

## **Self-regulated learning: does it affect mathematics learning outcomes?**

Submit:  
18 November 2022

Reviewed:  
20 November 2022

Terbit:  
17 December 2022

doi: 10.32505/tarbawi.v9i2.5076

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### **Abstract**

Many factors can affect student learning success, especially math learning outcomes which are considered a difficult subject by students. One of the factors is the self-regulation system in learning. Self-regulation system or known as self-regulated learning is certainly different among students. So, the purpose of this study is to determine the level of self-regulated learning and its effect on math learning outcomes. This research is quantitative research using an on-experimental research type with a survey method. The sample used in this study amounted to 40 students who were taken randomly using simple random sampling. While data collection was done with questionnaires and documentation. The data were analyzed using the Pearson product-moment test. From the results of the analysis at a significant level of 5%, it was concluded that there was a significant influence between self-regulated learning on students' math learning outcomes. With the contribution of variable X to variable Y amounting to 32.49%. This means that 32.49% of students' math learning outcomes are determined by self-regulated learning and 67.51% are determined by other variables that are not studied.

**Keywords:** Learning Outcomes; Mathematics; Self-Regulated Learning.

### **Abstrak**

Banyak faktor yang mampu mempengaruhi keberhasilan belajar siswa, terutama hasil belajar matematika yang dianggap sebagai pelajaran yang sulit oleh siswa. Salah satu faktornya adalah sistem pengaturan diri dalam belajar. Sistem pengaturan diri atau yang dikenal sebagai *self-regulated learning* tentu berbeda antar siswa. Maka tujuan dari penelitian ini adalah untuk mengetahui tingkat *self-regulated learning* dan pengaruhnya terhadap hasil belajar matematika. Penelitian ini merupakan penelitian kuantitatif dengan menggunakan jenis penelitian non eksperimen dengan metode survey. Sampel yang digunakan dalam penelitian ini berjumlah 40 siswa yang diambil secara acak dengan menggunakan *simple random sampling*. Sedangkan pengumpulan data dilakukan dengan angket dan dokumentasi. Data dianalisis dengan uji *pearson product moment*. Dari hasil analisis pada taraf signifikan 5% diperoleh kesimpulan bahwa ada pengaruh yang signifikan antara *self-regulated learning* terhadap hasil belajar matematika siswa. Dengan sumbangan variabel X terhadap variabel Y sebesar 32,49%. Hal ini berarti 32,49% hasil belajar matematika siswa ditentukan oleh self-regulated learning dan 67,51% ditentukan oleh variabel lain yang tidak diteliti.

**Kata Kunci:** Hasil Belajar; Matematika; Self-Regulated Learning.

## Introduction

The development of knowledge and technology that supports the development of culture and human life in various parts of the world is influenced by advances in the field of mathematics (Montalvo & Torres, 2004). There have been many perceptions of the difficulty of learning mathematics by students, resulting in decreased student initiative to learn, choosing the wrong learning strategy, and difficulty managing and controlling progress in learning (Raković et al., 2022). This affects student learning outcomes, which according to Haris (2019) still not in accordance with the expectations of the education that has been designed.

Internal factors that can affect learning include self-regulated learning (Paris et al., 2010). Self-regulated learning is a concept of how a person becomes a manager himself in his learning activities and can activate and encourage thoughts (cognition), feelings (affection), and actions (actions) that have been planned systematically and repeatedly orientated to achieve a goal. in studying (Ghimby, 2019); (Rivers et al., 2022). Besides that, Self-regulated Learning is the ability of someone who has knowledge of affective learning strategies and uses that knowledge so that students are able to regulate themselves in learning (Li & Lajoie, 2022).

Based on the results of the pre-research at SMPN 8 Kota Sungai Lilin, it was found that students tend to have feelings of fear of mathematics because there are lots of memorized formulas, calculations, and their abstract nature. This trend is in line with the math scores at SMPN 9 Kota Sungai which can be seen in Table 1 below.

