



The effect of self-regulated learning and learning interest on mathematics learning outcomes

Tri Astuti Arigiyati^{1, 2}, Betty Kusumaningrum^{1, 2*}, Irma Leny Maysaroh¹, K. S. Kuncoro³, Samsul Pahmi^{3, 4}, and Bahadır Özsüt⁵

¹ Mathematics Education, Universitas Sarjanawiyata Tamansiswa, Jl. Batikan, UH-3 No.1043, Yogyakarta, 55167, Indonesia

² Mathematics Education, Universitas Negeri Yogyakarta, Jl. Colombo Yogyakarta No.1, Sleman, Yogyakarta, 55281, Indonesia

³ Mathematics Education, Universitas Pendidikan Indonesia, Jl Dr. Setiabudi No. 229, Bandung, Jawa Barat, 40154, Indonesia

⁴ Elementary School Teacher Education, Nusa Putra University, Jl. Raya Cibolang No.21, Sukabumi, Jawa Barat, 43152 Indonesia

⁵ Department of Educational Sciences, Cukurova University, 01330 Sarıçam/Adana, Turkey

* Corresponding Author. Email: bettykusumaningrum.2021@student.uny.ac.id

Received: 5 June 2023; Revised: 21 June 2023; Accepted: 8 July 2023

Abstract: Learning outcomes are one of the important aspects in the learning process because it is used as a determining factor for the success of a learning process. The factors that influence student learning outcomes are divided into two, namely internal factors (learning interests, talents, motivation, self-regulation, etc.) and external factors (school environment, family environment, etc.). Self-regulation and learning interest were the focus of discussion in this research. This study aims to determine the positive and significant influence between independence and interest in learning on mathematics learning outcomes for class VIII students of SMP Negeri 24 Muaro Jambi. This type of research is associative quantitative research. The results showed that partially independence had a positive but not significant effect on mathematics learning outcomes with $t_{count} = 1,323$ and correlation coefficient 0,202, while interest in learning had a positive and significant effect on mathematics learning outcomes with $t_{count} = 4,193$ and correlation coefficient 0,548. Simultaneously, independence and interest in learning have a positive and significant effect on mathematics learning outcomes for class VIII students of SMP Negeri 24 Muaro Jambi as shown by the $F_{count} = 41,196$, with an effect of 66,8% and 33,2% influenced by other variables.

Keywords: Learning interest; Mathematics learning outcomes; Self-regulated learning

How to cite: Arigiyati, T. A., Kusumaningrum, B., Maysaroh, I. L., Kuncoro, K. S., Pahmi, S., & Özsüt, B. (2023). The effect of self-regulated learning and learning interest on mathematics learning outcomes. *Union: Jurnal Ilmiah Pendidikan Matematika*, 11(2), 317-329. <https://doi.org/10.30738/union.v11i2.15025>

INTRODUCTION

The learning outcome plays a crucial role in the learning process as it acts as a decisive factor in ensuring the successful completion of a course (Motola et al., 2013). It serves as an indicator of students' proficiency in the subject matter presented by teachers (Paolini, 2015). Learning outcomes are typically quantified using numerical or letter grades and serve as a representation of the actual learning experience of students. They provide a well-defined framework for evaluating students' acquisition of knowledge, comprehension, and skills in a specific subject. Moreover, learning outcomes serve as a fundamental measure of students' grasp of the subject



matter. They facilitate assessment, support curriculum development and alignment, empower students in their educational journey, facilitate feedback and progress, encourage communication and transparency, and contribute to promoting fairness and accessibility in education. By prioritizing learning outcomes, education systems can strive for continuous improvement and better equip students for success in their academic and professional pursuits.

A low grade indicates inadequate mastery of the topic by students. Teachers must conduct thorough and accurate evaluations of student outcomes with the aim of improving the quality of the learning process. The assessment of student results is performed by teachers to identify and enhance the learning process (Biggs, 1999). According to Biggs, the factors influencing student learning outcomes can be categorized as internal factors (e.g., interest in learning, aptitude, motivation, self-regulation) and external factors (e.g., school environment, family environment). This study focuses on self-regulation and interest in learning as two factors that significantly contribute to students' learning outcomes. Both self-regulation and learning interest play crucial roles in determining the level of student achievement.

