The Effect of Math Anxiety on Students' Literacy

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Abstract
This research is based on findings that students' low interest in mathematics subjects and the widespread assumption that mathematics is a difficult and scary subject, affecting students' numeracy. This is thought to be a result of students' math anxiety about. This study aims to describe students' mathematical anxiety and students' numeracy and describe the influence of both variables on grade V students of MIS Muhammadiyah Babakanloa. It investigated the relationship between math anxiety and numeracy among Class V students at MIS Muhammadiyah Babakanloa, involving 27 participants during the 2022/2023 academic year. The descriptive and inferential statistical analysis result shows that math anxiety negatively

impacts confidence and accuracy in calculations, while objective numeracy acts as a partial mediator in the association between math anxiety and performance in numerical reasoning tasks, with no significant gender differences in numeracy observed. Students' negative perceptions of mathematics and the dull learning methods contribute to low interest and heightened anxiety in the subject, significantly impacting numeracy by 21.71%. The negative relationship suggests that increased math anxiety corresponds to decreased numeracy. These findings emphasize the importance for teachers to innovate and create engaging learning experiences to alleviate math anxiety and enhance numeracy among students.

Keywords: math anxiety; numeracy; mathematics; madrasah ibtidaiyah

INTRODUCTION

Education is an effort to foster and develop human character in terms of physical and spiritual, it is also a tiered and continuous regular process where there are constantly new developments that appear as a step to improve the quality of its implementation. Education aims to create individuals with quality and character so that they have a broad view to achieve their goals and are expected to be able to adapt quickly and appropriately in various environments (Wartini et al., 2018).

Mathematics is a crucial and versatile tool that is widely acknowledged for its significance in various fields such as science, technology, and commerce. It plays a vital role in developing reasoning skills and is instrumental in addressing everyday challenges. As a result, mathematics is an essential subject taught at all educational levels. The importance of mathematics in problem-solving is evident in various studies

that highlight its role in word problem comprehension, arithmetic skills, and mathematical reasoning ability (Pongsakdi et al., 2019; Kenedi et al., 2019; Bae et al., 2015; Nugraheni, 2021). Additionally, the multidimensional structure of math anxiety has been explored, emphasizing the psychological aspects related to mathematical problem-solving (Henschel & Roick, 2020; Lukowski et al., 2019).

Furthermore, the ability to connect mathematical concepts with other sciences and daily life has been identified as a significant factor in students' problem-solving performance (Rafiepour & Faramarzpour, 2023; Sari et al., 2020). The role of mathematical communication and visualization in enhancing problem-solving skills has also been emphasized, indicating the diverse aspects involved in mastering mathematical problem-solving (Almuwaiziri et al., 2023; Moleko, 2021; Amni, 2021). Moreover, the impact of mathematical disposition, independence, and literacy on problem-solving skill has been investigated, shedding light on the psychological and cognitive dimensions of mathematical problem-solving (Kusmaryono et al., 2019; Nurhanurawati et al., 2022; Sundari et al., 2022). These findings collectively underscore the multifaceted nature of mathematical problem-solving and its far-reaching implications in education and beyond.

The objectives of mathematics learning according to the Ministry of Education and Culture 2013 are, (1) improving intellectual abilities, (2) problem-solving abilities, (3) improving learning outcomes, (4) practicing communication, and (5) developing student character. The purpose of

learning elementary school mathematics is for students to know simple numbers, recognize simple calculation operations, recognize measurements, and recognize fields.

Students in the 21st century are expected to possess numeracy for learning mathematical concepts, reasoning, analysing, and interpreting data to solve everyday problems, in addition to the general objectives previously mentioned. numeracy involves understanding and utilising numbers, symbols, and basic mathematical ideas to solve practical issues and interpret information presented in different media such as graphs. Tables, charts, and similar tools are used to analyse the outcomes of analysis for decision-making purposes (Weilin et al., 2017). numeracy is the capacity to apply numerical concepts and counting operations in real-life situations, comprehend numerical information, and utilise it to make judgements while solving everyday problems.

The numeracy includes the ability to apply mathematical concepts and rules in the real context of everyday life, when problems are not structured, have many ways of solving, or even do not have clear solutions, and are related to factors outside mathematics. Thus, it can be concluded that numeracy includes the skill of applying mathematical concepts contextually to solve problems that have many ways of solving, or do not have complete solutions related to various factors both related to mathematics and outside mathematics. numeracy is part of mathematics, while the components are taken from the scope of mathematics in the 2013

curriculum with one of the material scopes, namely numbers (Mahmud &; Pratiwi, 2019).

