



Self-Regulated Learning and Mindset as Predictors of Mathematics Achievement: An Ex Post Facto Study on Fourth-Grade Students

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Abstract

Persistent challenges in elementary mathematics achievement highlight the need to understand influential non-cognitive factors. While self-regulated learning (SRL) and mindset are recognized as significant predictors of academic success, their combined impact on the performance of young students is not yet fully understood. Therefore, this study investigates the independent and combined effects of self-regulated learning and mindset on the mathematics achievement of fourth-grade elementary school students. Using an ex post facto quantitative design, the study involved 34 students selected via saturated sampling. Data were collected using Likert-scale questionnaires for SRL and mindset, and academic scores for mathematics achievement. The data were analyzed using descriptive statistics and multiple linear regression, following prerequisite tests (normality, linearity, multicollinearity, and homoscedasticity). The findings revealed that self-regulated learning had a significant positive effect, explaining 81.7% of the variance in mathematics achievement ($p < 0.001$). Mindset also demonstrated a significant positive effect, accounting for 13.0% of the variance ($p = 0.013$). Combined, both variables significantly influenced mathematics achievement ($p < 0.001$), explaining 94.3% of the variance (Adjusted $R^2 = 0.943$), with the remaining 5.7% attributable to other factors. These results underscore that fostering students' ability to self-regulate their learning and cultivate a growth mindset are crucial components for effective mathematics instruction in primary education.

Keywords: self-regulated learning, mindset, mathematics achievement, elementary school students, multiple linear regression

Abstrak

Rendahnya prestasi matematika di sekolah dasar menjadi tantangan berkelanjutan yang menunjukkan perlunya memahami faktor-faktor non-kognitif yang berpengaruh. Meskipun *Self-Regulated Learning* (SRL) dan pola pikir (*mindset*) diakui sebagai prediktor penting kesuksesan akademik, pengaruh gabungan keduanya pada siswa usia dini masih belum banyak diteliti. Oleh karena itu, penelitian ini bertujuan mengkaji pengaruh *Self-Regulated Learning* dan pola pikir, baik secara parsial maupun simultan, terhadap prestasi matematika siswa kelas IV sekolah dasar. Menggunakan desain kuantitatif *ex post facto*, penelitian ini melibatkan 34 siswa yang dipilih melalui teknik sampling jenuh. Data SRL dan pola pikir dikumpulkan dengan kuesioner skala Likert, sementara prestasi matematika diukur dari nilai akademik. Analisis data menggunakan statistik deskriptif dan regresi linier berganda setelah uji prasyarat (normalitas, linearitas, multikolinearitas, dan homoskedastisitas). Hasil penelitian menunjukkan bahwa *Self-Regulated Learning* berpengaruh positif dan signifikan, menjelaskan 81,7% varians prestasi matematika (p

$< 0,001$). Pola pikir juga berpengaruh positif dan signifikan, menjelaskan 13,0% varians ($p = 0,013$). Secara simultan, kedua variabel berpengaruh signifikan terhadap prestasi matematika ($p < 0,001$) dengan kontribusi sebesar 94,3% (Adjusted $R^2 = 0,943$), sedangkan 5,7% sisanya dijelaskan oleh faktor lain. Temuan ini menegaskan bahwa pengembangan kemampuan regulasi diri dalam belajar dan pola pikir bertumbuh (*growth mindset*) merupakan komponen krusial untuk pengajaran matematika yang efektif di tingkat sekolah dasar.

Kata Kunci: Self-Regulated Learning, pola pikir, prestasi matematika, siswa sekolah dasar, regresi linier berganda.

1. INTRODUCTION

Mathematics achievement in elementary school serves as a critical gateway to future opportunities in science, technology, engineering, and mathematics (STEM), while also fostering essential life skills such as logical reasoning and problem-solving. Despite its importance, ensuring high levels of mathematics proficiency among young learners remains a persistent global challenge (Ningsih et al., 2022). For decades, educational research has sought to identify the key drivers of academic success. While cognitive ability is undeniably a factor, a growing consensus highlights that it alone is insufficient to explain the wide variance in student performance. This has led to a crucial shift towards examining non-cognitive factors, with research demonstrating that students' beliefs, behaviors, and learning strategies are powerful determinants of their academic trajectory (Hattie, 2009; Duckworth & Yeager, 2015).