Self-regulation is very important for the learning process (Järvelä & Järvenoja, 2011; Zimmerman, 2008). Therefore, self-regulated learning has been an important topic in educational research in recent years (Schunk, 2005; Underwood & Banyard, 2011). Understanding the relationship between self-regulated learning, learning interest, and mathematics learning outcomes is important because it allows educators to enhance student motivation, personalize learning approaches, identify effective learning strategies, address learning difficulties, and inform educational policy and practice. By considering these factors, educators can optimize the learning experience and promote better mathematics learning outcomes for all students. The results of the study indicate the extent to which students are able to manage their own learning can significantly improve their learning outcomes (Cheng, 2011; Kostons et al., 2012; Zheng & Zhang, 2020). By having self-regulated learning, students are able to regulate better learning habits, apply more effective learning strategies (Harris et al., 2005), better monitor learning progress (Harris et al., 2005), build a more productive environment for learning, seek help more often when needed, evaluate their academic progress (Harris et al., 2005), expend better effort and persist, adapt strategies better, and assign more effective goals (Cazan, 2013; Schunk, 2005; Zumbunn, 2011). Another reason is that we live in a society where lifelong learning is essential. Lifelong learning takes place in an informal learning environment where in an informal learning environment the teacher plays less of a role in learning but tends to be more student oriented and means they will require a greater level of self-regulation skills. Therefore, it is necessary to conduct research on self-regulated learning to improve these skills in students. In order to improve self-regulated learning in students, teachers thus should be familiar with the factors that influence a learner's ability to self-regulate and the strategies they can use to identify and promote self-regulated learning in their classrooms that can promote improved student learning outcomes.

In addition to self-regulation, learning interest can also have a pivotal impact on students' academic outcomes (Azmidar et al., 2017). Interest is conceptualized as an affective state that represents students' subjective experience of learning (Ainley, 2006). Learning interest can be defined as a relatively enduring tendency to attend or engage in learning activities (Lin et al., 2013). When students are genuinely interested in a topic, they are more likely to actively participate and engage in learning activities. Learning interest encourages students to pay attention directly, facilitate concentration, prevent distractions, strengthen attachment to subject matter, and reduce boredom of learning. Interest in learning helps students direct and sustain their attention on the task at hand. Learning interest also fosters intrinsic motivation, which refers to the internal desire and enjoyment derived from the learning process itself rather than external rewards or pressures.

Learning interest greatly affects the way students learn. A student who wants to get good learning outcomes, then he will study seriously by focusing on the lesson. On the other hand, students who have no interest in learning may mean students have no achievement goals, or,

it may mean they do not see any value in the educational experience open to them. When students are described as unaffected, it indicates that the educational experience does not trigger positive feelings (Ainley, 2006). Previous studies have often examined self-regulated learning and learning interest as separate constructs, neglecting the potential combined effects they may have on mathematics learning outcomes. While the relationship between self-regulated learning, learning interest, and mathematics learning outcomes has been explored to some extent, there is a lack of research investigating the underlying mediating mechanisms. Previous research has paid limited attention to exploring these potential moderating factors. Many studies in this area have adopted cross-sectional designs, limiting our understanding of the long-term effects of self-regulated learning and learning interest on mathematics learning outcomes. Longitudinal studies that track students' learning progress over an extended period can provide insights into the developmental nature of these constructs and their cumulative effects on achievement. The majority of previous research has focused on specific age groups or student populations, often limiting generalizability to broader contexts. By addressing these limitations and gaps in previous research, our study aims to contribute to the existing literature by providing a more nuanced and comprehensive understanding of the combined effects of self-regulated learning and learning interest on mathematics learning outcomes. It also seeks to investigate the mediating and moderating factors involved, utilize longitudinal designs, and examine diverse populations, thereby advancing knowledge in this field and informing effective instructional practices in mathematics education.