The Indonesian Student Competency Assessment (AKSI) and Indonesia National Assessment Programme (INAP) scores revealed worrisome results. Nationally, the percentage of students falling into the lower category for numeracy was 77.13%, literacy was 46.83%, and science ability was 73.61% (Atmazaki et al., 2017). The 2018 PISA survey results indicate that Indonesia's proficiency in numeracy, science, and literacy is inadequate. In mathematics, Indonesia is rated 75th out of 81 nations, with a score of 379. Currently, numerous students still perceive mathematics as a challenging subject. This assumption is a problem that occurs at various levels of education, especially at the elementary school level (Atmazaki, et al., 2017). Based on these data, it can be seen that concerning results were obtained, so that one of the problems of the Indonesian nation that must be handled seriously is regarding the interest in reading and literacy and numeracy.

Nowadays, not a few students think that mathematics is a complicated subject so it is not uncommon for students to feel afraid and feel themselves incapable of mathematics lessons (Giriansyah & Pujiastuti, 2021). Supardi US (2010) suggests that students tend to see maths as a subject that causes fear and boredom as it relates to numbers and formulas. As revealed Juminah (2017) Because mathematics lessons are considered difficult and the assumption that usually learning mathematics requires high concentration so that until now quite a lot of students have difficulty

in learning mathematics. Supported by the facts stated by Setiawati & Syaf (2018), there are differences in characteristics between the nature of children and the nature of mathematics, namely the way of thinking of elementary / MI students is at the Pre-Concrete stage while the nature of mathematics is abstract.

This low math score is caused by external and internal factors. Math anxiety is one aspect that affects achievement in learning mathematics. Utami (2011) made a statement that emphasized that some students have not fully realized that mastery of mathematics is very important so that students lack appreciation for mathematics lessons and in following mathematics learning. The problem caused anxiety among students. The anxiety that students experience in mathematics subjects can also be known as math anxiety.

Anxiety is a state of mind characterized by negative effects in the form of unfavorable sentiments, actions and signs of physiological or physical responses, in which a person takes into account the potential for future danger or tragedy (Astuti, 2016). As explained by Sakarti (2018), anxiety is a condition where students feel unpleasant feelings when solving math problems that interfere with students' mathematics learning achievement, which is characterized by physical signs such as increased heart rate, sweating, and the like, as well as psychological symptoms such as panic, anxiety, confusion, difficulty concentrating, thought disorders and so on.

According to multiple pertinent studies on math anxiety Djafar (2018) proposes that learning outcomes are positively impacted by learning

anxiety. However, the effect of learning anxiety on learning outcomes through motivation is favorable but not statistically significant. Pratiwi (2021) proposed that mathematics anxiety had a substantial negative impact on students' mathematical representation skills, accounting for 35.9% of the variance, which was deemed significant. Sugiarti & Intan's (2022) study found that during the Covid-19 epidemic, elementary school pupils reported moderate levels of mathematics anxiety, with 53.3% falling in the medium category, 16.7% in the high category, and 30% in the low category. Kusmaryono & Ulia (2020) research indicates that several factors, including teacher teaching approaches such as Problem Based Learning, play a significant role in reducing math anxiety among pupils. The teacher's teaching style and the math material have a significant impact on pupils' anxiety levels.

Based on initial conversations with mathematics educators, it is clear that students' apprehension towards learning, especially in mathematics, greatly affects their academic performance. The interviews revealed a widespread feeling of anxiety among pupils while dealing with mathematical subjects. Children show a hesitancy to accept mathematical learning, displaying dread when given calculations or problem-solving tasks. Despite being given examples or an organized method, pupils continue to view mathematics as difficult. They are reluctant and generally uninterested in the topic, as many pupils find mathematics classes to be complex and dull. This qualitative observation highlights the necessity of conducting additional research using complementary approaches to validate before

proceeding with the primary study on the impact of mathematical anxiety on students' numeracy. Furthermore, the purpose of this study is to describe students' mathematical anxiety and students' numeracy and describe the influence of both on grade V students of MIS Muhammadiyah Babakanloa.

METHODS

This study focused on systematically investigating the relationship between math anxiety and numeracy among Class V students at MIS Muhammadiyah Babakanloa during the 2022/2023 academic year, involving a total of 27 students. The initial phase included distributing Math Anxiety Questionnaires to assess participants' levels of math anxiety and administering numeracy tests to evaluate their proficiency (Gashaj et al., 2022).

