attitudes toward mathematics, aiming to identify key affective factors that influence their engagement and performance in the subject. Utilizing a quantitative survey design, data were collected from a diverse sample of undergraduate students across various academic disciplines. ATMI (Attitudes Towards Mathematics Inventory) was used to understand individual differences in attitude towards mathematics by assessing multiple dimensions, including self-confidence, enjoyment, value, and motivation. Participants in the survey comprised 170 Universiti Teknologi MARA (UiTM) students from diverse academic backgrounds who had enrolled in mathematics-related courses during the previous semester. Findings show that even though students see mathematics as important and useful, many do feel anxious and lack confidence, which can affect their performance in school. Moreover, it is also suggested that younger students, particularly those aged 17–19, tend to exhibit more favourable attitudes toward mathematics compared to other age groups. Notably, students who reported higher levels of enjoyment and perceived value of mathematics tend to demonstrate better performance in the subject. The study underscores that students at the Pre-Diploma level tend to have the most positive attitude towards mathematics, which may be attributed to their recent or ongoing exposure to fundamental mathematical concepts that foster confidence and engagement. Based on gender, both genders generally show a positive attitude toward mathematics.

## 1. INTRODUCTION

Mathematics is often regarded as a cornerstone of education, playing a fundamental role not only in science, technology, engineering, and mathematics (STEM) fields but also in developing logical reasoning and problem-solving skills across disciplines. Despite its recognized importance, students' attitudes toward mathematics vary widely, influencing their motivation, performance, and willingness to engage with

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mathematical content. At the university level, where students face increased academic autonomy and diverse learning environments, these attitudes can significantly shape their academic path.

Zan and Martino (2007) defined attitude towards mathematics as a positive or negative emotional disposition towards mathematics. Research has shown that positive attitudes toward mathematics, such as confidence in one's abilities, enjoyment of the subject, and recognition of its real-world relevance, are associated with greater achievement and persistence in mathematics-related courses. Conversely, negative attitudes, particularly mathematics anxiety and perceived difficulty, can act as barriers to learning and discourage students from pursuing further studies in quantitative fields. These attitudes are often shaped by prior educational experiences, teaching methods, social influences, and individual factors such as gender, academic major, and self-efficacy.

Given the growing emphasis on data-driven decision-making and the increasing integration of quantitative skills in various academic disciplines, it is important to understand how university students perceive mathematics and what factors influence their attitudes. This study seeks to provide descriptive insights into mathematics attitudes among university students, focusing on dimensions such as self-confidence, enjoyment, value, and motivation. By examining patterns across different student groups, this research aims to inform teaching practices and support strategies that foster more positive mathematical mindsets in the higher education environment.

## 2. LITERATURE REVIEW

Since mathematics is popularly perceived as being unpopular, research indicates that students' attitudes toward mathematics play a significant role in affecting their ability and class participation in mathematics. Attitude is a sub-field of affective science that differs from emotion by being more cognitive and enduring (Goldin et al., 2016). In a Ghanaian study, Mensah et al. (2013) discovered a strong positive relationship between students' attitudes and academic achievement. Students' attitude towards mathematics is developed by their understanding and awareness over time. Majeed et.al (2013) discovered that the attitudes of students are formed over a long period of time and have a significant influence on their successful involvement, engagement, and mathematical achievement. These attitudes may be altered slowly and have a substantial influence on their performance (Khoo & Ainley, 2005). Syyeda (2016) says that attitudes may be transformed over time, and a Theobald et al. (2023) revealed that students who believe in their own competencies are more likely to persist, stay motivated, and maintain productive study behaviours. While Abu and Eu (2017) found that students' attitudes towards mathematics are crucial. A student's attitude towards a subject can have an indirect impact on their achievement.

Attitude towards mathematics may influence the tendency to study, as well as the benefits of mathematical instruction. Research by Lipnevich et al. (2016) indicated that mathematical attitudes contributed to university students' mathematics achievement, in addition to personality and cognitive ability. Furthermore, attitudes towards mathematics have a substantial impact on an individual's decisions about the amount and kind of mathematics that they will study in the future. According to Primi et al (2020), attitudes concerning mathematics show a significant impact on an individual's decisions about the amount and nature of the mathematics that they will study in the future. The Attitudes Towards Mathematics Inventory (ATMI) (Tapia & Marsh, 2004) is a relatively new tool; however, according to Chamberlin (2010), this method has not been widely used in research. This study chose a focused approach with four dimensions to assess attitudes towards mathematics. ATMI has been extensively researched, exposing a strong connection between attitude characteristics and successful mathematics achievement (Davadas & Lay, 2017; de-la-Peña et al., 2021; Karjanto, 2017; Tok, 2015; Van Praag et al., 2015; White et al., 2018). Kartowagiran and Manaf (2021) conducted an innovative meta-analysis with longitudinal modelling, demonstrating that students' positive attitudes towards mathematics learning had a significant influence.

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Researchers maintained that there are numerous attitudes towards mathematics components, based on multidimensional views. For example, based on questionnaire information from a sample of 318 Malaysian secondary school students, Davadas and Lay (2017) promoted motivation, enjoyment, self-efficacy, and value as attitude towards mathematics components. Moreover, Trends in International Mathematics and Science Study (TIMSS) researchers queried students' attitudes towards mathematics using three criteria (Mullis et al., 2020): value of mathematics, confidence in mathematics, and enjoyment of mathematic. Furthermore, Berger et al. (2020) found that in terms of students' attitude towards mathematics, they identified four types of attitudes: negative, neutral, positive, and very positive.