Table 1. Results of Mathematics Scores at SMPN 8 Kota Sungai Lilin

Grade	Total Students	Score	
		≥70	<70
VII	186	82	104
VIII	175	68	107
IX	193	74	119
Sum	554	224	330

Based on Table 1, it can be seen that the mathematics scores of students at SMPN 8 Kota Sungai Lilin tend to be low. This is indicated by the child's awareness in choosing and using learning methods. Therefore, self-regulated learning has a very important role in student learning outcomes (Panadero & Alonso-Tapia, 2014) stated that self-regulated learning is a cognitive and effective process so that students can complete their academic assignments. Therefore, knowing the aspects of self-regulated learning makes students swift and organized in carrying out all their assignments (Naderi et al., 2021)

The low level of self-regulated learning has a negative effect on the development of students' academic procrastination behavior (Robbi Fathoni & Indrawati, 2022), dexterity or one's ability to think critically and creatively, the development of metacognition and individual careers (Hsu et al., 2022) and the importance of self-regulated learning explained by Zimmerman and Martinez Pons

where the aspects of self-regulated learning include self-evaluating, organizing and transforming, goal-setting and planning, seeking information, keeping records and monitoring, environment structuring, self-consequential Ing, rehearsing and memorizing , seeking social assistant, and, reviewing record (Zimmerman, 1990). Besides that, self-regulated learning is a fusion of skill and will. The strategic learner is one who has learned to plan, control and evaluate his or her cognitive, motivational/affective, behavioral and contextual processes. This learner knows how to learn, is self-motivated, knows his or her possibilities and limitations, and as a function of this knowledge, controls and regulates learning processes in order to adjust them to the task objectives and to the context, to optimize his or her performance and improve skills through practice (Montalvo & Torres, 2004).

Based on this, it is necessary to see whether there is a real influence between self-regulated learning on students' mathematics learning outcomes so that teachers can focus on the advantages of self-regulated learning in the learning process considering that self-regulated learning is an important factor in order to obtain optimal learning results (Ghimby, 2019).

**Method**

The research used is a quantitative approach using a non-experimental research type with a quantitative descriptive survey type method. Surveys are used to collect as much data as possible regarding the supporting factors of self-regulated learning and learning outcomes in the field which will then be analyzed for these factors to find the truth. The research design uses a simple paradigm design which is explained in Figure 1 below;

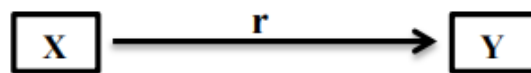


Figure 1. The simple paradigm of the relationship between variables

- X: Self-regulated learning
- r: The relationship between variable X and variable Y
- Y: Learning outcomes

The population in this study were all students of grades VIII of SMPN 8 Sungaipuh city and the sampling technique used was probability sampling with the simple random sampling method with a total sample of 40 students from grades VII and VIII. The population has fulfilled the normality and homogeneity tests. The instruments used were self-regulated learning questionnaires, observation sheets, and documentation instruments in the form of mathematics learning outcomes for

students of SMPN 8 Kota Sungai Lilin which had met the elements of validity and instrument reliability test (0.87). The hypothesis test that was carried out was correlation with the Product Moment correlation test, namely comparing the magnitude of  $r_{xy}$  with the  $r_{table}$  value. as well as by being carried out after the prerequisite tests in the form of tests for normality, homogeneity and linearity of the data are fulfilled.

### C. Result and Discussion

#### 1. Result

##### a) Normality and Homogeneity of Population Test

Prior to sampling, the population must be normally distributed and have a homogeneous variance. The population normality test using the chi square test obtained the following data:

Tabel 2. Homogeneity Test

Class	Student	$X^2_{count}$	$X^2_{table}$	Decision
VIIIA	35	-76.14	9.48	Normal
VIIIB	36	-71.27	9.48	Normal

Based on Table 2, it can be concluded that the population is normally distributed, which means that the population has a normal and directional distribution pattern. Furthermore, the homogeneity test was carried out on the population using a different variance test. The results of the homogeneity test can be seen in table 3 below.