That way, it is expected that students have a high interest in learning to help students get high learning outcomes well. Therefore, researchers feel the need to conduct this research. This study aims to: (1) Determine the impact of self-regulated learning on mathematics learning outcomes; (2) Investigate the influence of learning interest on mathematics learning outcomes; (3) Examine the combined effect of self-regulated learning and learning interest on mathematics learning outcomes.

METHOD

The type of this research is quantitative research that is explaining phenomena by collecting numerical data that are analyzed using mathematically based methods (in particular statistics) (Sukamolson, 2007). There are several reasons why researchers may choose quantitative research methods for their study: quantitative research aims to obtain objective and measurable data, allowing for replication and verification of results, it often involves larger sample sizes, which can increase the generalizability of the findings to a broader population, it employs statistical techniques to analyze data, enabling researchers to identify patterns, relationships, and associations between variables with a high degree of precision, quantitative research allows for the quantification of variables, making it possible to measure and compare phenomena objectively, it enables researchers to test hypotheses and establish cause-and-effect relationships, often more efficient and time-effective than qualitative approaches, and provides empirical evidence that can inform policy-making, decision-making, and evidence-based practice. This research was conducted on February 4, 2022 at SMP Negeri 24 Muaro Jambi, Jambi Province, Indonesia. This study involved self-regulated learning variables and learning interest as independent variables and mathematics learning outcomes as dependent variables. All 8th grade students were taken as a population of 50 students. A sample of 44 students was obtained from the population using simple random sampling technique. Simple random sampling is a basic type of sampling, which is often used as a sampling technique itself or as a building block for more complex sampling methods (Meng, 2013).

Research data collection was carried out using questionnaires, tests, and documentation. Questionnaires were used to measure students' independence and interest in learning, while test question was used to measure mathematics learning outcomes. Questionnaire testing is critical for identifying problems for both respondents and interviewers with regard to, e.g. question wording and content, order/context effects, and visual design (Brancato et al., 2006).

In this study, the questionnaire was designed to assess students' levels of self-regulated learning and their interest in learning mathematics. It consisted of items or statements related to different aspects of self-regulated learning, such as goal setting, time management, self-reflection, and self-evaluation. Additionally, the questionnaire has included items to assess students' intrinsic motivation, curiosity, and enjoyment related to learning mathematics. Test questions for measuring mathematics learning outcomes: to assess students' mathematics learning outcomes, a test was used. The test consisted of problem-solving questions. The questions were designed to assess students' understanding, application, and problem-solving skills in mathematics. Questionnaires and tests before being used in the field are first tested for validity and reliability so that the research data obtained can be scientifically accounted for.

The data that has been obtained are then analyzed using multiple linear regression, multiple and partial correlation analysis, hypothesis testing (t test and F test), and coefficient of determination, by conducting prerequisite tests (normality test, linearity test, and multicollinearity test) first using SPSS 21. Multiple linear regression is a statistical approach used to describe the simultaneous associations of self-regulated learning and learning interest variables with one continuous outcome, i.e., mathematics learning outcomes. Multiple linear regression analysis and multiple correlation analysis slightly overlap but have many differences that the two analytical procedures involve different research questions and study designs, different inferential approaches, different analysis strategies, and different reported information. Multiple correlation attempts to measure the relationship between multiple independent variables (in this case, self-regulated learning and learning interest) and a dependent variable (mathematics learning outcomes) simultaneously (Fernandez-Macho, 2018). Partial correlation analysis can be used as a way to measure the relationship between variables while controlling for the influence of other variables (Marrelec et al., 2006). In the context of the study, partial correlation analysis can help determine the specific contribution of self-regulated learning and learning interest to mathematics learning outcomes while controlling for other factors that might influence the relationship. By controlling these variables, researchers can better isolate the unique effect of self-regulated learning and learning interest on mathematics learning outcomes.