## 2.1 Students' attitudes toward mathematics

The Attitudes Toward Mathematics Inventory (ATMI), developed by Tapia and Marsh (2004), is a psychometric instrument designed to evaluate students' affective responses to mathematics. The instrument consists of 40 items across four subscale which are, self-confidence, value, enjoyment and motivation. Each attribute plays a distinct role in shaping students' mathematical attitudes and has been the focus of substantial empirical research.

Self-confidence in mathematics refers to a student's belief in their ability to understand, apply, and succeed in mathematical tasks. It overlaps significantly with the concept of mathematical self-efficacy, a term rooted in Bandura's (1997) theory of self-efficacy. According to this theory, self-efficacy influences individuals' thoughts, emotions, and behaviors. Students with high mathematical self-confidence are more likely to persevere in problem solving, take on challenging tasks, and exhibit resilience when faced with setbacks.

Tapia and Marsh (2004) demonstrated that self-confidence is a strong predictor of overall attitude toward mathematics. Similarly, studies by Bhati and Sethy (2022) shown individuals with high self-efficacy choose to engage themselves in different academic domains for fostering development in their skills and abilities. Pajares and Graham (1999) also emphasized that self-confidence was more predictive of math performance than actual ability. Gender disparities in self-confidence have been extensively studied. For instance, Sakellariou (2022) reported strong reciprocal effects between self-efficacy and achievement among male students, with earlier academic success having a greater influence on later self-efficacy. These findings highlight the importance of fostering confidence, particularly among underrepresented groups. From an educational perspective , raising students' awareness of the importance of mathematics is essential, as math self-efficacy significantly influences career choices in science-related fields (Onoshakpokaiye, 2023). Educators play a crucial role in fostering students' motivation and enjoyment of the subject by either building or undermining students' confidence through classroom discourse and feedback mechanisms.

Value attribute measures the extent to which students perceive mathematics as useful, important, and relevant to their lives, education and future careers. It closely aligns with the task value component of the Expectancy-Value Theory (Wigfield et al., 2009). This theory theorises that students' achievement behaviours are influenced by their expectations of success and the value they place on the task. Task value includes intrinsic interest, utility, attainment, and cost. A favourable perception of the importance of mathematics indicates students' capacity to relate their interest in the subject to prospective career trajectories, underscoring their recognition or value of its practical relevance and real-world applicability (Moussa & Saali, 2022). In Tapia and Marsh's (2004) study, the value subscale was positively correlated with both academic intentions and mathematics enjoyment. For education implications demonstrating real-world applications of mathematics, incorporating project-based learning, and exposing students to math-related careers can improve perceived value (Boaler, 1998). Making content relevant and meaningful is especially important for marginalized populations who may not see themselves reflected in traditional math pathways.

Enjoyment refers to the degree of pleasure or satisfaction a student derives from engaging in mathematical activities. It reflects an affective response that contributes to intrinsic motivation and long-

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term engagement. Enjoyment is a critical component of intrinsic motivation, as proposed by Ryan and Deci (2020) Self-Determination Theory. Students are more likely to engage deeply with subjects they find enjoyable and intellectually stimulating. Enjoyment has been consistently linked to persistence and higher academic achievement. Hannula (2002) found that enjoyment predicted both participation and performance in mathematics, independent of ability. Similarly, Tapia and Marsh (2004) reported strong correlations between enjoyment and other positive attitude dimensions. Instructional style significantly influences enjoyment. Interactive teaching methods, collaborative learning, and the use of games or technology have been shown to increase students' enjoyment of math (Rittle-Johnson and Star, 2009). However, enjoyment often declines with age, particularly in systems that emphasize testing and correctness over exploration and understanding (Stipek et al., 2001). Students who associate math primarily with anxiety and performance pressure tend to report lower enjoyment and avoid math-related fields (Ashcraft, 2002). Fostering enjoyment through engaging pedagogy, creativity, and a low-stakes learning environment can lead to more positive attitudes. Programs like YouCubed and the Mathematics Olympiad have demonstrated success in making math enjoyable and accessible.

Motivation in the ATMI context refers to students' desire, effort, and persistence in learning mathematics. It encompasses both intrinsic and extrinsic drivers and includes goal orientation and perseverance. Motivation is central in various educational theories. Studied by Yee (2010) assessed students' attitudes toward mathematics and academic achievement in relation to their motivational factors. Results showed a positive attitude towards mathematics with extrinsic motivations to do mathematics although the extrinsic motivation showed a low association degree with achievement in addition to the fact that achievement was strongly related to the intrinsic motivations. Motivated students are more likely to invest time, seek help when needed, and persist in the face of difficulties (Pintrich and De Groot, 1990). Tapia and Marsh (2004) validated the ATMI's motivation scale as significantly associated with students' math grades and future educational goals. Motivation is also influenced by prior success, support systems, and classroom climate. According to Schunk and Zimmerman (2008), teachers can foster motivation by setting achievable goals, offering timely feedback, and modelling enthusiasm for math.

Socioeconomic status, cultural background, and school resources also affect student motivation. Students from under-resourced schools may experience low motivation due to a lack of encouragement, materials, or perceived opportunity (Meece et al., 2006). To increase motivation, educators should create autonomy-supportive environments, promote mastery learning, and help students set personal goals. Extrinsic motivators such as reward and grades may yield short-term compliance but can undermine intrinsic interest if not used thoughtfully.