Subsequent to data collection, a thorough analysis ensued, incorporating both descriptive and inferential statistical methods. Descriptive data analysis involved computing averages, middle values, variances, maximum and minimum values, standard errors, and range values. In inferential statistical analysis, the Kolmogorov-Smirnov test assessed data normality, determining a hypothetical formula, values of Z, FT, FS, and FT – FS, and establishing the level of significance and criteria for hypothesis testing (Choi et al., 2020). Nonparametric statistical tests, particularly the Spearman Rank correlation test, were employed for hypothesis testing, and the Coefficient of Determination formula was used to assess the influence of variable X on variable Y (Gashaj et al., 2022). The

entire data analysis process was conducted using SPSS 29, ensuring a systematic exploration of the impact of math anxiety on numeracy among Class V students.

The study's findings also revealed that math anxiety negatively affects confidence and accuracy in calculations and risk interpretations, while higher objective numeracy has a positive impact (Peters et al., 2017). Additionally, objective numeracy was identified as a partial mediator in the association between math anxiety and performance in numerical reasoning tasks, establishing a significant direct link between math anxiety and performance (Rolison et al., 2020).

Furthermore, the results indicated that students' numeracy falls within the low category descriptively, with female students exhibiting higher numeracy than their male counterparts. Inferentially, data on students' numeracy were found to be normally distributed and homogeneous, with no significant difference observed between male and female students (Jahring & Haidar, 2023).

DISCUSSION

Based on the results of the analysis of the mathematics anxiety questionnaire, a mean score of 60.22 (scale 0 – 120) was obtained so that it could be interpreted that students' mathematical anxiety was in the low category, because it was in the interval of 43.3 – 62.4. While the numeracy variable obtained an average or mean value of 20.15 (scale 0 – 100) which is classified as a very low category, because it is in the interval 0 – 20. The

standard deviation obtained in the mathematical anxiety variable is 13.656 and for the numeracy variable is 16.133 so that from the two variables that have been obtained have different levels of variation.

Table 1. Description of Research Variable Data

Variable	Mean	Standard Deviation	N
Math Anxiety	60.22	13.656	27
Numeration Literacy	20.15	16.133	27

The results of the mathematics anxiety questionnaire shows that 15% of students experience very low math anxiety, 37% of students experrise low anxiety, and 48% experience moderate anxiety. In other words, most students experienced moderate level of mathematics anxiety.
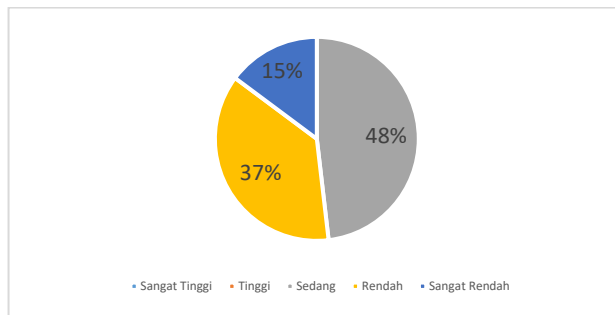

Figure 1. Student Math Anxiety Pie Chart

Regarding students' numeracy, 7% of students in the medium category get scores in the range of 41-60, 41% of students in the low category get grades in the range of 21-40, and 52% of students in the very low category with scores in the range of 0-20.
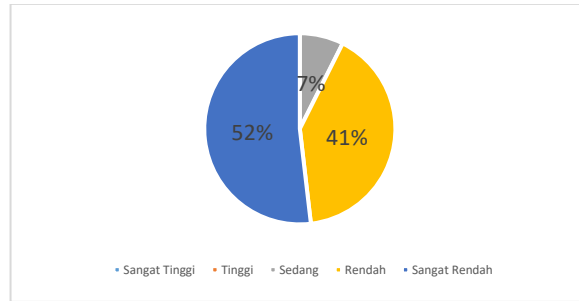
Figure 2. Student numeracy Pie Chart

Based on the results of the hypothesis test analysis using the Spearman Rank correlation test between mathematical anxiety and student numeracy, an r count of -0.466 was obtained, meaning that H0 was rejected and H1 was accepted because the count was greater than the rtable. So it can be concluded that there is a correlation between mathematical anxiety and student numeracy. Since the correlation coefficient shows negative value (-0.466), the relationship between the two variables goes in opposite directions, meaning that an increase in mathematical anxiety will be followed by a decrease or decrease in students' numeracy. In other words, the higher the student's mathematical anxiety, the lower the student's numeracy.