Among the most influential non-cognitive constructs are self-regulated learning (SRL) and mindset. Self-regulated learning refers to the proactive and cyclical process through which students set goals, select and apply learning strategies, monitor their progress, and reflect on their outcomes to guide future efforts (Zimmerman, 2002). In the context of mathematics, a self-regulated learner does not passively receive information; they actively manage their study time, seek help when confused, persist through challenging problems, and evaluate the effectiveness of their problem-solving methods. These skills are not innate and are often underdeveloped in elementary students, making the study of SRL at this level particularly important (Panadero, 2017).

Parallel to SRL is the concept of mindset, a theoretical framework developed by Carol Dweck (2006). Mindset refers to an individual's core beliefs about their own intelligence and abilities. Students with a fixed mindset believe that intelligence is a static, unchangeable trait, causing them to view effort as fruitless and to avoid challenges that might reveal their perceived limitations. Conversely, students with a *growth mindset* believe that intelligence can be developed through dedication and hard work. This belief encourages them to embrace challenges, see effort as the path to mastery, and learn from criticism and failure. In mathematics, a subject often erroneously associated with "innate talent," a student's mindset can profoundly impact their resilience and willingness to engage with difficult material (Boaler, 2016; Yeager & Dweck, 2020).

Despite extensive research validating the independent benefits of SRL (Panadero, 2017) and a growth mindset (Yeager & Dweck, 2020), a significant gap lies in the lack of studies examining their combined and synergistic influence. Educational research and

interventions often address these factors in a siloed manner—focusing either on teaching SRL strategies or on fostering a growth mindset. This approach fails to capture the reality that a student's willingness to apply effortful strategies (SRL) is likely dependent on their belief that such effort will yield results (mindset). By analyzing them only in isolation, we may be underestimating their true combined power. This study addresses this gap by providing a holistic analysis that investigates whether the whole is indeed greater than the sum of its parts.

Addressing this gap is urgent. The elementary years represent a critical window for intervention where fostering a growth mindset and teaching self-regulation skills can have a lasting impact on a student's entire academic journey. Therefore, this study aims to provide a more holistic understanding by examining the independent and combined effects of self-regulated learning and mindset on the mathematics achievement of fourth-grade students.

Based on the theoretical review and conceptual framework developed in this study, three hypotheses were formulated:

H₁: Self-regulated learning has a positive and significant effect on the mathematics achievement of fourth-grade elementary school students.

H₂: Mindset has a positive and significant effect on the mathematics achievement of fourth-grade elementary school students.

H₃: Self-regulated learning and mindset jointly have a positive and significant effect on the mathematics achievement of fourth-grade elementary school students.

2. METHOD

The research was carried out utilizing a quantitative approach rooted on an ex post facto methodology, which permits the investigation of inherent relationships unaffected by experimental intervention (Sugiyono, 2022). The purpose of the research was to examine how fourth graders' mathematical performance was impacted by their mentality and ability to self-regulate their learning. The study, which included 34 students, took place in the fall of the 2024–2025 school year. Despite the limited sample size, a comprehensive sampling strategy was used to ensure that every single person of the population was included for the research (Sugiyono, 2022). The conceptual framework of this study covers two independent variables in this model and one dependent variable. This independent variables are self-regulated learning (X_1) and mindset (X_2), while mathematics achievement (Y) served as the dependent variable.

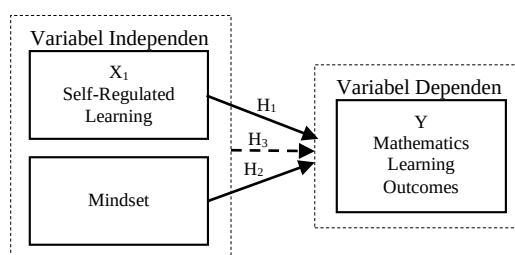


Figure 1. Research Design

Questionnaires and documentation served as the principal methods for collecting data in the present study (John W. Creswell & J. David Creswell, 2025). The questionnaires were administered to assess students' self-regulated learning and mindset, whereas documentation was used to obtain data on students' mathematics achievement.

The research instruments were developed based on the indicators of self-regulated learning derived from Zimmerman's theoretical framework and the mindset indicators adapted from Dweck's Mindset Theory. In constructing the instruments, particular attention was given to the developmental stage of elementary school students to ensure that each indicator accurately reflected the constructs under investigation. The instrument blueprint is presented in Table 2.