Each attribute of the ATMI represents a distinct yet interrelated dimension of students' attitudes toward mathematics. These factors not only affect academic outcomes but also influence long-term educational trajectories and career choices. Research consistently shows that improving these affective domains leads to better performance, greater participation in STEM, and more equitable educational outcomes. As such, the ATMI remains a valuable diagnostic and evaluative tool for educators, researchers, and policymakers seeking to understand and enhance students' experiences in mathematics.

## 3. METHODOLOGY

This study adopted a quantitative research methodology through the administration of a structured questionnaire aimed at exploring and analyzing students' attitudes toward mathematics in a comprehensive manner. The data collection process involved a total of 170 respondents who voluntarily participated in the survey, which was conveniently distributed and conducted via Google Form to ensure accessibility and efficiency. The primary research instrument utilized in this study was an adapted version of the Attitudes Toward Mathematics Inventory (ATMI), a well-established tool consisting of 40 sub-items designed to measure four key dimensions related to students' attitudes: Self-Confidence (C), which reflects students'

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belief in their ability to succeed in mathematics; Value (V), which assesses the perceived importance and usefulness of mathematics in daily life and future careers; Enjoyment (E), which captures the level of pleasure and interest students experience when engaging with mathematical tasks and Motivation (M), which evaluates the drive and enthusiasm students have toward learning and excelling in the subject.

Each item was rated using a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Items with negative statements were reverse-coded before analysis. The instrument's reliability was verified using Cronbach's Alpha and the results indicated an acceptable level of reliability for the data to be used in further statistical analyses. These values indicate high internal consistency, suggesting that the items within the instrument reliably measure the same underlying construct. This level of reliability enhances the credibility of the findings and supports the use of the instrument for subsequent analyses and interpretations within the context of the study.

Descriptive statistics were used to summarize respondent demographics such as age, gender, and level of education. The overall mean score of each respondent was computed and categorized into three attitude levels: Low (1.00–2.49), Moderate (2.50–3.49), and High (3.50–5.00). These levels were further analyzed through crosstabulation with demographic variables to explore any association. In addition, the mean and variance for each item were calculated and the highest and lowest mean values for each sub-item were identified to determine which specific aspects of students' attitudes toward mathematics were most and least positively perceived, thereby providing valuable insights into the areas where students exhibit strong interest, confidence, or motivation, as well as highlighting aspects that may require further attention, intervention, or support to enhance their overall learning experience and attitude toward the subject. Graphical representations such as bar charts were also utilized primarily to illustrate the distribution of respondents based on gender and level of education, allowing for a clearer and more accessible visual interpretation of the demographic data; however, for the age variable, a bar chart was not employed—instead, a crosstabulation (crosstab) analysis was conducted to better examine the frequency and relationship of age groups. The study used a 5-point Likert scale, with responses ranging from 1 (strongly disagree) to 5 (strongly agree), where higher scores reflect more positive attitudes toward mathematics. The instrument, known as the Attitudes Toward Mathematics Inventory (ATMI), consists of 40 items grouped into four conceptual constructs: self-confidence, value, enjoyment, and motivation. The questionnaire was adapted from previous study (Anastasiadis & Zirinoglou, 2022). The 40 questions (sub-items) and their classification into four items are presented in Table 1 below:

Table 1. Distribution of ATMI by items and sub-items

| Item | Sub-Item | Statement |
|---|---|---|
| Self-Confidence (C) | C1 | Mathematics is one of my most dreaded subjects |
| | C2 | My mind goes blank, and I am unable to think clearly when working with mathematics |
| | C3 | Studying mathematics makes me feel nervous |
| | C4 | Mathematics makes me feel uncomfortable |
| | C5 | When I hear the word mathematics, I have a feeling of dislike |
| | C6 | Mathematics does not scare me at all |
| | C7 | I have a lot of self-confidence when it comes to mathematics |
| | C8 | I am able to solve mathematics problems without too much difficulty |
| | C9 | I expect to do fairly well in any mathematics class I take |
| | C10 | I am always confused in my mathematics class |
| | C11 | I learn mathematics easily |
| | C12 | I believe I am good at solving mathematics problems |
| | C13 | I am always under a terrible strain in a math class |
| | C14 | It makes me nervous to even think about having to do a mathematics problem |
| | C15 | I feel a sense of insecurity when attempting mathematics |
| Value (V) | V1 | Mathematics is a very worthwhile and necessary subject |

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| | | |
|---|---|---|
| | V2 | I want to develop my mathematical skills |
| | V3 | Mathematics helps develop the mind and teaches a person to think |
| | V4 | Mathematics is important in everyday life |
| | V5 | Mathematics is one of the most important subjects to study |
| | V6 | High school mathematics courses would be very helpful no matter what I decide to study |
| | V7 | I can think of many ways that I use mathematics outside of school |
| | V8 | I think studying advanced mathematics is useful |
| | V9 | A strong math background could help me in my professional life |
| | V10 | I believe studying math helps me with problem solving in other areas |
| Enjoyment (E) | E1 | I have usually enjoyed studying mathematics in school |
| | E2 | Mathematics is dull and boring |
| | E3 | I like to solve new problems in mathematics |
| | E4 | I would prefer to do an assignment in mathematics than to write an essay |
| | E5 | I really like mathematics |
| | E6 | I am happier in a mathematics class than in any other class |
| | E7 | Mathematics is a very interesting subject |
| | E8 | I am comfortable expressing my own ideas on how to look for solutions |
| | E9 | I am comfortable answering questions in mathematics class |
| | E10 | I get a great deal of satisfaction out of solving a mathematics problem |
| Motivation (M) | M1 | I am confident that I could learn advanced mathematics |
| | M2 | I would not like to avoid using mathematics in tertiary education level |
| | M3 | I am willing to take more than the required amount of mathematics |
| | M4 | I plan to take as much mathematics as I can during my education |
| | M5 | The challenge of mathematics appeals to me |

## 4. RESULT AND DISCUSSION

### 4.1 Reliability analysis

A reliability test was conducted for each of the four items of ATMI. All constructs demonstrated strong internal consistency, confirming that the items used were suitable for further descriptive analysis. The results are shown in Table 2.