Table 2. Spearman Rank Correlation Test Results

Variable	rcount	rtable
Math Anxiety and Student numeracy	-0.466	0.381

The next step was to calculate the coefficient of determination. The goal is to determine how much influence the variable of mathematical anxiety (X) with students' numeracy (Y). Based on the calculation results, an

rcount of -0.466 was obtained so that the coefficient of determination can be calculated as follows.

$$KD (r2) = r2 \times 100\%$$
$$= -0.466^2 \times 100\%$$
$$= 0.2171 \times 100\%$$
$$= 21.71\%$$

Based on the calculation results, the coefficient of determination is 21.71%. So it can be interpreted that mathematics anxiety (X) affects the numeracy of MIS Muhammadiyah Babakanloa students by 21.71%, while the remaining 78.29% is influenced by other factors that are not related to this study.

Student Anxiety Level

The research results from distributing mathematics anxiety questionnaires to fifth-grade students at MIS Muhammadiyah Babakanloa show that 48% of students fall into the medium category of mathematics anxiety. Students experiencing cognitive symptoms in mathematics learning may feel a lack of mental clarity, confusion, lack of focus, and indecisiveness. Students with anxiety may have a reduced ability to focus on specific concerns, leading to a narrowed perspective and decreased awareness of surrounding information, as noted by Azizah et al. (2016). Anxiety in this group is indicated by behavioral responses such as slight tremors, restlessness, excessive talking, rapid speech, heightened voice volume, and sensations of unease. Affective responses, according to Yusuf et al. (2015), include worry and nervousness (Yusuf et al., 2015).

The results of the low-category math anxiety questionnaire were 37%. With symptoms of attitude aspects when dealing with mathematics learning situations, characterized by conditions of fear or tension in completing mathematics learning, as well as students' perceived difficulties regarding mathematics learning. Accompanied by physiological conditions where students feel nervous in certain situations. In line with that, Nurhalimah (2016) suggested that mild anxiety is often related to tension in daily life which causes to become more alert and improves his perceptual outlook, this mild anxiety has positive aspects, namely motivating someone to learn, as well as fostering and increasing creativity.

Students' numeracy

Students' numeracy were assessed through numeracy tests distributed to grade V students of MIS Muhammadiyah Babakanloa. The highest score obtained with a percentage of 7% with 2 students out of 27 students. The maximum score obtained by grade V students of MIS Muhammadiyah Babakanloa was 58 (scale 0-100), the minimum score obtained was 0, with an average score of 20.15 (scale 0 – 100) which is classified as a very low category.

Students' ability to apply mathematical concepts and skills in everyday life has been a subject of concern in educational research. It has been observed that many students struggle to translate real-life problems into mathematical language and find it difficult in solving mathematical problems (Fadillah & Wahyudin, 2022). This is consistent with the finding that students often have difficulty in changing contextualized problem into

mathematical models, indicating a gap in their numeracy (Hidayati et al., 2020). Furthermore, the importance of everyday mathematical knowledge in word problem solving has been emphasized, highlighting the need for contextualized questions related to students' daily lives to improve their mathematical problem-solving abilities (Bae et al., 2015).

The significance of numeracy in enabling students to solve practical problems related to numbers in daily life has been underscored (Aishalya et al., 2021). Students' difficulties in mathematical problem-solving often stem from their inability to acquire necessary mathematical abilities and cognitive learning skills (Siagian et al., 2019). Additionally, the influence of gender differences on students' numeracy has been explored, with smaller numeracy variance values associated with better results (Jahring & Haidar, 2023).

Moreover, the role of mathematical disposition and learning motivation in enhancing students' problem-solving abilities has been investigated, indicating the multifaceted nature of factors influencing mathematical proficiency (Hutajulu et al., 2019). The findings also suggest that students' attitudes, preferences, skills, and intellect play a crucial role in shaping their mathematical problem-solving abilities (Jusra & Iskandar, 2020). The ability of students to apply mathematical concepts and skills in everyday life is influenced by various factors, including numeracy, contextualized problem-solving, cognitive learning abilities, and mathematical disposition. Addressing these factors is essential for

improving students' mathematical problem-solving abilities and promoting a deeper understanding of mathematical concepts.