Table 3. Population Homogeneity Test Results

Fcount	Ftable	Decision
1.1547	1.7668	Homogen

Based on table 3 above, it can be concluded that the population is homogeneous, which means that all individuals who make up the population have the same characteristics, so that sampling can be done. Sampling was carried out using random sampling technique so that 40 respondents were selected as research subjects from VIII class.

##### b) Data on Research Results of Self-regulated learning and Learning Outcomes

Research takes precedence over self-regulated learning (X) data on students using a questionnaire and continues with data on mathematics learning outcomes (Y) obtained by taking documents from teachers and schools. The results of self-regulated learning data collection can be seen in table 4.

Table 4. Frequency Distribution of Self-regulated learning results

Interval	F	$x_1$	$x_1$	$x_1^2$	$Fx_1$	$Fx_1^2$	$x_1$	fbk	fka
89-94	3	94.5	3	9	9	27	94.5	40	3
83-88	14	88.5	2	4	28	56	88.5	37	17
77-82	7	82.5	1	1	7	7	82.5	23	24
71-76	5	76.5	0	0	0	0	76.5	16	29
65-70	5	70.5	-1	1	-5	5	70.5	11	34
59-64	4	64.5	-2	4	-8	16	64.5	6	38
53-58	2	58.5	-3	9	-6	18	58.5	2	40

In addition to table 3 above, the Self-regulated learning data is also depicted on the polygons in Figure 2 below.

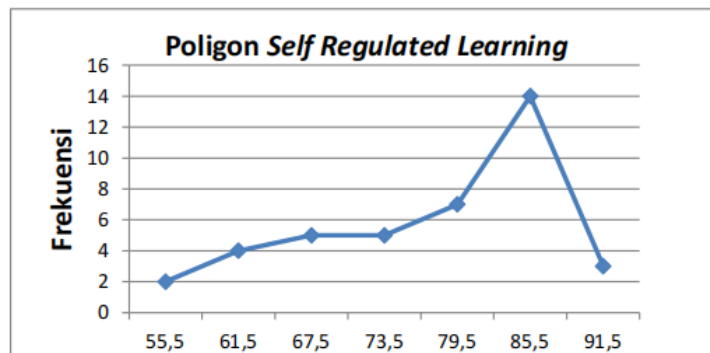


Figure 2 Self-regulated learning Polygons

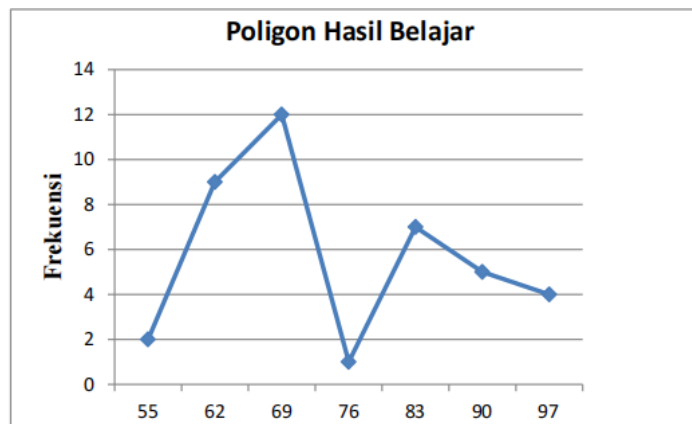
Based on the research results in the form of self-regulated learning scores from questionnaires given to students in the form of statements, the maximum value was 94 and the minimum was 55. From these data, the average value was 77.25, the median was 73.98, and the mode was 78.5 with a standard deviation of 10.08. Data on learning outcomes were obtained by taking documentation of students' daily mathematics test scores obtained through mathematics teachers. Data on learning outcomes can be seen in table 4 below