Table 2. Reliability Test

| | Item | Cronbach's Alpha |
|---|---|---|
| 1 | Self-Confident ( C ) | 0.899 |
| 2 | Value (V) | 0.934 |
| 3 | Enjoyment ( E ) | 0.88 |
| 4 | Motivation ( M ) | 0.841 |

The reliability test results indicate that the strong internal consistency, with Cronbach's Alpha values ranging from 0.841 to 0.934. These values exceed the generally accepted threshold of 0.70, indicating that the items within each subscale reliably measure the intended constructs. This aligns with findings by Amusuglo et al. (2024), whose study demonstrated high internal consistency with a Cronbach's Alpha of 0.907, supporting the notion that values above 0.70 are satisfactory for ensuring the reliability and validity of research instruments. Among the four subscales, the highest reliability was recorded for Value ($\alpha$ = 0.934), while the lowest was for Motivation ($\alpha$ = 0.841). Overall, the instrument, based on the ATMI, is considered suitable for further descriptive and inferential analysis.

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## 4.2 Demographic profile of respondents

Table 3 presents the frequency and percentage of respondents based on age, gender, and level of education. A total of 170 students participated in this study. The majority of respondents (74.7%) were aged between 17 and 19 years, followed by 23–25 years (16.5%). In terms of gender, 57.1% were female and 42.9% were male. Regarding educational background, more than half of the respondents were from the Pre-Diploma program (54.1%), followed by Diploma (25.9%) and Degree (20.0%). These demographics provide essential context for interpreting variations in mathematics attitudes across different subgroups.

Table 3. Demographic analysis for age, gender and education level

| Variable | Category | Frequency | Percentage (%) |
|---|---|---|---|
| **Age** | 17–19 years | 127 | 74.7 |
| | 20–22 years | 14 | 8.2 |
| | 23–25 years | 28 | 16.5 |
| | Others | 1 | 0.6 |
| | **Total** | **170** | **100** |
| **Gender** | Female | 97 | 57.1 |
| | Male | 73 | 42.9 |
| | **Total** | **170** | **100** |
| **Education Level** | Pre-Diploma | 92 | 54.1 |
| | Diploma | 44 | 25.9 |
| | Degree | 34 | 20.0 |
| | **Total** | **170** | **100** |

## 4.3 Means and variances for each item of ATMI

Table 4 presents the mean and variance scores for the four ATMI subscales: Self-Confidence, Value, Enjoyment, and Motivation. Among these, the Value subscale recorded the highest mean score (M = 4.254), suggesting that students perceive mathematics as important for intellectual development and future success. This reflects their recognition of mathematics as a useful tool for reasoning and decision-making in daily life. The Enjoyment subscale followed with a mean of 3.846, indicating that students generally find satisfaction and interest in engaging with mathematical problems and classroom activities. These two subscales, Value and Enjoyment highlight the generally positive affective perception students have toward the subject. Motivation showed a moderate mean score (M = 3.502), implying that students are reasonably willing to continue learning mathematics, although some variation in responses was observed (Variance = 0.867). According to Aguilar (2021), motivation strongly influences how students perceive mathematics, as motivated learners are more likely to invest effort into improving their skills. The Self-Confidence subscale recorded the lowest mean (M = 3.473) and the highest variance (1.108), suggesting considerable variability in students' beliefs about their mathematical abilities. While some students reported feeling confident, others appeared to lack self-assurance when solving mathematical problems. This may be linked to a fixed mindset regarding ability. As Purbaningrum et al. (2023) noted, students who believe their mathematical ability is unchangeable are less motivated to learn, which can make the subject more challenging for them. This variability points to a need for targeted instructional support that can help strengthen students' confidence in their math skills. Irhamna et al. (2020) emphasized that self-confidence significantly contributes to students' mathematical problem-solving abilities. Similarly, Akbari and Sahibzada (2020) found that confidence impacts not only how students perform but also how they develop interest in lessons. These findings indicate that improving students' self-confidence may be key to boosting both engagement and achievement in mathematics.

Although students value and enjoy mathematics, studies have shown that many still perceive it as difficult. Hagan et al. (2020) noted that students recognize the relevance of mathematics in daily life but continue to struggle with acquiring the necessary skills and concepts. This view reflects a broader perception of mathematics as both important and intellectually demanding. Furthermore, as Schukajlow

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(2023) explained, emotions and motivation in mathematics learning are complex. While positive emotions like enjoyment can enhance engagement, they are not always directly linked to improved learning outcomes. Similarly, negative emotions such as test anxiety do not always lead to poor academic performance. This suggests that affective factors such as confidence, motivation, and enjoyment must be understood within a broader educational context.

Overall, the findings suggest that students in this study hold a generally positive attitude toward mathematics, especially in how they value and enjoy the subject. However, there remains a need to strengthen self-confidence and sustain motivation to ensure long-term success and deeper engagement with mathematics.