Table 1. Research Instrument Blueprint

Variable	Aspect	Indicator
Self-Regulated Learning (X_1)	Planning	Setting mathematics learning goals; developing learning strategies
	Monitoring	Monitoring understanding of mathematical concepts; identifying learning difficulties
	Reflection	Evaluating learning outcomes; identifying errors in mathematical problem solving
	Motivation	Demonstrating motivation toward mathematics learning; maintaining persistence in learning activities
Mindset (X_2)	Beliefs About One's Abilities	Believing that mathematical ability can be developed; demonstrating confidence in mathematics learning
	Responses to Challenges and Difficulties	Making efforts to solve challenging problems; viewing difficulties as opportunities for learning

	The Role of Effort in Learning	Believing that effort contributes to success; being willing to practice to improve mathematical competence
	Self-Confidence	Demonstrating optimism toward academic success; showing confidence in mathematics learning
Mathematics Achievement (Y)	Cognitive Achievement	Students' mathematics assessment scores

The research instruments employed a five-point Likert scale with the following response categories: Strongly Disagree (1), Disagree (2), Neutral (3), Agree (4), and Strongly Agree (5). The Self-Regulated Learning (X_1) instrument consisted of 16 items, resulting in a theoretical score range of 16–80. Similarly, the Mindset (X_2) instrument comprised 16 items with a theoretical score range of 16–80. Higher scores indicate higher levels of self-regulated learning and a more positive mindset among students. In addition to the questionnaires, students' mathematics assessment scores were collected from their mathematics quizzes to measure mathematics achievement. Prior to data collection, the instruments underwent validity and reliability testing to ensure their accuracy and consistency in measuring the intended research constructs.

This validity of the research instruments was assessed using the Corrected Item–Total Correlation method to determine whether each item was capable of accurately measuring the intended construct (Ghozali, 2021). The evaluation of instrument validity was carried out through JASP statistical software. An item was retained as valid if its Corrected Item–Total Correlation coefficient surpassed the minimum threshold of 0,30.

The results of the validity analysis indicate that all items in the Self-Regulated Learning and Mindset instruments met the established validity criteria, as the corrected item-total correlation coefficients for all items exceeded the minimum threshold of 0.30. The item correlation coefficients for the Self-Regulated Learning instrument ranged from 0.363 to 0.944, whereas those for the Mindset instrument ranged from 0.455 to 0.911. These findings suggest that all questionnaire items were capable of accurately measuring the intended constructs. Therefore, all items were considered valid and were retained for subsequent analyses.

Following the confirmation of instrument validity, reliability testing was conducted to evaluate the consistency of the instruments in measuring the research constructs. The internal consistency of the research instruments was examined with the aid of JASP software. Reliability was evaluated based on Cronbach's Alpha coefficients, and instruments achieving values above 0.70 were considered sufficiently reliable for data collection purposes. The results of the analysis are displayed in Tables 2 and 3.

Table 2. Reliability Testing Results for the Self-Regulated Learning Instrument (X_1)*Frequentist Scale Reliability Statistics*

Coefficient	Estimate	Std. Error	95% CI	
			Lower	Upper
McDonald's ω	0.9661	0.006861	0.9509	0.9774
Cronbach's α	0.9550	0.007971	0.9360	0.9667

Table 3. Reliability Testing Results for the Mindset Instrument (X_2)*Frequentist Scale Reliability Statistics*

Coefficient	Estimate	Std. Error	95% CI	
			Lower	Upper
McDonald's ω	0.9595	0.008737	0.9403	0.9732
Cronbach's α	0.9526	0.009935	0.9286	0.9662

The reliability analysis revealed that the Self-Regulated Learning instrument obtained a Cronbach's Alpha coefficient of 0.955, while the Mindset instrument achieved a coefficient of 0.953. Both values substantially exceeded the recommended threshold of 0.70, indicating an excellent level of internal consistency. Therefore, both instruments were deemed reliable and suitable for use in the data collection process.

The analysis of the collected data proceeded through a number of stages. An initial descriptive statistical analysis was performed to characterize students' levels of Self-Regulated Learning, Mindset, and Mathematics Achievement (Sugiyono, 2022). Before conducting regression analysis, the dataset was evaluated against several statistical assumptions through tests of normality, linear relationships, multicollinearity, and homoscedasticity to ensure the appropriateness of the regression model (Ghozali, 2021).