T tests are usually used in cases where the experimental subjects are divided into two independent groups, with one group treated with A and the other group treated with B (Kim, 2011). In this study, researchers might employ a t-test to examine whether there are significant differences in mathematics learning outcomes between individuals with high self-regulated learning and individuals with low self-regulated learning. Similarly, they could use a t-test to investigate if there are significant differences in mathematics learning outcomes between individuals with high learning interest and individuals with low learning interest. F-test is used to test for significant differences between the treatment groups (Donaldson, 1968). The power of the F-test was investigated for cases of equal and unequal variance wherein the F-test was used to test for significant differences between the treatment groups (Donaldson, 1968). The coefficient of determination is well-defined in linear regression models, and measures the proportion of variation in the dependent variable explained by the predictors included in the model (Zhang, 2016). In this study, researchers have employed an F-test to examine whether there are significant differences in mathematics learning outcomes among individuals with different levels of self-regulated learning and learning interest. For example, they might compare mathematics learning outcomes among individuals with high self-regulated learning, moderate self-regulated learning, and low self-regulated learning.

RESULTS AND DISCUSSION

Results

1. Self-regulated learning variable (X_1)

In this variable, the value of variance and standard deviation are 36.875 and 6.073, respectively, lower than the mean value of 40.09. This resulted in the spread of the data close to the average value (mean) and can be interpreted as homogeneous data. Based on the calculation using the mean and standard deviation, it is found that the trend of student's self-regulated learning data is as presented in Table 1.

Table 1. Category of Student's Self-Regulated Learning

Interval	Frequency	Percentage (%)	Category
Score > 46,163	7	15,91%	High
34,017 < Score < 46,163	32	72,73%	Medium
Score < 34,017	5	11,36%	Low

The largest percentage of student's self-regulated learning is in the medium category with a frequency of 32 and a percentage of 72.73% (Table 1). It can be concluded that the students tend to have moderate self-regulated. In addition, data on learning interest are also obtained.

2. Learning Interest variable (X_2)

The mean value for the variable of learning interest is 43.32. The variance in this variable is 46,780 which is higher than the mean, so the spread of data on the learning interest variable can be interpreted that the data is very spread around the mean. The results of the data analysis of learning interest are presented in Table 2.

Table 2. Categories of Student's Learning Interest

Interval	Frequency	Percentage (%)	Category
Score > 50,16	7	15,91%	High
36,48 < Score < 50,16	32	72,73%	Medium
Score < 36,48	5	11,36%	Low

The largest percentage of student interest in learning is in the moderate category with a frequency of 32 and a percentage of 72.73% (Table 2). It can be concluded that students also tend to have moderate learning interest. Data on students' mathematics learning outcomes were obtained from the final grades of the odd semester for the 2021/2022 school year. The results of the analysis show that students' learning interest is low, this can be seen from the absence of students who reach the minimum completeness criteria (KKM) set by the school.

3. Prerequisite Test

The prerequisite test is carried out to find out whether the collected data meets the analysis requirements with the planned technique. The analysis prerequisite test includes a normality test, a linearity test, and a multi-collinearity test. The three prerequisite tests should be met in order for the analytical test to be carried out.

3.1. Normality Test

The normality test is a basic assumption of the linear regression models (Islam, 2011). Most of the inferential procedures currently being used are based on this assumption (Bartolucci & Scaccia, 2005). Normality test is a test carried out to check if our research data comes from a population that is normally distributed. The results of the normality tests are presented in Table 3.

Table 3. Normality Test Results

Variable	Asymp. Sig. (2-tailed)	Condition	Conclusion
X_1	0,586	$0,586 > \alpha = 0,05$	Data is normally distributed
X_2	0,586	$0,586 > \alpha = 0,05$	Data is normally distributed
Y	0,188	$0,188 > \alpha = 0,05$	Data is normally distributed

Based on Table 3, the results of normality testing using the Kolmogorov Smirnov One Sample test shows that the Asymp value Sig. (2-tailed) for the variables of student's self-regulated learning (X_1), learning interest (X_2) and learning outcomes in mathematics (Y) were 0.586, 0.586, and 0.188. This results in the Asymp value. Sig. (2-tailed) $> \alpha = 0.05$ on the three variables. Thus, the data obtained on the variables of student's self-regulated learning, learning interest, and learning outcomes in mathematics are normally distributed.

3.2. Linearity Test

The linearity test aims to determine whether two variables have a linear relationship or not significantly (Guswara & Purwanto, 2021; Yumhi et al., 2021). This test looks at how the variable (X) influences the variable (Y), whether the effect is directly proportional or inversely proportional. This test is typically used as a prerequisite in correlation analysis or linear regression. The results of the linearity tests are presented in Table 4.