Table 4. Mean and variance each item **of ATMI**

| | Item | Mean | Variance |
|---|---|---|---|
| 1 | Self Confident ( C ) | 3.473 | 1.108 |
| 2 | Value (V) | 4.254 | 0.507 |
| 3 | Enjoyment ( E ) | 3.846 | 0.791 |
| 4 | Motivation ( M ) | 3.502 | 0.867 |

The next analysis is related to the highest and lowest mean scores for each item. This analysis provides a more detailed understanding of which specific items are most and least endorsed by students within each factor. The results obtained are shown in Table 5 below:

Table 5. Highest and lowest mean scores for each attitude item towards Mathematics

| Item | Highest Mean Item (Item Code) | Mean | Lowest Mean Item (Item Code) | Mean |
|---|---|---|---|---|
| Self-Confidence (C) | I expect to do fairly well in any math class I take (C9) | 4.19 | Mathematics is one of my most dreaded subjects (C1) | 2.75 |
| Value (V) | Mathematics helps develop the mind and teaches a person to think (V3) | 4.51 | I think studying advanced mathematics is useful (V8) | 3.84 |
| Enjoyment (E) | I get a great deal of satisfaction out of solving a mathematics problem (E10) | 4.67 | I am happier in a math class than in any other class (E6) | 3.48 |
| Motivation (M) | I would NOT like to avoid using mathematics in university (M2) | 3.92 | I would prefer to do an assignment in math than to write an essay (E4) | 3.08 |

For the Self-Confidence, students showed the highest agreement with the statement “I expect to do fairly well in any math class I take” (Mean = 4.19), indicating a general sense of confidence in their mathematical abilities. The lowest mean was recorded for “Mathematics is one of my most dreaded subjects” (Mean = 2.75), suggesting that negative emotions such as fear or anxiety towards mathematics were not strongly prevalent. In terms of Value, students strongly agreed that “Mathematics helps develop the mind and teaches a person to think” (Mean = 4.51), reflecting a deep appreciation of the intellectual benefits of mathematics. Meanwhile, the statement “I think studying advanced mathematics is useful” (Mean = 3.84) received the lowest score in this factor, though still reflecting a positive attitude.

In the Enjoyment dimension, the highest-rated item was “I get a great deal of satisfaction out of solving a mathematics problem” (Mean = 4.67), showing that students gain significant personal satisfaction from engaging with mathematical challenges. However, “I am happier in a math class than in any other class” (Mean = 3.48) was rated lower, indicating that while students enjoy math, it may not be their most preferred subject. As for Motivation**,** students responded most positively to “I would NOT like to avoid using mathematics in university” (Mean = 3.92), demonstrating a willingness to continue learning mathematics

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in higher education. The lowest mean in this factor was for “I would prefer to do an assignment in math than to write an essay” (Mean= 3.08), suggesting that not all students favour math-related tasks over other academic work. Overall, these findings highlight a generally positive attitude toward mathematics, especially in terms of its perceived value and the satisfaction it provides.

## 4.4 Descriptive analysis of students’ mathematics attitude based on age, educational level, and gender

Table 6: The distribution of mathematics attitude levels based on different age groups.

| | | Attitute Level | | | Total |
|---|---|---|---|---|---|
| | | **Low** | **Moderate** | **High** | |
| **Age** | **17-19 years** | (0.8%) | (32.2)% | (67%) | 127 |
| | **20-22 years** | 0 | (35.7%) | (64.3%) | 14 |
| | **23-25 years** | 0 | (39.3%) | (60.7%) | 28 |
| | **others** | 0 | 0 | (100%) | 1 |
| **Total** | | 1 | 57 | 112 | 170 |

Table 6 shows that the majority of students aged 17–19 fall into the High attitude category, followed by those in the Moderate group. This concentration suggests early-stage students may be more open and optimistic toward mathematics, potentially due to recent exposure or structured learning environments. Students aged 20–22 showed a more balanced split between moderate (35.7%) and high (64.3%) attitudes. This contrasts with the 17–19 group, which had a more dominant high-attitude response. Interestingly, the 23–25 group, though slightly older, still showed a majority in the high category (60.7%), though a larger portion (39.3%) expressed moderate attitudes, indicating a possible decline in enthusiasm or increased critical perspectives as students’ progress academical. Students aged 23–25 also mostly scored in the High category, while those aged 20–22 showed a more even distribution between Moderate and High. Only one student scored in the Low category across all age groups. These findings suggest that younger students, particularly those aged 17–19, tend to exhibit more favourable attitudes toward mathematics compared to other age groups. These findings may reflect shifts in students’ academic experiences. Younger students often benefit from structured and supportive math environments, whereas older students may face more complex topics, academic pressure, or previous negative experiences

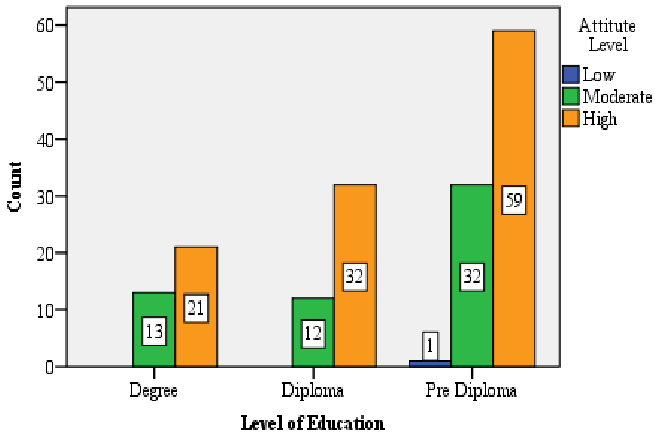


Fig 1. Bar chart of mathematics attitude levels based on different level of education

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Fig. 1 shows that Pre-Diploma students recorded the highest frequency in the High attitude category, followed by Diploma and Degree students. In the Moderate category, Pre-Diploma students also led in frequency. Very few students across all groups fell into the Low category. These findings indicate that students at the Pre-Diploma level tend to have the most positive attitude towards mathematics**,** which may be attributed to their recent or ongoing exposure to fundamental mathematical concepts that foster confidence and engagement.