We used multiple linear regression analysis to look at the hypotheses after we finished testing the assumptions (Ghozali, 2021). The study made use of a number of statistical methods. To evaluate the interrelationships of the research variables, Pearson correlation coefficients were computed. We used t-tests to look at how each predictor variable affected math achievement to a certain extent, and an F-test to see how Self-Regulated Learning and Mindset affected math achievement together. Furthermore, in order to measure the extent to which the independent factors accounted for the variance in students' Mathematics Achievement, the coefficient of determination (R^2) was used (Ghozali, 2021).

3. RESULT

Descriptive Statistics Analysis

Prior to running the hypothesis tests, descriptive statistics were computed to get a broad comprehension of the dataset. We used metrics of central tendency and dispersion, such as the mean, standard deviation, minimum score, and maximum score, to explain the variables of self-regulated learning, mindset, and mathematics achievement. Table 5 provides a comprehensive overview of these descriptive results

Table 4. Descriptive Statistics

Variable	N	Mean	SD	Minimum	Maximum
Self-Regulated Learning (X_1)	34	61,50	5,539	48	71
Mindset (X_2)	34	56,62	4,954	47	66
Mathematics Achievement (Y)	34	92,32	2,804	87	97

As shown in Table 4, the mean score for Self-Regulated Learning was 61.50, with scores ranging from 48 to 71. The mean Mindset score was 56.62, with a range of 47 to 66. Meanwhile, Mathematics Achievement had a mean score of 92.32, with scores ranging from 87 to 97. These findings indicate that, on average, the students demonstrated relatively high levels of Self-Regulated Learning, Mindset, and Mathematics Achievement.

Assumption Testing

Prior to hypothesis testing, a series of assumption tests was conducted to ensure that the data satisfied the provisions of multiple linear regression analysis. This test included assessments of normality, linearity, multicollinearity, and homoscedasticity.

Table 5. Results of Residual Normality Testing Using JASP

Test	Statistic	p
Kolmogorov-Smirnov	0.09306	.930
Shapiro-Wilk	0.9756	.629

The residuals were found to have a normal distribution, according to the normality tests. A significance level of 0.930 was achieved by the Kolmogorov-Smirnov test and a significance level of 0.629 by the Shapiro-Wilk test. Both results were deemed to have met the normalcy assumption as they were greater than the significance level of 0.05. Additional evidence for this finding came from the residual histogram and Q-Q plot, which demonstrated a normal distribution for the residuals.

Furthermore, both the Mindset and Mathematics Achievement correlations and the Self-Regulated Learning relationship were found to be linear according to the linearity test. Because of this, multiple linear regression analysis was considered suitable for this research.

The findings of the multicollinearity test demonstrated that the predictor variables were sufficiently independent of each other. As a result, Self-Regulated Learning and Mindset were retained together in the regression model for subsequent analyses. Furthermore, the homoscedasticity test showed that the residuals were randomly dispersed without forming any systematic pattern. The combined results of the assumption tests suggest that the data satisfied all criteria necessary for multiple linear regression, thereby providing a sound basis for subsequent hypothesis testing.

Multiple Linear Regression Analysis

Pearson Correlation Analysis

A Pearson correlation analysis run for testing purposes direction and strength of a relationship among Self-Regulated Learning, Mindset, and Mathematics Achievement. A summary of the Pearson correlation results is presented in Table 6.

Table 6. Results of Pearson Correlation Analysis

<i>Pearson's Correlations</i>			Pearson's r	p
X1 : Self-Regulated Learning	-	Y: Mindset	0.744***	< .001
X1 : Self-Regulated Learning	-	Y : Mathematics Achievement	0.967***	< .001
: Mindset	-	Y : Mathematics Achievement	0.792***	< .001

* $p < .05$, ** $p < .01$, *** $p < .001$

The results presented in Table 6 indicate that Self-Regulated Learning has a strong positive correlation with mindset ($r = 0.744$, $p < 0.001$). Moreover, Self-Regulated Learning demonstrated a positive and strong correlation with Mathematics Achievement ($r = 0.967$, $p < 0.001$). Mindset was also has as positive relationship with strongly students matematics Achievement ($r = 0.792$, $p < 0.001$).

These findings shows students that with a level of Self-Regulated Learning and a more positive Mindset tend to achieve higher levels of Mathematics Achievement. The significant positive correlations observed among the variables provide preliminary evidence supporting the proposed relationships examined in this study.

Results of the *t*-Test (Partial Effects)

To test the first hypothesis, Self-Regulated Learning was entered into the regression model as a predictor of Mathematics Achievement. The significance of its contribution was determined using the *t*-test procedure, with the corresponding results summarized in Table 7.