Tabel 5. Frequency Distribution of Data on Student Mathematics Learning Outcomes

Interval	F	$x_1$	$x_1$	$x_1^2$	$Fx_1$	$Fx_1^2$	$x_1$	fbk	fka
94-100	4	97	3	9	12	36	100.5	40	4
87-93	5	90	2	4	10	20	93.5	36	9
80-86	7	83	1	1	7	7	86.5	31	16
73-79	1	76	0	0	0	0	79.5	24	17

66-72	12	69	-1	1	-12	12	72.5	23	29
59-65	9	62	-2	4	-18	36	65.5	11	38
52-58	2	55	-3	9	-6	18	58.5	2	40

The results in table 5 can be described in the form of a polygon as shown in Figure 3 below;



Gambar 3. Polygon Hasil Belajar Matematika Siswa

Scores of students' mathematics learning outcomes obtained from the teacher's assessment book documentation with a maximum value of 100 and a minimum of 55. From these data obtained an average value of 74.775, a median of 68.51, and a mode of 80.2 with a standard deviation of 12.6.

**c) Research Hypothesis Test**

After obtaining what is needed, hypothesis testing is carried out with the intention of proving the research question. Normality, homogeneity and linearity tests were carried out before carrying out hypothesis testing with regression analysis. The results of the data normality test can be seen in table 4 below.

Table 4. Normality Test of Self-regulated learning and Learning Outcomes

Data	Variable		Decision
	Self-regulated learning	Mathematics learning outcomes	
X <sup>2</sup> count	-24.35	-88.7	Normal
X <sup>2</sup> Table	9.48	9.48	Normal

The data homogeneity test was carried out to test the variances of the variables studied were homogeneous. The homogeneity test carried out in this study is the variance test, based on the calculation of the homogeneity test results can be seen in table 5.

Tabel 5. Homogeneity Test of Self-regulated learning and Learning Outcomes

Variabel	Rata-rata	Varians	F <sub>hitung</sub>	F <sub>tabel</sub>	Keputusan
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<i>Self-regulated learning</i>	77.78	95.1	1.52	1.52	Homogen
Hasil Belajar	74.1	145.32	1.70	1.7	Homogen

Based on table 5 above, it can be concluded that the variants are homogeneous, which means the sample data comes from populations that have the same characteristics or variance. The data regression linearity test was carried out to find out whether the data has a linear pattern or not. The results of processing the linearity test data for self-regulated learning data and mathematics learning outcomes are presented in table 6 below.

Tabel 6. Self-regulated learning Linearity Test and Mathematics Learning Outcomes

Varians	Db	JK	RJK	F <sub>count</sub>	F <sub>table</sub>
Total	40	225745	-		
Regression (a)	1	220077.225	220077.225		
Regression (b a)	1	608.1176	608.1176	0.61	2.3
Residue	38	5059.657	105.89		
Error	15	2624	174.93		

The linearity test can also be seen through the polygons drawn in Figure 4 below.

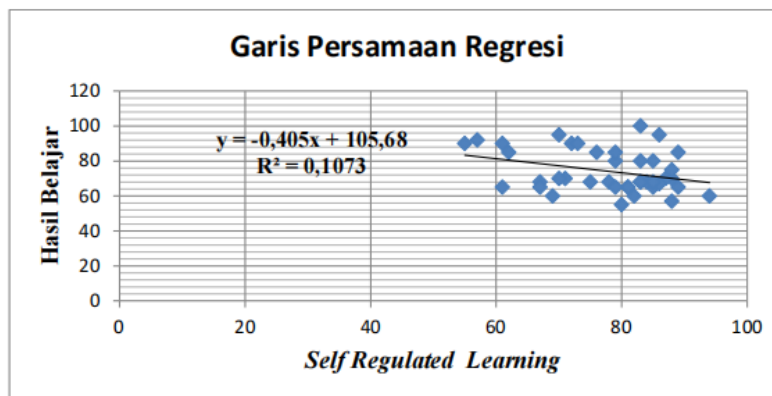


Figure 4. Data Regression Linearity Test Polygon

Based on table 6 and figure 4 above, it can be concluded that the data has a linear pattern, which means that any change that occurs in one variable will be followed by a change with an equal magnitude in the other variables. After the prerequisite test is met, the researcher tests the hypothesis using the Pearson product moment correlation test. The results of the correlation test can be seen in table 7 below.