The Effect of Math Anxiety on numeracy

The results of the statistical hypothesis test, obtained that the statistical value of the test is as much as -0.466 means that H0 is rejected and H1 is accepted because rcount is greater than rtable. Then look at the type of relationship between variables seen from the negative test statistical value of -0.466 so that it can be seen that the relationship between the two variables, namely walking in opposite or opposite directions, means that an increase or increase in mathematical anxiety will be followed by a decrease or decrease in students' numeracy. Or it can be tied to the higher the student's math anxiety, the lower the student's numeracy. Then to find out the calculated value in the strong or weak category, it can be seen from the interpretation of the correlation coefficient according to Sugiyono (2022), where r_{count} included in the medium category because it is included in the range of 0.40 – 0.599. So it can be concluded that there is a significant negative correlation between mathematics anxiety and numeracy of grade V students of MIS Muhammadiyah Babakanloa, with a moderate level of correlation.

The results of the study align with previous research that has shown a negative and significant impact of mathematics anxiety on students' mathematical representation ability (Skagerlund et al., 2019). This is further supported by Mansuri's research, which found a relationship between mathematics anxiety and student learning outcomes (Skagerlund et al.,

2019). Additionally, Djafar (2018) demonstrated that anxiety affects learning outcomes through learning motivation, further reinforcing the negative impact of mathematics anxiety on students' academic performance (Skagerlund et al., 2019). The findings of the current study are strengthened by the theoretical and empirical evidence from these previous studies, indicating a consistent negative relationship between mathematical anxiety and numeracy in grade V students (Skagerlund et al., 2019).

Furthermore, Prime & Suswandari (2021) suggested various strategies to improve students' mathematical literacy skills, such as stimulating students' curiosity, providing adequate facilities and infrastructure, conducting regular mathematics literacy programs, and enhancing teachers' thematic learning approaches (Skagerlund et al., 2019). Additionally, Nurjanah et al. (2022) emphasized the importance of fostering a love of reading in students and creating a stimulating learning environment to enhance students' numeracy problem-solving skills (Skagerlund et al., 2019).

After a correlation or connectedness test, the coefficient of determination was calculated to find out how much influence math anxiety had on students' numeracy. The calculation results show that the r value is -0.466 and the r2 value is 0.2171, thus the magnitude of the coefficient of determination is 21.71%. That is, the influence of students' math anxiety on students' numeracy was 21.71% and 78.29% was influenced by other factors.

Moreover, the coefficient of determination calculated after a correlation test revealed that math anxiety accounted for 21.71% of the influence on students' numeracy, with 78.29% being influenced by other factors (Skagerlund et al., 2019). This underscores the substantial impact of math anxiety on students' numeracy.

The results of the study indicate a negative and significant relationship between mathematical anxiety and numeracy in grade V students (Primi et al., 2017). The coefficient of determination shows that math anxiety influences students' numeracy by 21.71% (Primi et al., 2017). Additionally, low numeracy may be influenced by factors such as lack of learning facilities and non-fulfillment of supporting factors (Miralda et al., 2022). To improve students' mathematical literacy skills, providing stimuli to stimulate curiosity, availability of facilities, and capacity building programs are recommended (Miralda et al., 2022). Furthermore, the study emphasizes the need to increase accuracy in understanding the content of the story text and students' numeracy problem-solving skills (Miralda et al., 2022).

The study's findings are consistent with previous research, highlighting the detrimental effect of mathematics anxiety on students' numeracy. The results underscore the need for targeted interventions to alleviate mathematics anxiety and enhance students' numeracy.

CONCLUSION

Students' views on mathematics make mathematics difficult and unpleasant, the relatively monotonous method of learning mathematics also causes low student interest in mathematics which results in high student anxiety about mathematics subjects. Student anxiety about mathematics has a negative and significant influence on students' numeracy, with a large influence of 21.71%. So that the relationship between the two variables goes in opposite or opposite directions, meaning that an increase or increase in math anxiety will be followed by a decrease or decrease in students' numeracy. Or it can be said that the higher the student's mathematical anxiety, the lower the student's numeracy. It is hoped that with these findings, teachers can innovate more in teaching and learning activities to create effective and fun learning in minimizing student anxiety about mathematics and improving students' numeracy. Teachers should be more creative in packaging mathematics learning, broaden knowledge and insight into learning models so that it is expected to eliminate the assumption "mathematics is a difficult and scary subject" so that students prefer mathematics subjects and can improve students' numeracy.

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