Table 7. Results of the *t*-Test for Partial Effects

Coefficients

Model		Unstandardized	Standard Error	Standardized	t	p	95% CI	
							Lower	Upper
M ₀	(Intercept)	92.32	0.481		192.0	< .001	91.35	93.30
M ₁	(Intercept)	60.77	1.409		43.14	< .001	57.90	63.64
	X1 : Self-Regulated Learning	0.428	0.031	0.845	13.62	< .001	0.364	0.492
	: Pola Pikir	0.093	0.035	0.164	2.644	.013	0.021	0.164

With a significance level below 0.001, as shown in Table 7, H₁ was accepted. This stands for Self-Regulated Learning. The findings show that there is a statistically significant relationship between students' mathematics achievement and self-regulated learning inside the regression model. High levels of self-regulation of learning are linked to better levels of mathematical success, according to the regression coefficient of 0.428. In addition, SRL had a significant role in predicting students' mathematical ability, accounting for an effective 81.7% of the variation explained in students' Mathematics Achievement.

Results of the *F*-Test (Simultaneous Effect)

The third hypothesis was tested to examine the combined effect of Self-Regulated Learning and Mindset on students' Mathematics Achievement. This hypothesis was evaluated using the *F*-test within the multiple linear regression model. A summary of the results is presented in Table 8.

Table 8. Results of the *F*-Test

Model		Sum of Squares	df	Mean Square	F	p
M ₁	Regression	245.6	2	122.8	275.2	< .001

Model	Sum of Squares	df	Mean Square	F	p
Residual	13.83	31	0.446		
Total	259.4	33			

As presented in Table 8, the F -test yielded an F value of 275.2 with a significance level of less than 0.001. Since the obtained significance value was well below the threshold of 0.05, H_3 was accepted. This result indicates that Self-Regulated Learning and Mindset jointly exert a positive and statistically significant effect on the Mathematics Achievement of fourth-grade elementary school students.

These findings suggest that students' Mathematics Achievement is not determined by a single factor but rather by the combined influence of their ability to regulate their learning processes and their positive beliefs about their capacity to learn mathematics. In other words, students are more likely to achieve higher levels of Mathematics Achievement when they possess both strong self-regulated learning skills and a positive mindset toward learning.

Coefficient of Determination (R^2)

The coefficient of determination (R^2) was calculated to assess the extent to which Self-Regulated Learning and Mindset explained the variance in students' Mathematics Achievement. The coefficient of determination serves as an indicator of the model's explanatory capacity by quantifying how much variation in the outcome variable is accounted for by the predictors. The results obtained from this analysis are reported in Table 10.

Table 9. Coefficient of Determination

Model Summary - Y								
Model	R	R ²	Adjusted R ²	RMSE	R ² Change	df1	df2	p
M ₀	0.000	0.000	0.000	2.804	0.000	0	33	
M ₁	0.973	0.947	0.943	0.668	0.947	2	31	< .001

Note. M₁ includes X₁ : Self-Regulated Learning, : Pola Pikir

According to Table 9, the model achieved an R^2 value of 0.947 and an adjusted R^2 value of 0.943. This demonstrates that self-regulated learning and mindset possess substantial explanatory power, jointly explaining 94.7% of the variability in students' mathematics achievement. After adjusting for the number of independent variables and sample size, the adjusted R^2 value remained high at 0.943, indicating that these two predictors together account for 94.3% of the variation in mathematics achievement. The other 5.7% of the variance can be attributed to additional factors that were not incorporated into the

regression model. These findings suggest that Self-Regulated Learning and Mindset are significant predictors of Math Achievement among fourth-grade elementary school students and collectively provide a robust explanatory model for students' academic performance in mathematics.

4. DISCUSSION

This study investigated the combined influence of self-regulated learning (SRL) and mindset on mathematics achievement, revealing that these non-cognitive factors are powerful predictors of student success. The findings not only confirm the individual importance of each construct but also highlight their synergistic relationship in the context of elementary mathematics education.

The Dominant Role of Self-Regulated Learning

The substantial contribution of self-regulated learning (81.7%) underscores that the process of learning is as critical as, if not more critical than, inherent ability. This finding aligns strongly with Zimmerman's (2002) conceptualization of SRL, where students who actively plan, monitor, and reflect on their learning achieve superior outcomes. The mechanism behind this powerful effect likely lies in the practical application of these skills in mathematics. For a fourth-grader, this translates into tangible actions such as breaking down multi-step word problems, checking calculations for errors, allocating study time before a test, and seeking help from a teacher when a concept is not understood. These are not passive behaviors; they are deliberate strategies that directly combat common points of failure in mathematics.