Tabel 7. Hasil Uji Korelasi *Pearson Product Moment*

Correlation	C <sub>x</sub> <sup>1</sup>	C <sub>y</sub> <sup>1</sup>	SD <sub>x</sub>	SD <sub>y</sub>	r <sub>xy</sub>	Decision
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Self-regulated							
learning - Learning	0.625	-0.175	1.68	1.8	0.57	Ha accepted	
Outcomes							

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Based on table 7 it is known that the value is 0.57 with a df of 38 with a 5% confidence level, the  $r_{table}$  is 0.402. so that  $r_{xy}$  is greater than  $r_{table}$ , it can be concluded that the hypothesis  $H_a$  is accepted in other words there is a significant positive correlation between self-regulated learning and students' mathematics learning outcomes. Next, look for the contribution of variable X to variable Y with the KP formula. It was found that the contribution of variable X to variable Y was 32.49%. This means that 32.49% of students' mathematics learning outcomes are determined by self-regulated learning and 67.51% are determined by other variables not examined.

## 2. Discussion

Based on the findings of the researchers, it was found that self-regulated learning has a significant positive effect on students' mathematics learning outcomes with a low contribution of self-regulated learning to mathematics learning outcomes. This is in line with the results of research by Rahmiyati, Handayani and Ghimby where there is an effect of self-regulated learning on student achievement. (Ghimby, 2019); (Handayani & Sholikhah, 2021). That is, the higher the student's self-regulated learning, the more influential it will be on student achievement (Rahmiyati, 2017) included in learning mathematics (Sholiha et al., 2022). The level of correlation is also in line with Rahmiyati's research which states that there is a low correlation between self-regulated learning and learning achievement (Rahmiyati, 2017). According to the researchers' assumptions, this is due to differences in the subjects studied, as is the case with research in biology subjects which also has a low correlation (Tarumasely, 2022).

In addition to the effect of differences in subjects, also according to the assumptions of researchers due to differences in academic motivation and anxiety (Hunta et al., 2019), parenting style received by students (Chotimah & Nurmufida, 2020), sex differences (Istiqomah et al., 2021) and prior knowledge possessed by students (Tarumasely, 2020).

Seeing the results of the research above, it is necessary to develop self-regulated learning in the learning process where according to (Paris et al., 2010) this development will have a positive impact on one's thinking ability. Based on the results of the research that has been done, the author's suggestions are; In an effort to improve learning outcomes, it is recommended for teachers to improve self-regulated learning which is carried out in several ways such as self-evaluation and monitoring of students, determining learning outcomes and learning strategies when in class (Rahmadani et al., 2022) such as self-regulated learning can be applied in class by carrying out discussion and analysis activities (Paris & Paris, 2001) It can even be

applied to technology-based learning such as distance learning (blended learning) (Setyaningrum, 2019); (Handayani & Sholikhah, 2021) and use learning media (Memon et al., 2022).

#### **D. Conclusion**

Based on the results of the analysis above, it can be concluded that there is a significant influence between self-regulated learning on students' mathematics learning outcomes. With the contribution of variable X to variable Y of 32.49%. This means that 32.49% of students' mathematics learning outcomes are determined by self-regulated learning and 67.51% are determined by other variables not examined.

#### **Acknowledgment**

The author's thanks go to SMPN 8 Kota Sungai Lilin which has given the author the opportunity to conduct research and all parties involved so that this article can be published to add to the body of knowledge.

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*At-Tarbawi: Jurnal Pendidikan, Sosial dan Kebudayaan*  
*Volume 9 Nomor 2 Tahun 2022*  
*e-ISSN: 2086-9754/p-ISSN: 2086-9754*