



The effect of anxiety and learning motivation on the mathematics learning outcomes of elementary school students

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Abstract: This study aims to analyse the influence of mathematics anxiety and learning motivation on the mathematics learning outcomes of sixth-grade students at an elementary school in Samarinda City. The research employed a quantitative, correlational design. A total of 56 students participated as research subjects using a total sampling technique. Data were collected through a mathematics anxiety questionnaire, a learning motivation questionnaire, interviews, and documentation of the final exam scores. Data analysis was conducted using multiple linear regression after confirming the assumptions of normality, multicollinearity, and heteroscedasticity. The results showed that mathematics anxiety did not have a significant effect on learning outcomes ($\text{Sig.} = 0.118 \geq 0.05$), whereas learning motivation did ($\text{Sig.} = 0.004 \leq 0.05$). Simultaneously, both variables had a significant effect, contributing 23.1% to mathematics learning outcomes. Learning motivation was found to be the most dominant factor. From the interviews, other factors influencing learning outcomes were identified, including family and school environments, teaching methods, and students' study habits. The findings imply that teachers should analyse students' characteristics to design adaptive instruction that optimises learning outcomes.

Keywords: math anxiety; learning motivation; math learning outcomes; elementary school students.

Pengaruh kecemasan dan motivasi belajar terhadap hasil belajar matematika siswa Sekolah Dasar

Abstrak: Penelitian ini bertujuan untuk menganalisis pengaruh kecemasan matematika dan motivasi belajar terhadap hasil belajar matematika peserta didik kelas VI di salah satu sekolah dasar di Kota Samarinda. Penelitian ini menggunakan desain kuantitatif korelasional. Sebanyak 56 peserta didik berpartisipasi sebagai subjek penelitian dengan teknik total sampling. Data dikumpulkan melalui kuesioner kecemasan matematika, kuesioner motivasi belajar, wawancara, dan dokumentasi nilai ujian akhir. Analisis data dilakukan dengan regresi linier berganda setelah memastikan terpenuhinya asumsi normalitas, multikolinearitas, dan heteroskedastisitas. Hasil penelitian menunjukkan bahwa kecemasan matematika tidak berpengaruh signifikan terhadap hasil belajar ($\text{Sig.} = 0.118 \geq 0.05$), sedangkan motivasi belajar berpengaruh signifikan ($\text{Sig.} = 0.004 \leq 0.05$). Secara simultan, kedua variabel tersebut berpengaruh signifikan dan memberikan kontribusi sebesar 23.1% terhadap hasil belajar matematika. Motivasi belajar ditemukan sebagai faktor yang paling dominan. Dari hasil wawancara, ditemukan faktor lain yang memengaruhi hasil belajar, antara lain lingkungan keluarga dan sekolah, metode mengajar, serta kebiasaan belajar peserta didik. Temuan ini mengimplikasikan bahwa guru perlu menganalisis karakteristik peserta didik untuk merancang pembelajaran yang adaptif guna mengoptimalkan hasil belajar.

Kata Kunci: kecemasan matematika; motivasi belajar; hasil belajar matematika; siswa sekolah dasar.

INTRODUCTION

Education is one of the most important ways to develop students' potential and abilities. Education plays a very important role in developing various skills in students, including mathematical skills, which contribute to improving logical and critical thinking (Asalamah et al., 2025). Mathematics is also a discipline that is very helpful in solving everyday problems, in the workplace, and in the development of science and technology (Harahap & Rahman, 2023). Through the process of learning mathematics, students are expected to master basic concepts and improve their thinking skills. In addition, understanding the basics of mathematics helps in recognising patterns and routines and in developing logical thinking, both of which play a very important role in solving mathematical problems. This situation shows that mathematics has a major influence on education and technological development today (Hasanah et al., 2020).

Even though mathematics instruction has been implemented optimally, students' mathematical understanding varies. Some students can follow the lessons well, while others face various obstacles (Sulasih & Firmansyah, 2025). Mathematics education still faces low levels of student understanding, with students often viewing the subject as boring and intimidating (Setiani et al., 2025). Kambey et al. (2018) argue that in the mathematics learning process, many students still face challenges in achieving learning objectives, caused, among other things, by a lack of understanding of the material provided by teachers. Mathematics is often viewed as a complicated subject at the elementary school level, causing some students to feel afraid and worried, which affects their attitude and enthusiasm even before they actually learn about this subject (Budhiarti & Mustaqim, 2025).