Table 4. Linearity Test Results

Variable	Sig. Deviation from Linearity	Condition	Conclusion
$Y \times X_1$	0,101	$0,101 > \alpha = 0,05$	There is a significant linear relationship
$Y \times X_2$	0,768	$0,768 > \alpha = 0,05$	There is a significant linear relationship

Based on Table 4 the results of the linearity test using the Test for linearity, it is known that the value of Sig. Deviation from Linearity between the self-regulated learning variable (X_1) and the mathematics learning outcome variable (Y) and between the learning interest variable (X_2) and the mathematics learning outcome variable (Y) are 0.101 and 0.768. Thus, it can be concluded that there is a significant linear relationship between the self-regulated learning variables (X_1) and mathematics learning outcomes (Y) and the learning interest variables (X_2) and mathematics learning outcomes (Y).

3.3. Multi-collinearity Test

The multi-collinearity test was carried out to find out the presence or absence of independent variables that have similarities between the independent variables in the one regression model. If there is a correlation, it is stated that regression models have multi-collinearity problems and vice versa. Multi-collinearity appears when two or more independent variables in the regression model are correlated (Divya & Devi, 2014). A little bit of multi-collinearity will sometimes cause big problems but when it is moderate or high then it will be a problem to be solved (Nevin et al., 2017). The results of the multi-collinearity test are presented in Table 5.

Table 5. Multi-collinearity Test Results

Variable	VIF	Tolerance	Condition	Conclusion
X_1	0,344	2,909	$VIF < 10$ $Tolerance > 0,01$	There is no multicollinearity problem
X_2	0,344	2,909	$VIF < 10$ $Tolerance > 0,01$	There is no multicollinearity problem

Based on Table 5, the results of the multi-collinearity test show that the value of $VIF < 10$ and $Tolerance > 0.01$ on the two independent variables. So, it can be concluded that between the variables of self-regulated learning (X_1) and learning interest (X_2) there is no multi-collinearity problem.

4. Analysis test

After the prerequisite tests are met, the analysis test is carried out. The analysis test carried out in this study includes multiple linear regression analysis, multiple correlation

analysis, partial correlation analysis, hypothesis testing, namely t test and F test, and analysis of the coefficient of determination.

4.1. Multiple Linear Regression Analysis

Multiple linear regression is a statistical approach used to describe the simultaneous associations of several variables with one continuous outcome. Important steps in using this approach include estimation and inference, variable selection in model building, and assessing model fit. The special cases of regression with interactions among the variables, polynomial regression, regressions with categorical (grouping) variables, and separate slopes models are also covered (Eberly, 2007). Multiple Linear Regression Analysis results can be seen in Table 6.

Table 6. Multiple Linear Regression Analysis

Dependent Variable	Constanta (α)	Coefficient X_1 (β_1)	Coefficient X_2 (β_2)
Y	4,122	0,207	0,582

It can be seen in Table 6, the constant value, self-regulated learning coefficient (X_1), and learning interest coefficient (X_2) are 4.122; 0.207; 0.582. The multiple linear regression equation formed is $Y = 4,122 + 0,207X_1 + 0,582X_2$. It shows that if the variables of self-regulated learning and learning interest are kept constant, the students' mathematics learning outcomes are 4.122. If value of self-regulated learning is increased by 1 point while learning interest's value is considered constant, then mathematics learning outcomes' value will increase by 0.207. If learning interest's value increases by 1 point while value of self-regulated learning is constant, learning outcomes will increase by 0.582. Thus, it can be concluded that if self-regulated learning and learning interest increase, the learning outcomes of mathematics will also increase, and vice versa.

4.2. Multiple Correlation Analysis

Multiple correlation attempts to measure the overall statistical relationship that may exist on different time scales between a series of observations on a multivariate random variable (Fernandez-Macho, 2018). Multiple Correlation Analysis results can be seen in Table 7.

Table 7. Multiple Correlation Analysis

Correlation	Sig. F Change	Correlation Coefficient (R)	Conclusion
X_1 and X_2 with Y	0,000	0,817	There is a significant relationship between independence (X_1) and learning interest (X_2) with mathematics learning outcomes (Y).