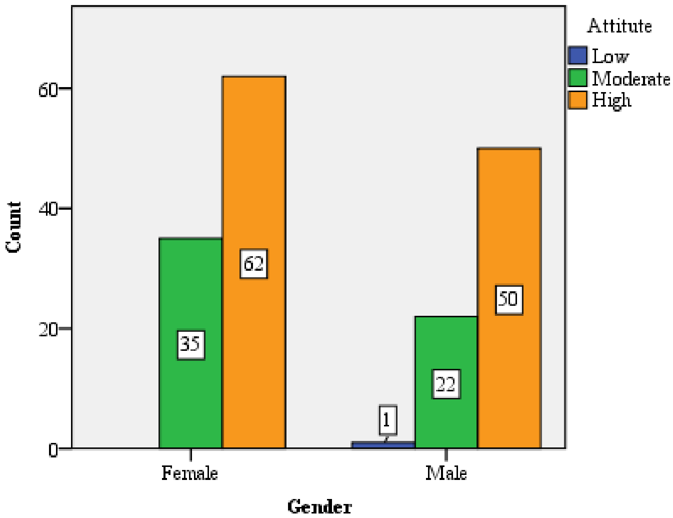


Fig 2. Bar chart of Mathematics attitude levels based on gender

Fig. 2 illustrates the distribution of attitude levels across genders. The majority of both male and female students are in the High category, with 62 females and 50 males. In the Moderate category, there were 35 female students and 22 male students. Only one male student fell into the Low category. Overall, the chart suggests that both genders generally exhibit a positive attitude toward mathematics, with female students slightly outnumbering male students in the High category. The differences between male and female students were minimal, indicating that both groups tend to view mathematics positively. This finding is consistent with Anastasiadis and Zirinoglou (2022), who reported no statistically significant relationship between gender and students’ attitudes toward mathematics.

## 5. CONCLUSION

This study explored students’ attitudes toward mathematics through four key factors: self-confidence, value, enjoyment, and motivation. The results showed that most students, especially females aged 17–19 in Pre-Diploma programs, held generally positive attitudes. Among the factors, students rated the value of mathematics highest, reflecting their recognition of its importance in everyday life. However, self-confidence was rated lowest, indicating some uncertainty about their ability to succeed in the subject. While students expressed satisfaction with solving problems and acknowledged the benefits of mathematics, some also showed discomfort in classroom situations, highlighting emotional and motivational barriers. Cross-tabulations confirmed that younger students tended to have stronger positive attitudes, suggesting a need for age-specific teaching strategies.

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In conclusion, while students value and enjoy mathematics, greater attention is needed to boost their confidence and motivation. Educators and policymakers should consider enrichment programs and targeted interventions such as workshops and seminars to help promote and sustain positive attitudes toward mathematics among all learners.

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## 7. CONFLICT OF INTEREST STATEMENT

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders.

## 8. AUTHORS' CONTRIBUTIONS

**Norazah Umar**: Designed the methodology, implemented the experiment, and managed data collection.; **Maisurah Shamsuddin**: Performed data analysis, result interpretation, and prepared the results and discussion section; **Siti Balqis Mahlan**: Validated findings, wrote the conclusion, and reviewed and edited the final manuscript; **Syarul Heiry Yahaya**: Conceptualised the study, defined research objectives, and drafted the abstract and introduction; **Muniroh Hamat:** Conducted the literature review and developed the theoretical and technical background .

## 9. REFERENCES

Abu, N. E. B., & Eu, L. K. (2017). Hubungan antara sikap, minat, pengajaran guru dan pengaruh rakan sebaya terhadap pencapaian matematik tambahan tingkatan 4. *JuKu: Jurnal Kurikulum & Pengajaran Asia Pasifik*, *2*(1), 1-10. https://juku.um.edu.my/index.php/JUKU/article/view/8058/5571.

Aguilar, J. J. (2021). High school students' reasons for disliking mathematics: The intersection between teacher's role and student's emotions, belief and self-efficacy. *International Electronic Journal of Mathematics Education*, 16(3), em0658. https://doi.org/10.29333/iejme/11294.

Akbari, O., & Sahibzada, J. (2020). Students' self-confidence and its impacts on their learning process. *American International Journal of Social Science Research*, *5*(1), 1-15. https://doi.org/10.46281/aijssr.v5i1.462.

Amusuglo, M. K., Jančařík, A., Marcom, G. S., & Kleinke, M. U. (2024). Pre-Service Early Grade Teachers Attitude Towards Mathematics in Ghana. Annales Universitatis Paedagogicae Cracoviensis| Studia ad Didacticam Mathematicae Pertinentia, 16, 5-21. https://doi.org/10.24917/20809751.16.1.

Anastasiadis, L., & Zirinoglou, P. (2022). Students' attitudes toward Mathematics: The case of Greek students. *International Journal of Education and Social Science*, *9*(3), 2415-1246. https://www.researchgate.net/publication/364282937_Students'_attitudes_toward_Mathematics_The_case_of_Greek_students.