This result is consistent with a large body of research demonstrating a robust link between SRL and academic performance across various domains (Panadero, 2017; Schunk & DiBenedetto, 2020). While some studies may report smaller effect sizes, the particularly large contribution found here may be attributable to the developmental stage of the sample. At the elementary level, self-regulatory skills are still emerging and vary widely among students (De Ruig et al., 2023). Consequently, students who have developed even basic SRL strategies possess a significant advantage over their peers who have not, leading to a more pronounced impact on their achievement scores.

The Foundational Importance of Mindset

Although its individual contribution was smaller (13.0%), mindset remains a statistically significant predictor of mathematics achievement. This finding supports Carol Dweck's seminal theory, which posits that a student's belief about their intelligence shapes their academic behaviors (Yeager & Dweck, 2020). The result can be interpreted through the lens of resilience. Mathematics is a subject where students frequently encounter challenges and make mistakes. As argued by Boaler (2016), students with a growth mindset view these challenges not as a verdict on their fixed ability, but as opportunities to learn and improve. They are more likely to persist, try different strategies, and maintain motivation.

Conversely, students with a fixed mindset may interpret difficulty as a sign that they are "not a math person," leading to decreased effort and task avoidance. This finding aligns with previous studies showing a positive correlation between a growth mindset and academic persistence (Dong et al., 2023). The reason its contribution is smaller than SRL may be that mindset is a foundational belief, an "enabler" of productive behaviors, whereas SRL encompasses the productive behaviors themselves. Mindset is the psychological fuel, but SRL is the engine in motion.

The Combined Effect of Self-Regulated Learning and Mindset on Mathematics Achievement

Perhaps the most crucial finding of this study is the powerful combined effect of SRL and mindset, which together explained 94.3% of the variance in mathematics achievement. This demonstrates a profound synergy between believing one can improve (mindset) and knowing how to do so (SRL). This result provides empirical support for the theoretical model proposed by Burnette et al. (2013), which suggests that a growth mindset energizes the self-regulation process.

A growth mindset provides the "why" (the belief that effort will lead to mastery), while SRL provides the "how" (the concrete strategies to apply that effort effectively). A student with a growth mindset but no self-regulation skills may be willing to try but lack the methods to succeed. Conversely, a student taught SRL strategies but holding a fixed mindset may abandon those strategies at the first sign of significant struggle. It is the combination of both—the resilient belief and the strategic action—that creates a robust and effective learner. This highlights that interventions in mathematics education should not treat these as separate issues but should aim to foster a growth mindset while simultaneously teaching explicit self-regulation strategies.

Limitations of the Study

The findings of this study should be considered in light of its methodological limitations. The primary limitation is the small sample size ($N=34$), which was a result of employing a saturated sampling technique on a specific cohort of fourth-grade students at one elementary school. While this approach eliminates sampling error and provides a highly accurate depiction of the dynamics within this particular group, it inherently limits the generalizability of the results. The strong effects observed may be specific to the demographic and educational context of the participating school.

Therefore, caution should be exercised when applying these findings to broader or more diverse student populations. Future research is needed to replicate this study with larger samples drawn from multiple schools and varied socioeconomic backgrounds. Such studies would enhance the external validity of the findings and provide a more robust understanding of the synergistic relationship between self-regulated learning and mindset in mathematics achievement.

5. CONCLUSION

Based on the data analysis and discussion, this study concludes that both self-regulated learning and mindset are significant positive predictors of mathematics achievement among fourth-grade students. Self-regulated learning was found to be the most dominant factor, highlighting that students' ability to strategically manage their own learning process is paramount to their success. Furthermore, the powerful synergistic effect observed when both variables were combined underscores a critical insight: the belief that one can improve (a growth mindset) and the skills to effectively do so (self-regulation) are deeply intertwined.

The primary implication of these findings is that efforts to improve elementary mathematics achievement should move beyond purely cognitive instruction. Educators are encouraged to adopt a holistic approach that simultaneously fosters a growth mindset in the classroom culture while explicitly teaching students practical self-regulation strategies. Cultivating students who believe in their capacity for growth and possess the tools to direct their own learning is fundamental to building a robust foundation for their future academic journey.

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