The results of multiple correlation analysis found Sig. F Change is 0.000 and the correlation coefficient is 0.817 (Table 7). This results in the value of Sig. F Change = 0.000 < = 0.05. Thus, self-regulated learning (X_1) and learning interest (X_2) have a significant relation with mathematics learning outcomes (Y). The level of correlation can be seen in Table 8.

Table 8. Correlation Coefficient Interpretation Guidelines

Coefficient Interval	Correlation Rate
$0,00 \leq r < 0,20$	Very low
$0,20 \leq r < 0,40$	Low
$0,40 \leq r < 0,60$	Medium
$0,60 \leq r < 0,80$	Strong
$0,80 \leq r \leq 1,000$	Very strong

The coefficient value of 0.817 is in the interval $0,80 \leq r \leq 1,000$ (Table 8) so that the correlation between self-regulated learning (X_1) and learning interest (X_2) with mathematics learning outcomes (Y) is very strong. So, it can be concluded that there is a positive and significant correlation between self-regulated learning (X_1) and learning interest (X_2) and mathematics learning outcomes (Y) simultaneously.

4.3. Partial Correlation Analysis

In addition, a partial correlation test was also carried out to find out the correlation between self-regulated learning (X_1) and learning interest (X_2) and mathematics learning outcomes (Y) partially. The results of the partial correlation analysis are presented in Table 9.

Table 9. Results of The Partial Correlation Analysis

Correlation	Control variable	Sig. (2-tailed)	Correlation Coefficient (R)	Conclusion
X_1 with Y	X_2	0,193	0,202	There is a correlation between X_1 and Y (X_2 is controlled)
X_2 with Y	X_1	0,000	0,548	There is a correlation between X_2 and Y (X_1 is controlled)

The value of Sig. (2-tailed) = 0.193 \geq 0.05 on the variables of self-regulated learning (X_1) and mathematics learning outcomes (Y) (Table 9). The correlation coefficient value is known to be positive at 0.202 (Table 9) and is in the low category with a correlation coefficient value of 0.202 (Table 8). The correlation coefficient value is known to be positive at 0.202 (Table 9) and is in the low category with a correlation coefficient value of 0.202 (Table 8). It can be concluded that there is a positive but not significant correlation between self-regulated learning (X_1) and mathematics learning outcomes (Y). Based on Table 9 it can also be seen that the value of Sig. (2-tailed) = 0.000 \leq 0.05 on the variable of learning interest (X_2) and mathematics learning outcomes (Y) with the control variable being self-regulated learning (X_1). The correlation coefficient value is 0.548 and is positive. Thus, it means that there is a positive and significant relationship between learning interest and learning outcomes in mathematics which are controlled by self-regulated learning. The level of relationship between learning interest and learning outcomes in mathematics is in the medium category (Table 8).

4.4. Hypothesis Testing (t test and F test)

Next, hypothesis testing which includes t-test and F-test is carried out. Partial test (t-test) is a test to determine the effect of self-regulated learning and learning interest variables on mathematics learning outcomes partially. Simultaneous test (F test) was conducted to determine the simultaneous effect of self-regulated learning variables on the dependent variable in this study. Hypothesis testing was carried out with the help of the SPSS program and the results of the calculations are shown in Table 10.

Table 10. T-Test

Variable	Sig.	t_{count}	Conclusion
X_1 with Y	0,193	1,323	Self-regulated learning (X_1) does not affect mathematics learning outcomes (Y).
X_2 with Y	0,000	4,193	Learning interest (X_2) has an effect on learning outcomes in mathematics (Y).