One non-intellectual factor that greatly influences mathematical achievement, but is often overlooked, is anxiety about mathematics (Julya & Nur, 2022). Debora & Bernarto (2025) explain that math anxiety is an emotional response that appears during math lessons or tests, and it involves feelings of restlessness, anxiety, worry, and fear. Puspananda & Rahmawati (2020) define anxiety as a psychological condition related to a person's emotional state, characterised by feelings of restlessness, uncertainty, and fear in the face of reality or life events. Anxiety is also often characterised by tension and worry that arise when individuals engage in mathematical activities, both in learning contexts and in everyday life (Nurhidayati, 2024).

In essence, mathematical anxiety in students is a condition influenced by various symptoms related to physical, cognitive, affective, and mathematical comprehension aspects. According to Tsaqila & Astriani (2023), student math anxiety is characterised by various symptoms across somatic, cognitive, affective, and mathematical knowledge domains. Somatic symptoms are characterised by physical reactions such as trembling, sudden blurred vision, palpitations, and sweaty hands. Cognitively, anxiety manifests itself through difficulty concentrating, concern about being judged by others, and forgetfulness. The affective aspect is demonstrated by anxiety about learning mathematics, fear of determining the steps to solve a problem, and low self-confidence.

Meanwhile, in terms of mathematical knowledge, anxiety is related to students' understanding of the material and their perceptions of their own mathematical abilities. Based on a review of the literature, it can be concluded that mathematical anxiety is a psychological and emotional condition characterised by feelings of anxiety, restlessness,

tension, and worry that arise when students encounter mathematical activities. This condition involves symptoms that affect somatic, cognitive, affective, and mathematical knowledge, which can impair concentration, understanding of material, self-confidence, and student performance in learning and applying mathematics in everyday life.

In addition to anxiety, other factors that influence mathematics learning outcomes include learning motivation (Wati et al., 2023). According to Prasetyo & Dasari (2023), learning motivation is the drive that arises within learners that plays a role in directing and controlling their learning behaviour on an ongoing basis, enabling them to achieve the goals set in the learning process. Shofa et al. (2023) state that students who are motivated to learn will show perseverance and a high level of interest in mathematics, enabling them to achieve better learning outcomes. In addition, students with high levels of learning motivation tend to show greater active participation, more intense involvement in the learning process, and greater caution in their actions than students with low learning motivation. Learning motivation is also one of the factors that determine learning effectiveness. A student will study diligently if they are highly motivated to learn (Herwati et al., 2023). Students with high levels of learning motivation generally demonstrate enthusiasm, persistence, and resilience in the learning process, whereas low learning motivation can lead to low participation and suboptimal learning outcomes (Julyanti et al., 2021). This shows that motivation to learn is a key factor influencing students' academic achievement in mathematics.

Based on interviews with two sixth-grade teachers at an elementary school in Samarinda, it can be concluded that most students are afraid of mathematics, both during lessons and during mathematics exams. This anxiety is evident in their lack of confidence, tendency to avoid active participation in learning, frequent complaints when given questions they consider difficult, and mistakes in answering questions. As a result, the students' final exam scores in mathematics do not fully reflect their actual academic abilities. In addition to math anxiety, teachers emphasised that motivation for learning is a highly influential factor in mathematics learning. Based on teachers' experiences, students with high motivation tend to persevere in class, actively ask questions when they encounter difficulties, and consistently complete assignments despite various obstacles. Teachers also said that highly motivated students have a strong desire to understand the material, do not give up easily, and are more engaged during learning, so learning outcomes tend to be better. Conversely, the teacher revealed that students with low learning motivation lack enthusiasm for learning, are often unfocused, are reluctant to participate in class discussions, and are less engaged.

