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THE RELATIONSHIP BETWEEN SELF-REGULATED LEARNING AND STUDENT'S MATHEMATICS ACHIEVEMENT

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ABSTRACT
Mathematics learning achievement reflects students' ability to understand and apply concepts; however, in reality, many students have not yet reached optimal results. This condition emphasizes the importance of considering internal factors that influence academic performance, one of which is self-regulated learning (SRL), defined as students' ability to plan, monitor, and evaluate their learning process independently. This study aims to examine the relationship between SRL and students' mathematics learning achievement. The method used is quantitative with an ex-post facto design. The population consisted of all seventh-grade students of SMPN 4 Klari in the 2024/2025 academic year, with a sample of 87 students selected using simple random sampling. The research instruments were an SRL scale and mathematics midterm exam scores, while data analysis was conducted using Spearman's rank correlation test. The results showed a correlation coefficient (rs) of 0.308 with a significance level of 0.004 ($\rho < 0{,}05$), indicating a significant positive (direct) relationship between SRL and mathematics learning achievement with a weak correlation. The results demonstrate that the higher the students' SRL, the better their mathematics learning achievement.

Keywords: academic achievement; mathematics; self-regulated learning

ABSTRAK
Prestasi belajar matematika mencerminkan kemampuan siswa dalam memahami dan menerapkan konsep, namun kenyataannya masih banyak siswa yang belum mencapai hasil optimal. Kondisi ini menegaskan pentingnya memperhatikan faktor internal yang memengaruhi capaian akademik, salah satunya adalah self-regulated learning (SRL), yaitu kemampuan siswa dalam merencanakan, memantau, dan mengevaluasi proses belajar secara mandiri. Penelitian ini bertujuan untuk mengkaji hubungan antara SRL dan prestasi belajar matematika siswa. Metode yang digunakan adalah kuantitatif dengan desain ex-post facto. Populasi penelitian mencakup seluruh siswa kelas VII SMPN 4 Klari Tahun Ajaran 2024/2025, dengan sampel sebanyak 87 siswa yang dipilih melalui teknik simple random sampling. Instrumen penelitian berupa skala SRL dan nilai UTS matematika, sedangkan analisis data dilakukan menggunakan uji korelasi rank Spearman rho. Hasil penelitian menunjukkan koefisien korelasi (rs) sebesar 0,308 dengan taraf signifikansi 0,004 ($\rho < 0{,}05$)*, yang menunjukkan adanya hubungan positif (searah) yang signifikan antara SRL dan prestasi belajar matematika dengan tingkat hubungan yang lemah. Hasil penelitian menunjukkan bahwa semakin tinggi tingkat SRL siswa, maka semakin baik prestasi belajar matematika yang dicapai.*
***Kata kunci**: matematika; prestasi akademik; self-regulated learning*

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Introduction

Academic achievement refers to an individual's attainment or level of success in reaching learning objectives as a result of optimal learning efforts. This achievement is typically represented in the form of grades or scores and serves as an important indicator of learning success in schools (Sa'adah & Ariati, 2018) . Azwar explains that evaluation can be conducted through various forms, such as daily tests, formative assessments, summative tests, national examinations, or university entrance selections (Anas & Alsa, 2016) . These evaluations reflect students' ability to understand, analyze, and apply the concepts they have learned. Therefore, academic achievement not only indicates students' success in obtaining final grades but also demonstrates their capacity to internalize knowledge and apply it in various contexts (Thabroni, 2022).

Academic achievement is not only important for students individually but also serves as an indicator of the effectiveness of the education system. However, in reality, many students still face challenges in achieving optimal learning outcomes (Pramesti & Prasetya, 2021) . This highlights the need for an in-depth study of the factors influencing academic performance. The literature indicates that academic achievement is affected by both internal and external factors (Hastuti & Yoenanto, 2018; Wibowo et al., 2021 ; Akbar et al., 2022) . Salemeto asserts that external factors, such as the school environment, family, and society, have a significant contribution (Akbar et al., 2022) . On the other hand, internal factors, such as self-regulated learning (SRL), also play a crucial role in supporting students' learning success (Sari, 2021). Learning initiatives, monitoring, organizing, and controlling learning, learning continuity, and evaluating the learning process and outcomes, which are indicators of student learning independence (Indriyani et al., 2020). For students who do not yet have a high level of learning independence, educators must actively instruct students to research the material to be studied or work on problems in textbooks (Hidayah et a., 2019).