Ashcraft, M. H. (2002). Math anxiety: Personal, educational, and cognitive consequences. *Current directions in psychological science*, *11*(5), 181-185. https://doi.org/10.1111/1467-8721.00196.

https://doi.org/10.24191/jcrinn.v11i2.548

Bandura, A. (1997). Self-efficacy: The exercise of control. New York: W. H. Freeman and Company. https://www.proquest.com/openview/55c56d1a75f8440c4bea93781b0dc952/1?pq-origsite=gscholar&cbl=36693.

Berger, N., Mackenzie, E., & Holmes, K. (2020). Positive attitudes towards mathematics and science are mutually beneficial for student achievement: A latent profile analysis of TIMSS 2015. *The Australian Educational Researcher*, *47*(3), 409-444. https://doi.org/10.1007/s13384-020-00379-8.

Bhati, K., & Sethy, T. (2022). Self-efficacy: Theory to educational practice. *The International Journal of Indian Psychology*, *10*(1), 1123-1128. https://doi.org/10.25215/1001.112.

Boaler, J. (1998). Alternative approaches to teaching, learning and assessing mathematics. *Evaluation and Program Planning*, *21*(2), 129-141. https://doi.org/10.1016/S0149-7189(98)00002-0.

Chamberlin, S. A. (2010). A review of instruments created to assess affect in mathematics. Journal of Mathematics Education, 3(1), 167–182. https://journalofmathed.scholasticahq.com/article/90462.

Davadas, S. D., & Lay, Y. F. (2017). Factors affecting students' attitude toward mathematics: A structural equation modeling approach. Eurasia Journal of Mathematics, Science and Technology Education, 14(1), 517–529. https://doi.org/10.12973/ejmste/80356.

de-la-Peña, C., Fernández-Cézar, R., & Solano-Pinto, N. (2021). Attitude toward mathematics of future teachers: How important are creativity and cognitive flexibility? *Frontiers in Psychology*, *12*, 713941. https://doi.org/10.3389/fpsyg.2021.713941.

Goldin, G. A., Hannula, M. S., Heyd-Metzuyanim, E., Jansen, A., Kaasila, R., Lutovac, S., et al. (2016). Attitudes, beliefs, motivation and identity in mathematics education: An overview of the field and future directions. In *ICME-13 Topical Surveys*. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-32841-6.

Hagan, J. E., Amoaddai, S., Lawer, V. T., & Atteh, E. (2020). Students' perception towards mathematics and its effects on academic performance. *Asian Journal of Education and Social Studies*, *8*(1), 8-14. https://doi.org/10.9734/ajess/2020/v8i130210.

Hannula, M. S. (2002). Attitude Towards Mathematics: Emotions, Expectations and Values. Educational Studies in Mathematics. 49. 25-46. https://doi.org/10.1023/A:1016048823497.

Kartowagiran, B., & Manaf, A. (2021). Student Attitude and Mathematics Learning Success: A Meta-Analysis. *International Journal of Instruction*, *14*(4), 209-222. https://doi.org/10.29333/iji.2021.14413a.

Irhamna, I., Amry, Z., & Syahputra, H. (2020). Contribution of mathematical anxiety, learning motivation and self-confidence to student's mathematical problem solving. *Budapest International Research and Critics in Linguistics and Education (BirLE) Journal*, *3*(4), 1759-1772. https://doi.org/10.33258/birle.v3i4.1343.

Karjanto, N. (2017). Attitude toward mathematics among the students at Nazarbayev University Foundation Year Programme. *International Journal of Mathematical Education in Science and Technology*, *48*(6), 849–863. https://doi.org/10.1080/0020739X.2017.1288812.

Khoo, S. T., & Ainley, J. (2005). Attitudes, Intentions and Participation. Longitudinal Surveys of Australian Youth. Research Report No. 41. *Australian Council for Educational Research*. https://research.acer.edu.au/ lsay_research/45.

Lipnevich, A. A., Preckel, F., & Krumm, S. (2016). Mathematics attitudes and their unique contribution to achievement: Going over and above cognitive ability and personality. *Learning and Individual Differences*, *47*, 70-79. https://doi.org/10.1016/j.lindif.2015.12.027.

https://doi.org/10.24191/jcrinn.v11i2.548

Majeed, A. A., Darmawan, I. G. N., & Lynch, P. (2013). A confirmatory factor analysis of attitudes toward mathematics inventory (ATMI). *The Mathematics Educator*, *15*(1), 121–135.

Meece, J. L., Anderman, E. M., & Anderman, L. H. (2006). Classroom goal structure, student motivation, and academic achievement. *Annu. Rev. Psychol.*, *57*(1), 487-503. https://doi.org/10.1146/annurev.psych.56.091103.070258.

Mensah, J. K., Okyere, M., & Kuranchie, A. (2013). Student attitude towards mathematics and performance: Does the teacher attitude matter. *Journal of education and practice*, *4*(3), 132-139. https://www.researchgate.net/publication/334122369_Student_attitude_towards_Mathematics_and_performance_Does_the_teacher_attitude_matter.

Moussa, N. M., & Saali, T. (2022). Factors affecting attitude toward learning mathematics: A case of higher education institutions in the Gulf Region. *Sage Open*, *12*(3). https://doi.org/10.1177/21582440221123023.

Mullis, I.V.S., Martin, M.O., Foy, P., Kelly, D.L. and Fishbein, B. (2020). TIMSS 2019 International Results in Mathematics and Science. Boston College, TIMSS & PIRLS International Study Center. https://timssandpirls.bc.edu/timss2019/international-results/.

Onoshakpokaiye, O. E. (2023). Does Mathematics Self-Efficacy Influence Students' Career Choice in Science Related Discipline?. *St. Theresa Journal of Humanities and Social Sciences*, *9*(2), 101-115.