The effect of self-regulated learning (X_1) on mathematics learning outcomes (Y) is shown by the value of Sig.=0.193 with $t_{count}=1.323$ (Table 10) where the value of Sig. $>$ 0.05 and $t_{count} = 1.323 < t_{table} = 2.020$, so it can be concluded that self-regulated learning has no significant effect on learning outcomes in mathematics. Based on the results of the calculation of the correlation test, it is known that there is a positive but not significant relationship between self-regulated learning and mathematics learning outcomes as indicated by the value of Sig. (2-

tailed) = 0.193 > = 0.05 and the correlation coefficient 0.202 is positive. So, it can be concluded that partially self-regulated learning has a positive but not significant effect on mathematics learning outcomes for 8 grade's students of SMP Negeri 24 Muaro Jambi. The results of this study are in line with research conducted by [Suhendri \(2011\)](#) which states that self-regulated learning has a positive but not significant effect on mathematics learning outcomes. This means that if self-regulated learning's value is increases, the learning outcomes of mathematics also increase. In line with this, [Suhendri \(2011\)](#) states that students who have high self-regulated learning will have high mathematics learning outcomes as well.

Another factor that also affects learning outcomes in mathematics is learning interest. Based on [Table 10](#), it is known that the effect of learning interest (X_2) on mathematics learning outcomes (Y) is indicated by the value of Sig. and t_{count} of 0.000 and 4.193. This means the value of Sig. < 0.05 and $t_{count} > t_{table} = 2,020$ then learning interest has a significant effect on learning outcomes in mathematics. In the calculation of the partial correlation test using SPSS, it was found that between learning interest and learning outcomes in mathematics there is a positive and significant relationship with the value of Sig. (2-tailed) = 0.000 < = 0.05 and the correlation coefficient is 0.548, so it can be concluded that learning interest has a positive effect on learning outcomes in mathematics. Thus, it can be concluded that learning interest has a positive and significant effect on mathematics learning outcomes for 8 grade students of SMP Negeri 24 Muaro Jambi partially. This is in line with [Usatnoby et al. \(2020\)](#) in his research which states that the relationship between learning interest and learning outcomes in mathematics is positive, so that the higher the learning interest, the higher the learning outcomes in mathematics. F test results are presented in [Table 11](#).

Table 11. F-Test

Variable	Sig.	F _{count}	Conclusion
X ₁ and X ₂ with Y	0,000	41,196	Self-regulated learning (X ₁) and learning interest (X ₂) affect mathematics learning outcomes (Y) simultaneously

Based on [Table 11](#), it is known that the value of Sig. and F_{count} which shows the effect of self-regulated learning (X_1) and learning interest (X_2) on mathematics learning outcomes (Y) simultaneously are 0.000 and 41.196. This means the value of Sig. = 0.000 < = 0.05 and F_{count} = 41,196 > F_{table} = 3,220 then simultaneously self-regulated learning and learning interest have a significant effect on learning outcomes in mathematics. The results of the multiple correlation test concluded that self-regulated learning and learning interest had a positive and significant relationship with mathematics learning outcomes as indicated by a large Sig value. F Change = 0.000 < = 0.05 and the correlation coefficient of 0.817 is positive. This resulted in simultaneous self-regulated learning and learning interest have a positive effect on learning outcomes in mathematics. This means that any increase in self-regulated learning' value and learning interest' value together will be followed by an increase in student learning outcomes in mathematics. Agree with this, the results of research conducted by [\(Edriani & Gumanti, 2021\)](#) stated that self-regulated learning and learning interest had a good impact on students' mathematics learning outcomes.

4.5. Analysis of the coefficient of determination

Simultaneously self-regulated learning and learning interest have a positive and significant effect on mathematics learning outcomes for 8 grade students of SMP Negeri 24 Muaro Jambi. The magnitude of the influence given by the variables of self-regulated learning and learning interest can be seen from the coefficient of determination shown in [Table 12](#).

Table 12. Coefficient of Determination

Variable	R Square	Percentage
X ₁ and X ₂ with Y	0,668	66,8%

Table 12 shows that the coefficient of determination is 0.668 or 66.8%. Thus, the positive and significant influence between self-regulated learning and learning interest on mathematics.

Discussion

The research findings revealed that self-regulated learning and learning interest significantly influence mathematics learning outcomes, accounting for 66.8% of the variance. This indicates the importance of these factors in improving students' performance in mathematics. Self-regulated learning is a key aspect of effective learning (Zimmerman & Schunk, 2013). According to Zimmerman's social cognitive theory of self-regulation, individuals who engage in self-regulated learning actively control and direct their own learning processes. They set goals, plan strategies, monitor their progress, and make adjustments accordingly. The positive influence of self-regulated learning on mathematics learning outcomes is consistent with Zimmerman's theory. When students take responsibility for their learning, they are more likely to engage in effective learning strategies and achieve better results.