Self-regulated learning (SRL) refers to students' ability to manage themselves throughout the learning process, including monitoring, managing, and controlling cognitive, motivational, and behavioral aspects of learning (Lestari & Yudhanegara, 2017) . Tahar and Enceng argue that SRL represents an attitude that enables individuals to act based on internal motivation while being able to regulate themselves in solving problems and taking responsibility for their actions (Dewi et al., 2020). Pintrich further explains that SRL is an active learning process in which students set goals, monitor, and control their learning continuously, while also creating an environment that facilitates effective learning (Anas & Alsa, 2016) . Yamin also emphasizes that SRL plays a crucial role in contributing to academic achievement (Siagian et al., 2020).

Although SRL is important, in reality, many students exhibit low levels of SRL due to a lack of awareness for independent learning (Ambiyar et al., 2020) . Previous studies (Kurnia & Warmi, 2020; Febriyanti & Imami, 2021; Ghassani et al., 2023) have also reported that students' SRL in mathematics remains suboptimal. In mathematics learning, SRL is particularly crucial because the subject requires deep understanding and independent application, rather than mere memorization (Tamrin et al., 2024) . In line with this, Zamnah explains that implementing SRL enables students to manage the learning process based on an understanding of

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effective strategies, allowing them to apply these strategies appropriately during learning activities (Sari et al., 2023).

The researcher's observations during the FKIP Mengajar activities at SMPN 4 Klari indicated a low level of SRL among students. Many students still rely heavily on teacher instructions, show little initiative for independent learning, and exhibit unproductive habits, such as completing homework at school. This is reflected in the results of daily tests, where the majority of students did not achieve the Minimum Competency Criteria (KKM) of 75. In class VII B, out of 44 students, only 12 met the criteria, with an average score of 57.9. Meanwhile, in class VII D, which consisted of 43 students, only 17 students met the criteria, with an average score of 64.8. Although the average score in class VII D was higher, both classes still face significant challenges in achieving optimal academic performance, as most students did not reach the expected scores.

Further observations revealed that students with low scores generally did not apply SRL in their learning. These students tended to be inattentive during teacher explanations, showed little interest in the material, were passive in learning activities, and depended heavily on teacher guidance. In contrast, students who achieved high scores exhibited stronger SRL characteristics, such as taking initiative in learning, effectively managing their time, and actively participating in discussions and task completion. This indicates that learning success is strongly influenced by students' ability to independently and consistently regulate their learning strategies.

One factor contributing to low SRL is the continued use of conventional learning methods, which tends to make students passive. In the digital era, students have access to numerous online learning resources that could be utilized, yet their use remains very limited (Sakti, 2023). Moreover, although many studies have shown that students with high SRL tend to achieve better academic performance than those with low SRL (Anas & Alsa, 2016; Sari & Satwika, 2018; Sholiha et al., 2022) , some studies report different findings, indicating no significant relationship between SRL and academic achievement (Supriyanto, 2017; Marlibi et al., 2021). This inconsistency suggests that the relationship between SRL and academic performance is not entirely consistent across different contexts.

Based on the previous discussion, there appears to be a gap that requires further investigation to obtain a clearer understanding of the relationship between SRL and academic achievement in different contexts. Therefore, this study aims to examine the relationship between SRL and mathematics academic performance among junior high school students. The findings of this study are expected to contribute to the literature by strengthening the understanding of the role of SRL in supporting academic achievement.

Research Methods

This study employed a quantitative approach using the ex-post facto method, as the data analyzed were derived from events that had already occurred without any treatment or intervention by the researcher. This method was chosen to examine the relationship between self-regulated learning (SRL) and mathematics academic achievement without manipulating any variables. The limitation of this method is that it does not allow the researcher to draw definitive causal

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conclusions, only indicating correlations between variables. The research stages included planning, determining the population and sample, data collection through documentation and questionnaires, data processing with ranking for ordinal data, and data analysis using descriptive statistics and Spearman's rho correlation test.

The study was conducted at SMPN 4 Klari, with a population consisting of all seventh-grade students, totaling 477 students. Seventh grade was selected as the population because students at this level are transitioning from elementary to middle school, requiring a higher level of learning independence. The sample was selected using a simple random sampling technique, which provides an equal chance for each student in the population to be chosen.

The representative sample size was determined using Slovin's formula as follows:

$$n = \frac{N}{1+N(e)^2} \tag{1}$$

where:
n = sample size
N = population size
e = *margin of error* (10%)
With a population of N = 477 and e = 0.1, the calculation is:

$$n = \frac{N}{1+N(e)^2} = \frac{477}{1+477(0,1)^2} = \frac{477}{1+4,77} = 82,7 \approx 83 \text{ students} \tag{2}$$

Based on the calculation in equation (2), the minimum required sample size is 83 students. However, this study involved 87 students from two classes, namely VII B (44 students) and VII D (43 students), to anticipate potential missing or incomplete data.