Pajares, F., & Graham, L. (1999). Self-efficacy, motivation constructs, and mathematics performance of entering middle school students. *Contemporary Educational Psychology*, *24*(2), 124-139. https://doi.org/10.1006/ceps.1998.0991.

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and Self-Regulated Learning Components of Classroom Academic Performance. *Journal of Educational Psychology, 82*(1), 33–40. https://doi.org/10.1037/0022-0663.82.1.33.

Primi, C., Bacherini, A., Beccari, C., & Donati, M. A. (2020). Assessing math attitude through the Attitude Toward Mathematics Inventory–Short form in introductory statistics course students. *Studies in Educational Evaluation*, *64*, 100838. https://doi.org/10.1016/j.stueduc.2020.100838.

Purbaningrum, M., Ramadhan, S., & Thauzahra, R. (2023). Why is math difficult?: Beliefs that affecting students' mathematics skills. *Jurnal paedagogy*, *10*(4), 1000-1009. https://doi.org/10.33394/jp.v10i4.8652.

Rittle-Johnson, B., & Star, J. R. (2009). Compared with what? The effects of different comparisons on conceptual knowledge and procedural flexibility for equation solving. *Journal of Educational Psychology*, *101*(3), 529-544. https://doi.org/10.1037/a0014224.

Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary educational psychology*, *61*, 101860. https://doi.org/10.1016/j.cedpsych.2020.101860.

Sakellariou, C. (2022). The reciprocal relationship between mathematics self-efficacy and mathematics performance in US high school students: Instrumental variables estimates and gender differences. *Frontiers in Psychology*, *13*, 941253. https://doi.org/10.3389/fpsyg.2022.941253.

Schukajlow, S., Rakoczy, K., & Pekrun, R. (2023). Emotions and motivation in mathematics education: Where we are today and where we need to go. *ZDM–Mathematics Education*, *55*(2), 249-267. https://doi.org/10.1007/s11858-022-01463-2.

https://doi.org/10.24191/jcrinn.v11i2.548

Schunk, D. H., & Zimmerman, B. J. (Eds.). (2008). *Motivation and Self-Regulated Learning: Theory, Research, and Applications.* Lawrence Erlbaum Associates Publishers. https://doi.org/10.4324/9780203831076.

Stipek, D. J., Givvin, K. B., Salmon, J. M., & MacGyvers, V. L. (2001). Teachers' beliefs and practices related to mathematics instruction. *Teaching and teacher education*, *17*(2), 213-226. https://doi.org/10.1016/S0742-051X(00)00052-4.

Syyeda, F. (2016). Understanding attitudes towards Mathematics (ATM) using a multimodal model: An exploratory case study with secondary school children in England. *Cambridge Open-Review Educational Research e-Journal*, *3*(1), 32–62. https://doi.org/10.17863/CAM.41157.

Tapia, M., & Marsh, G. E. (2004). An instrument to measure mathematics attitudes. *Academic Exchange Quarterly*, *8*(2), 16-22.

Theobald, M., Bäulke, L., Bellhäuser, H., Breitwieser, J., Mattes, B., Brod, G., ... & Nückles, M. (2023). A multi-study examination of intra-individual feedback loops between competence and value beliefs, procrastination, and goal achievement. *Contemporary Educational Psychology*, *74*, 102208. https://doi.org/10.1016/j.cedpsych.2023.102208.

Tok, Ş., & Kandemir, A. (2015). Effects of creative writing activities on students' achievement in writing, writing dispositions and attitude to English. *Procedia - Social and Behavioral Sciences*, 174, 1635–1642. https://doi.org/10.1016/j.sbspro.2015.01.815.

Varathan, K., KC, V. K., Subramanian, S. S., Alfawaz, S. S., Alzahrani, G. A., Priya, H., ... & Gaowgzeh, R. A. (2023). Validation of the exercise protocol satisfaction questionnaire by content validation method. *Fizjoterapia Polska, 23*(4), 22–27. https://doi.org/10.56984/8ZG20AD8A.

Van Praag, L., Boone, S., Stevens, P. A., & Van Houtte, M. (2015). How tracking structures attitudes towards ethnicout-groups and interethnic interactions in the classroom: An ethnographic study in *Belgium. Social Psychology of Education*, *18*(1), 165–184. https://doi.org/10.1007/s11218-014-9273-7.

White, A.S., Hacquard, V. and Lidz, J. (2018), Semantic Information and the Syntax of Propositional *Attitude Verbs. Cogn Sci*, *42*, 416-456. https://doi.org/10.1111/cogs.12512.

Wigfield, A., Tonks, S., & Klauda, S. L. (2009). Expectancy-value theory. In K. R. Wenzel & A. Wigfield (Eds.), *Handbook of motivation at school* (pp. 55–75). Routledge/Taylor & Francis Group. https://doi.org/10.1006/ceps.1999.1015.

Yee, L. S. (2010). Mathematics Attitudes and Achievement of Junior College Students in Singapore. *Mathematics Education Research Group of Australasia*. 681-689. https://files.eric.ed.gov/fulltext/ED521019.pdf.

Zan, R., & Di Martino, P. (2007). Attitude toward mathematics: Overcoming the positive/negative dichotomy. In *B. Sriraman (Ed.), The Montana Mathematics Enthusiast* (Monograph 3, pp. 157–168). The Montana Council of Teachers of Mathematics.



https://doi.org/10.24191/jcrinn.v11i2.548

https://doi.org/10.24191/jcrinn.v11i2.548