Previous research has consistently shown the significant impact of self-regulated learning on academic achievement across various domains, including mathematics (Sun et al., 2018). For instance, a study by Cleary and Kitsantas (2017) found that students who exhibit higher levels of self-regulated learning perform better in mathematics. They demonstrated better problem-solving skills, persistence, and metacognitive awareness, which are crucial for success in mathematics.

Learning interest refers to an individual's intrinsic motivation and curiosity towards a specific subject or topic (Pekrun, 2019). Learning interest is a term used to describe an individual's natural inclination or enthusiasm for a particular subject or topic (Keller et al., 2017). It reflects their intrinsic motivation to explore, acquire knowledge, and engage with the subject matter. When someone has a strong learning interest, they are typically more curious, engaged, and willing to invest time and effort into learning and understanding that specific area (Corso et al., 2013). When students have a genuine interest in learning mathematics, they are more likely to engage in the learning process, explore concepts deeply, and persist in the face of challenges. The current study highlights the significant contribution of learning interest to mathematics learning outcomes. The results align with the intrinsic motivation theory proposed by Taylor et al. (2014), Froiland and Worrell (2016) and English (2016), which emphasizes the importance of internal motivation in promoting learning and achievement. When students are intrinsically motivated, they engage in learning activities for the inherent satisfaction and enjoyment derived from the process itself. This theory suggests that students who have a genuine interest in mathematics are more likely to invest effort, seek understanding, and ultimately perform better in the subject. Prior research has consistently demonstrated the positive relationship between learning interest and academic achievement. A study by Murayama et al. (2013) and Wilder (2014) found that students' interest in mathematics positively predicted their mathematics achievement. They suggested that interest acts as a motivational catalyst, enhancing students' willingness to invest time and effort into learning.

Although self-regulated learning and learning interest accounted for a significant proportion of the variance in mathematics learning outcomes, the study also acknowledged that 33.2% of the variance was attributed to other factors not included in the analysis. This study used a limited sample size or recruited participants from specific demographics, i.e. only from certain age groups and from certain schools. These limited samples may not be representative of the wider population, reducing the generalizability of the findings. By acknowledging and discussing the limitations of a study, readers are empowered to critically evaluate the study's conclusions, question its generalizability, and recognize the opportunities for further research. This process contributes to the advancement of knowledge and the continuous improvement of scientific inquiry. While the study focuses on self-regulated learning and learning interest, acknowledge that there may be other factors that contribute to mathematics learning

outcomes. Further research is needed to identify and explore these additional factors that contribute to mathematics learning outcomes. Potential areas of investigation could include teaching quality, classroom environment, socio-economic background, and parental support. Understanding the interplay of these factors with self-regulated learning and learning interest can provide a more comprehensive understanding of the determinants of mathematics learning outcomes.

CONCLUSION

The study highlights the significant impact of self-regulated learning and learning interest on mathematics learning outcomes. The results showed that self-regulated learning and learning interest partially had a positive effect on mathematics learning outcomes for 8th grade students of SMP Negeri 24 Muaro Jambi. Partially self-regulated learning has a positive but not significant effect on mathematics learning outcomes. It means that if self-regulated learning increases, the learning outcomes of mathematics also increases. Meanwhile, partially learning interest has a positive and significant effect on mathematics learning outcomes. It is stated that increasing learning interest will also improve learning outcomes in mathematics. On the other hand, self-regulated learning and learning interests have a positive and significant effect on mathematics learning outcomes simultaneously. The contribution of the influence of self-regulated learning and learning interest to mathematics learning outcomes is 66.8%, while 33.2% is affected by other factors not included in this study. However, it is crucial to acknowledge the existence of other factors that contribute to mathematics learning outcomes. Future research should aim to investigate these factors and their interactions with self-regulated learning and learning interest to provide a more comprehensive understanding of the dynamics at play.

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