Based on the previous explanation, this study aims to analyse the combined influence of mathematics anxiety and learning motivation on elementary school students' mathematics learning outcomes. In addition to these two main variables, the study identifies other factors that may affect learning outcomes, from psychological and environmental perspectives. By doing so, this research is expected to provide a more comprehensive overview of the role of non-intellectual factors, particularly anxiety and learning motivation, as well as other supporting factors in the success of mathematics learning in elementary schools. The results

of this study are expected to serve as a basis for improving the quality of instruction by taking students' psychological aspects into account.

METHOD

This study uses a quantitative correlational design, specifically multiple linear regression, to examine the simultaneous influence of mathematics anxiety and learning motivation on students' mathematics learning outcomes. This design was chosen because it allows analysis of the strength and direction of relationships between two or more independent variables and a dependent variable.

This study was conducted at an elementary school in Samarinda City during the odd semester of the 2025/2026 academic year. The research examined mathematics anxiety and learning motivation as independent variables, and mathematics learning outcomes as the dependent variable. The study population comprised all sixth-grade students in the 2025/2026 academic year, totalling 56 individuals. The sampling technique used was total sampling, so all students were included as research subjects (Sugiyono, 2023).

This study collected data using questionnaires, documentation, and interviews. Each questionnaire consisted of 22 statements designed to measure students' levels of mathematics anxiety and learning motivation, with responses recorded on a 4-point Likert scale to obtain total scores for each variable. These scores were analysed as quantitative data to assess levels of anxiety and motivation and to test their influence on mathematics learning outcomes. Before use, the questionnaire was validated by three lecturers, each an expert in mathematics, and one sixth-grade teacher, and was revised according to their suggestions until deemed valid and appropriate for use. Data on learning outcomes were obtained from documentation of odd-semester final exam scores for the 2025/2026 academic year, which served as the dependent variable. The scores for mathematics anxiety and learning motivation were analysed as independent variables to examine their simultaneous effects on mathematics learning outcomes using multiple linear regression. Interviews were used as supporting data to identify other factors outside the studied variables that also influence students' learning outcomes.

Next, the research instruments were piloted with sixth-grade students at an elementary school in Samarinda that was not the main research site. The purpose was to assess whether the instruments were appropriate and clear before being used in the main study. Validity testing was conducted using the product-moment correlation technique. The results showed that all statements in both the mathematics anxiety and learning motivation questionnaires met the validity criteria. In addition, the reliability of the instruments was tested using Cronbach's Alpha coefficient, where an instrument is considered reliable if the Cronbach's Alpha value is greater than 0.6. The reliability test results indicated that the mathematics anxiety questionnaire had a Cronbach's Alpha coefficient of 0.912, while the learning motivation questionnaire scored 0.958. Based on these results, both research instruments demonstrated adequate reliability and were suitable for use in this study.

After the instrument was declared valid and reliable, the next step was to collect data by distributing the questionnaire to respondents and documenting mathematics learning outcomes from the sixth-grade teacher. The collected data were then processed and organised as research data for further analysis. Before testing the hypothesis, prerequisite tests for normality, multicollinearity, and heteroscedasticity were conducted to ensure the data met the assumptions of regression analysis. Furthermore, the data were analysed using multiple linear regression in SPSS version 27 to assess the simultaneous effects of mathematics anxiety and learning motivation on mathematics learning outcomes.

RESULTS AND DISCUSSION

Before testing the hypothesis, a preliminary analysis was conducted to ensure that the data met the requirements for regression analysis. In multiple linear regression, the assumptions tested include normality, multicollinearity, and heteroscedasticity. The normality test was conducted using the Kolmogorov-Smirnov test because the number of respondents exceeded 50. The result showed an *Asymp. Sig. (2-tailed)* value of 0.200, which is greater than 0.05, indicating that the data are normally distributed. For the multicollinearity test, the Tolerance value was 0.917 (greater than 0.10), and the *Variance Inflation Factor (VIF)* was 1.091 (less than 10), indicating no multicollinearity. This means the regression model is free of multicollinearity, i.e., there is no strong correlation among the independent variables. The results of the multicollinearity test are shown in Table 1.