The research instruments consisted of two types. First, the Mid-Semester Examination (UTS) scores for the odd semester of the 2024/2025 academic year on the integer material, consisting of 15 questions, were used as a measure of students' mathematics academic achievement. Second, a self-regulated learning (SRL) scale containing 30 statements, with 15 positive and 15 negative items, was adopted from Najilah (2022) . The scale used a four-point response format: strongly agree (SA), agree (A), disagree (D), and strongly disagree (SD). Positive statements were scored from 1 to 4, while negative statements were reverse-scored to maintain consistency in the evaluation direction. The SRL scale was developed based on eight indicators proposed by Heris Hendriana, namely: 1) initiative in learning, 2) identification of learning needs, 3) goal setting in learning, 4) utilization of learning resources, 5) selection of learning methods and evaluation of outcomes, 6) collaboration, 7) construction of meaningful understanding, and 8) self-control in the learning process.

Data were collected by directly administering the SRL scale to students, while the UTS scores were obtained from the subject teachers' documentation. Since the SRL scale data are ordinal, they cannot be analyzed directly. Therefore, the data were converted into ranks to provide equal intervals, enabling mathematical operations $(+, -, \times, \div)$ and statistical analysis (Lestari & Yudhanegara, 2017).

Data analysis was conducted in two stages. First, descriptive statistics were used to present an overview of the research data without aiming to draw generalizable conclusions (Sugiyono, 2019) . Second, Spearman's rank correlation test was employed to examine the relationship between self-regulated learning

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and mathematics academic achievement. This test was chosen because it does not require normal distribution and can be applied to ordinal data or a combination of ordinal and numerical data (Yudihartanti, 2018). To ensure accurate and efficient analysis, the data were processed using IBM SPSS Statistics 25 software.

The strength of the relationship between variables was determined based on the correlation coefficient (r), which was classified according to Guilford's criteria, as presented in Table 1 below:

Table 1. Correlation Coefficient Criteria According to Guilford's Empirical Rules

Correlation Coefficient (r)	Interpretation
$0{,}00 < r < 0{,}20$	Very Weak
$0{,}20 \leq r < 0{,}40$	Weak
$0{,}40 \leq r < 0{,}70$	Moderate
$0{,}70 \leq r < 0{,}90$	Strong
$0{,}90 \leq r \leq 1{,}00$	Very strong

The hypotheses used in the Spearman's rank correlation test are as follows:

$H_0 : \rho = 0$, there is no significant relationship between self-regulated learning and mathematics academic achievement

$H_1 : \rho \neq 0$, there is a significant relationship between self-regulated learning and mathematics academic achievement

The decision-making in the correlation test is based on the significance value (Sig.) with the following criteria:

If Sig. < 0.05, H_0 is rejected

If Sig. ≥ 0.05, H_0 is not rejected

The direction of the relationship is determined by the sign of the correlation coefficient. A positive coefficient indicates a direct relationship, meaning that an increase in self-regulated learning is followed by an increase in academic achievement. Conversely, a negative coefficient indicates an inverse relationship, meaning that an increase in self-regulated learning is followed by a decrease in academic achievement. The strength and direction of the relationship between variables are considered meaningful only if statistically significant, as determined by the Sig. (2-tailed) value. The relationship is considered significant if Sig. (2-tailed) is less than 0.05 or 0.01; otherwise, the relationship is considered not significant.

Results and Discussion

This study used the Mid-Semester Examination (UTS) scores for the 2024/2025 academic year on the integer material, consisting of 15 questions, as a measure of mathematics academic achievement. In addition, a self-regulated learning (SRL) scale containing 30 statements was employed. Since the SRL data are ordinal, they cannot be analyzed directly. Therefore, the data were first converted into ranks using Microsoft Excel 2016, ensuring equal intervals between data points and allowing for further mathematical operations.

After the ranking process, the data were analyzed descriptively to obtain an overview of students' academic achievement and SRL levels. Descriptive statistics

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included the minimum, maximum, mean, and standard deviation values. The results are presented in Table 2.