Table 1. Multicollinearity Test and Partial Results of Multiple Linear Regression Analysis

Model		Unstandardized Coefficients		Standardised Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-36.845	23.844		-1.545	0.128		
	Mathematics Anxiety	0.527	0.332	0.200	1.589	0.118	0.917	1.091
	Learning Motivation	0.932	0.306	0.383	3.048	0.004	0.917	1.091

A heteroscedasticity test was also conducted. Using the Glejser test, the results showed *Sig.* values for mathematics anxiety of 0.354 and the learning motivation of 0.386, both greater than 0.05. This indicates that the regression model is not heteroscedastic. In other words, the independent variables in the model have homogeneous variances.

After all the prerequisite tests for multiple linear regression analysis have been fulfilled, the next step is to test the hypothesis. Based on Table 1, the Results of the multiple linear regression analysis show that mathematics anxiety does not have a significant effect on mathematics learning outcomes (*Sig.* = 0.118 \geq 0.05). Conversely, learning motivation has a significant effect (*Sig.* = 0.004 \leq 0.05). The resulting regression equation is $Y = -36.845 + 0.527X_1 + 0.932X_2$. These regression coefficients indicate that, holding learning motivation constant, a one-point increase in mathematics anxiety is associated with a 0.527-point increase in learning outcomes. In comparison, a one-point increase in learning motivation is

associated with a 0.932-point increase in learning outcomes, holding mathematics anxiety constant.

Table 2. Simultaneous Significance Test Results

		ANOVA ^a				
Model		Sum of Squares	dr	Mean Square	r	Sig.
1	Regression	4648.636	2	2324.318	7.965	<0.001 ^b
	Residual	15465.346	53	291.799		
	Total	20113.982	55			

To examine the simultaneous effects of all independent variables, the researcher used ANOVA to test the regression model. Based on Table 2 ANOVA, the value of $F(2, 53) = 7.965$, $p < 0.001$ was obtained. The significance value, which is less than 0.05, indicates that the regression model used in this study is statistically significant. Therefore, mathematics anxiety and learning motivation jointly affect students' mathematics learning outcomes.

These results indicate that both independent variables in the model can jointly explain the variation in mathematics learning outcomes. This finding also demonstrates that psychological factors, such as mathematics anxiety and learning motivation, play a role in students' achievement in mathematics. In other words, changes in mathematics anxiety and learning motivation are jointly related to changes in mathematics learning outcomes. This highlights that in mathematics learning, affective aspects such as motivation and students' emotional conditions are also important to consider, as both can influence students' success in achieving optimal learning outcomes. The combined influence of mathematics anxiety and learning motivation on students' mathematics learning outcomes is explained as follows.

Table 3. Results of the Coefficient of Determination Test

Model	Model Summary			
	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.481 ^a	0.231	0.202	17.082

The contribution of the independent variables to the dependent variable was analysed using the coefficient of determination (R^2). Based on Table 3, the coefficient of determination (R^2) of 0.231 indicates that mathematics anxiety and learning motivation together account for 23.1% of the variance in mathematics learning outcomes. In comparison, the remaining 76.9% is attributable to other factors.

The partial test results indicate that mathematics anxiety does not significantly affect mathematics learning outcomes. This means that students' anxiety levels do not directly determine their academic achievement, as each individual responds to anxiety differently. In contrast, learning motivation has been proven to have a significant influence and is a more dominant factor in improving learning outcomes. Students with high motivation are usually more active, diligent, and consistent in participating in the learning process. Together, these

two variables account for 23.1% of mathematics learning outcomes, with the remainder attributable to other factors.