Tabel 2. Descriptive Statistics

	N	Minimum	Maximum	*Mean*	*Std. Deviation*
SRL	87	35	89	58,10	11,171
Prestasi Belajar	87	21	100	65,53	17,782
Valid N *(listwise)*	**87**				

Based on Table 2, the average SRL score was 58.10, with a minimum of 35, a maximum of 89, and a standard deviation of 11.171. Meanwhile, mathematics academic achievement measured through UTS scores showed a mean of 65.53, with a minimum of 21, a maximum of 100, and a standard deviation of 17.782. The mean score approaches the applicable Minimum Competency Criteria (KKM), but there is still considerable variation among students, as indicated by the wide score range and relatively high standard deviation.

The next stage was to examine the relationship between the two variables using Spearman's rank correlation test. This test was selected because the SRL data were ordinal and ranked, while the UTS scores were numerical. The test was used because the ranked data retain their ordinal properties even after equalizing the intervals between data points. The results of the correlation test are presented in Table 3.

Tabel 3. Spearman's Rank Correlation between SRL and Academic Achievement

Correlations

			SRL Score Rank	Academic Achievement
Spearman's rho	SRL Score Rank	Correlation Coefficient	1,000	,308**
		Sig. (2-tailed)	.	,004
		N	87	87
	Academic Achievement	Correlation Coefficient	,308**	1,000
		Sig. (2-tailed)	,004	.
		N	87	87

Based on Table 3, the significance value (Sig.) was 0.004, which is smaller than the significance level of 0.05. Therefore, H_0 is rejected, and it can be concluded that there is a statistically significant relationship between self-regulated learning (SRL) and mathematics academic achievement. The significance value below 0.05 reinforces that this relationship did not occur by chance but is statistically meaningful. The Spearman's rank correlation coefficient of 0.308 falls within the range of $0{,}20 \leq r < 0{,}40$, which, according to the classification in Table 1, indicates a weak correlation. Nevertheless, it still shows a positive direction: the higher the students' SRL, the higher their mathematics achievement. Conversely, students with low SRL tend to have lower academic performance.

This condition can be influenced by several factors. First, some students still demonstrate low learning independence, evident in their reliance on teacher

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instructions and passive behavior during learning. Second, basic mathematics skills, such as arithmetic operations and multiplication, have not been optimally mastered, which hinders the resolution of more complex problems. Third, the predominantly conventional teaching methods limit students' opportunities to consistently apply independent learning strategies.

The findings of this study are consistent with those of Arsyad et al. (2022) and Sholiha et al. (2022) , which indicate a positive contribution of SRL to mathematics academic achievement. Students with high SRL tend to be more proactive, capable of regulating their learning strategies, and consistent in utilizing study time. Conversely, students with low SRL rely on teacher instructions and are less productive in independent learning, resulting in lower achievement. These results are also supported by classroom observations, where students with low SRL exhibited passive behavior and inattention, while students with high SRL were more active in discussions, managed their time effectively, and completed tasks independently.

Academic achievement reflects students' success in learning activities, measured according to established standards (Harahap, 2024) . Assessment can take the form of numerical scores, letter grades, or descriptive evaluations that illustrate students' abilities over a specific period (Sari et al., 2023) . Thus, academic achievement not only represents students' academic performance but also their mastery of the learning content provided.

Theoretically, the findings of this study reinforce the concept that SRL is an internal factor contributing to academic achievement. Pintrich (2000) emphasizes that SRL is an active, constructive process that is crucial for learning success. Chung (Sari & Satwika, 2018) asserts that SRL is an internal component influencing academic performance. Students' ability to self-regulate, set goals, control motivation, and monitor progress is key to improving learning outcomes. Therefore, this study highlights the relevance of SRL in mathematics learning, which requires independent and systematic problem-solving skills.

Practically, the findings of this study provide valuable insights for education. Educators can utilize them to design learning strategies that foster SRL development, for example, through assignments that require planning, self-monitoring, reflection, and the use of educational technology. In this way, even though the relationship between SRL and academic achievement was found to be weak, there remains substantial potential to enhance students' independence and responsibility in mathematics learning.

Conclusion and Suggestion

Based on the results and discussion, the Spearman's rank correlation test indicated a significant positive relationship between SRL and students' mathematics academic achievement, albeit with a weak correlation. This confirms that the null hypothesis (H_0) is rejected, demonstrating that SRL plays a role in improving students' academic performance, although its contribution remains relatively limited.

This study is limited to instruments in the form of academic achievement tests and the SRL scale. Therefore, future research is recommended to incorporate additional methods, such as interviews or observations, to strengthen the findings

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and obtain more in-depth data. Another limitation lies in the sample size and diversity. Consequently, subsequent studies should involve students from various educational levels and schools with differing characteristics, while also considering moderating variables, such as parental support. This approach is expected to provide a more comprehensive understanding of the factors influencing the relationship between SRL and academic achievement.

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