The findings of this study indicate that students' fear of mathematics can affect their learning outcomes, either positively or negatively, depending on how they respond to the situation. The results of this study are consistent with the findings reported by (Utami et al., 2021), which show that mathematics anxiety does not always hurt learning achievement, as well as the study by Berliani & Persada (2024) which found that the anxiety variable significantly affected the mathematics learning achievement of fourth-grade students, with a regression coefficient value of B of 0.599 and a significance level of 0.000 ($p \leq 0.05$), meaning that every one-point increase in anxiety is associated with a 0.599 increase in learning achievement. The difference in the results of this study may be due to differences in sample characteristics. Their research was conducted on fourth-grade students, whereas this study involved sixth-grade students. Sixth-grade students typically have more learning experience and are more accustomed to facing learning evaluations. This may cause mathematics anxiety to no longer be the main factor influencing the learning outcomes of sixth-grade students. In addition, research by Elhag et al. (2025) indicates that students' anxiety levels correlate positively and significantly with academic achievement in several subjects, including science, mathematics, and English, with a correlation coefficient of 0.220 ($p \leq 0.001$). Although math anxiety is often considered negative, these findings show that anxiety can serve as a motivating factor that encourages students to focus more, try harder, and prepare themselves better. However, excessive anxiety can also cause feelings of restlessness, fear, and physiological disturbances, thereby reducing concentration and self-confidence, which ultimately hurts student learning outcomes. Thus, math anxiety has a dual role: it can act as a motivator that improves performance and as an inhibiting factor when its intensity is not controlled.

In addition, the results of testing the learning motivation variable show that the t value of 3.048 exceeds the t table value of 2.003 with a significance level of <0.001 . Based on the analysis, the learning motivation variable significantly affects students' mathematics learning outcomes. Therefore, learning motivation has a greater impact on supporting mathematics learning outcomes than anxiety towards mathematics. Students with high learning motivation are usually more active, persistent, and consistent in completing mathematical challenges, which ultimately positively impacts their learning outcomes. The findings of this study are consistent with those of previous studies, including (Giawa et al., 2020), which indicate that learning motivation positively and significantly affects the academic achievement of fifth-grade students at SD Negeri 067245 Medan. Statistical evidence is shown through a regression coefficient of 0.603, a t value of $5.235 \geq t$ table value of 1.697, and a significance level of $0.000 \leq 0.05$. Furthermore, research by Wicaksono & Rahmawati (2021) also revealed that learning motivation had a positive and significant effect on the mathematical achievement of fourth-grade elementary school students, as indicated by a contribution of 3.6%, a significance level of $0.019 \leq 0.05$, and an F value of 5.585. Similar findings were reported by (Amalia et al., 2022), who found that learning motivation positively and significantly affects mathematics

achievement among fourth-grade students at an elementary school in Gebang District, Purworjo Regency, during the 2021/2022 academic year. The findings are supported by a calculated t value of 4.834, which exceeds the table t value of 1.969 at a significance level of $0.000 \leq 0.05$. In addition, the calculated r value of 0.288 is also higher than the table r value of 0.121 ($df = 260$), confirming a positive and significant relationship between learning motivation and mathematics learning achievement.

The results of this research showed that mathematics anxiety does not have a partial effect on learning outcomes. However, when combined with learning motivation, both variables have a significant influence. These findings indicate that there are other, more dominant factors. To gain a deeper understanding, the researcher interviewed students and teachers to identify additional factors influencing mathematics learning outcomes.

From the interviews with the two sixth-grade teachers, the first factor is the family environment. The teachers stated that the family environment is the main factor influencing students' mathematics achievement. Students who receive attention, guidance, and encouragement from their parents tend to develop better learning habits and a better understanding of the material (Butarbutar et al., 2022). The second factor is the lack of guidance and supervision in studying at home. The teachers explained that insufficient parental support, lack of study supervision, and the absence of regular study habits make it difficult for students to review material, leaving them less prepared for learning or evaluation. Parental guidance is an important factor in supporting children's future success. Parents also have the task of guiding their children in line with their potential and interests. The interaction between parents and children significantly influences the learning guidance process at the elementary school level, with parental participation supporting children's academic and personal development (Sari & Ain, 2023).

Based on interviews with six students, the family environment is not the only factor influencing mathematics achievement; the school learning environment is also a major factor. The students stated that a tidy, orderly, and conducive classroom atmosphere helps them focus better during learning. In line with this, Prawidia & Khusna (2021) stated that a conducive school environment helps improve students' understanding of the material presented by teachers; therefore, a supportive learning atmosphere is an important factor in students' learning success. The second factor is seating positions facing the blackboard. According to the students, sitting at the front of the classroom makes it easier for them to understand the teacher's explanations and reduces distractions during learning. This statement is reinforced by Safaruddin et al. (2020), who state that the arrangement of seats in the classroom has an impact on the effectiveness of student learning, where some students show better understanding when sitting in the front seats, while other students are more comfortable and effective learning in the middle, back, or semi-circular arrangements. The third factor is the teacher's teaching methods. The students explained that varied and interactive methods, including play-based activities, are considered to increase their interest and concentration. This is reinforced by (Kurniawan et al., 2019), who state that the effective and efficient use of learning media helps create a balance among students' cognitive,

affective, and psychomotor abilities, enabling learning to take place in a more meaningful and comprehensive manner. The students stated that play-based learning makes them more engaged during the learning process and helps prevent them from becoming bored quickly. This approach also helps them understand the mathematical concepts being taught more easily. Professional teachers can use various methods, models, and learning media to present lesson material. These competencies enable teachers to create an interactive and enjoyable environment, which in turn encourages students to actively engage in learning activities (Assoim & Sukriadi, 2025). In this era of rapid technological development, the use of game-based learning media has become an important strategy in improving learning effectiveness. The use of innovative and creative media and the creation of a fun learning environment provide a more meaningful learning experience and support the improvement of students' numeracy skills (Hasanah et al., 2024). Based on the information provided by the teachers during the interview, understanding basic mathematical concepts and regular practice are also important factors in supporting learning success. Students who have a good understanding of the basics and are accustomed to doing practice problems tend to continue to achieve optimal learning outcomes, even when experiencing anxiety during learning or evaluation. This is consistent with the opinion expressed by (Azizah & Haerudin, 2021), who argue that mathematical intelligence affects students' interest and attitudes towards mathematics learning, with students with higher intelligence being more interested and more critical and evaluative. Conversely, students with relatively low intelligence generally show lower interest in learning and are less evaluative of mathematics material.

The results of this interview indicate that, in addition to math anxiety and learning motivation, other factors influence students' math learning outcomes. These factors include the family environment, a conducive school environment, classroom seating arrangements, teaching methods, media used by teachers, and the use of technology in learning. In addition, practice habits, basic mathematical understanding, and students' intelligence levels all contribute to optimal mathematics learning outcomes.

CONCLUSION

The results and discussion indicate that mathematics anxiety and learning motivation together have a significant effect on sixth-grade students' mathematics learning outcomes at an elementary school in Samarinda City. However, when examined separately, mathematics anxiety does not significantly affect learning outcomes. These findings indicate that the intensity of anxiety felt by students is related to variations in mathematics learning outcomes, both as an inhibiting factor and as a motivating factor, depending on the individual responses of students in dealing with this anxiety. In addition, the results of this study indicate that learning motivation has a significant effect on students' mathematics learning outcomes, and it is the most significant. Students with high levels of learning motivation tend to demonstrate activity, perseverance, and consistency in their approach to learning, enabling them to achieve better mathematics learning

outcomes. Conversely, low learning motivation leads to suboptimal student involvement in learning and low learning achievement.

This study confirms that analysing the influence of mathematics anxiety and learning motivation on learning outcomes is only one of many factors affecting students' mathematics achievement. The interview results revealed that family and school support, teaching methods and the media used by teachers, study habits, and mastery of basic mathematical concepts also play important roles in students' learning success. These findings support the research background, which states that cognitive, psychological, and environmental factors influence mathematics learning outcomes. To improve mathematics achievement, efforts should focus on strengthening motivation to learn, managing anxiety appropriately, and creating a conducive learning environment at both school and home. This study has limitations, as it examines only two independent variables; thus, it does not account for other factors that may also affect students' mathematics learning outcomes. Future research is recommended to broaden the range of variables to provide a more comprehensive understanding of the factors influencing mathematics learning outcomes at the elementary school level. The implications of this study suggest that teachers should conduct an initial analysis of students' characteristics before the lesson, including psychological aspects, prior abilities, and learning styles. This is important so that teachers can design adaptive lessons tailored to students' needs, thereby optimising learning outcomes.

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