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The Effectiveness of the Discovery Learning Model on the Metacognitive Ability of the Students of SMP Negeri Satap Lesten Gayo Lues Regency

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ABSTRACT

Research is research involving one class as an experimental class. The purpose of this study was to determine the effectiveness of using a discovery learning model to apply mathematical learning with Pythagorean material. It is related to the metacognitive abilities of eighth-grade middle school students. This study is a quasi-experimental study. The population in this study were all grade VIII students of SMP Negeri Lasten Kab, Gayo Lues for the academic year 2020/2021, which amounted to 9 classes. The sample was drawn using cluster random sampling so that a sample of Class VIII-1 students was obtained from 17 female students and 15 male students. men, as the experimental class without a control class group. The research test instrument used was an initial mathematical ability test and a student's metacognitive ability test by learning the *Discovery Learning model*. Analysis, descriptive analysis and inferential analysis of the data used. From the research conducted, findings (1) indicate that students' initial math skills remain low prior to applying the discovery learning model for learning. (2) The metacognitive ability scores of the learning models were found to be in the good category. Based on the results of the research conducted, it can be said that learning using the discovery learning model effectively improves the metacognitive abilities of the class VIII SMP Negeri Lasten Kab, Gayo Lues.

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INTRODUCTION

Through metacognition the mind can be guarded, planned, and controlled. Metacognitive emphasizes the ability to think at a higher level beyond normal thinking in reflecting on thinking itself. In the context of learning, students know how to learn, know their learning abilities and modalities, and know the best learning strategies for effective learning. Students with metacognitive awareness are aware of their strengths and limitations in learning. That is, when students know their mistakes, students are aware of the importance of admitting that they are wrong, and trying to correct them so that it will support success in learning and memory. The success of students can be influenced, one of which is the success of their learning (Hidayat, 2022).

Metacognition ability is an ability that is very well developed at every level of education in an effort to improve learning outcomes even better. Metacognitive ability is awareness, belief in someone's knowledge of processes and ways of thinking about things they do themselves so as to improve learning processes and memory. Metacognition is a mental activity that allows a person to organize, organize and monitor all thinking processes carried out during problem solving. Metacognition is also defined as a form of the ability to look at

oneself so that what is done can be controlled optimally. Metacognition is a person's awareness of his thought processes related to the cognitive process. According to Andriani et al., (2017), metacognition is knowledge and awareness about the process of cognition, or knowledge about the mind and how it works. Meanwhile, Lee and Baylor (Ikram, Z. J. W., & Aziz, N. 2017; Diandita, E. R., et al., 2017) define metacognition as an awareness of one's own cognitive activities, the methods used to regulate one's own cognition processes and a mastery of how to direct, plan, and monitor cognitive activities.

Meanwhile, according to Sugiarto and Shopianingtyas (Malahayati, et al., 2015; Rizkiani, A., & Septian, A. 2019;) metacognitive skills can help develop students' thinking skills which in turn can also affect student learning outcomes. From one's ability to think will affect one's understanding. In the learning process, students will be required to solve various mathematical problems. Activities that occur in the learning process to stimulate students to think.

Based on experience and observations at SMP Negeri Satap Lesten Kab Gayo Lues**,** it was found that the problem was that the learning process carried out was still in the form of conventional learning or learning activities were still teacher-centred (Teacher-Centered Learning), had not used a scientific approach and had not applied a learning model based on the problem so that students feel bored and there are some who do not pay attention when learning takes place. The teacher also does not give students the opportunity to develop ideas and ideas that can train their thinking (reasoning) abilities. Even though the curriculum used in the school is the 2013 curriculum. This causes students to be less trained in their thinking skills and results in low learning outcomes, namely there are still many students who cannot complete assignments and get scores below the minimum completeness criteria of 70.

In the learning process the teacher has a very important role, therefore it is expected that the teacher has a good teaching model and is able to choose the right learning model, so that students are able to master the competencies specified in the learning carried out. Mastery of competence by students can be assisted by the use of learning models that are in accordance with the material provided, so that the teacher not only functions as a source of information that is always a reference for students, but he also has to act as a stimulant in developing students' interest in finding information independently.

Students are required to construct their own understanding, so that knowledge will be obtained meaningfully which will have an impact on learning outcomes. However, to achieve high mathematics learning outcomes is not an easy thing, there are many factors that influence the student learning process, namely the application of appropriate learning techniques or models. The purpose of learning mathematics can help students to understand concepts, solve systematic problems, relate mathematics to everyday life, and be able to use mathematical ideas both orally and in writing.

One of the learning models that can be used to improve the quality of learning outcomes is the discovery learning model. According to Tanjung, D.F., Syahputra, E. & Irvan, I. (2020), discovery learning is a learning model that shifts learning from teacher-centred (teacher-centred learning) to student-centred learning (student-centred learning). The teacher's role as a guide who directs students actively and in accordance with learning objectives. The *Discovery Learning* model is a teaching model that regulates teaching in such a way that children acquire previously unknown knowledge, not through notification, partially or wholly discovered by them.

Schunk's discovery learning (Subagio, L., et al., 2021; Triana, R., et al., 2021) is a learning model that requires asking questions, questions, or confusing situations that are Response when determined. The advantage of the discovery-learning model is that it is related to the mastery of knowledge, which is acquired through a process of seeking, processing, exploring, and investigating.

According to raising Winoto, Y. C., & Prasetyo, T. (2020), Discovery Learning is a learning model with a constructivist approach that requires students to use the knowledge they already have to find new concepts. The Minister of Education and Culture Regulation Number 22 of 2016 explains that to strengthen the scientific approach (scientific), integrated thematic (thematic between lessons), and thematic (in a subject) it is necessary to apply a discovery-based learning model, namely the Discovery Learning model.

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According to Permendikbud 2016, the learning process should lead students to find out, not be told. This means that students are directed to find new concepts with previous knowledge, not being given new concepts directly by the teacher. Discovery Learning Model aims to make students more active and creative in learning to find information or knowledge. Research conducted by Mawaddah, N. E., & Suyitno, H. (2015) show an increase in mathematical creative thinking skills using the application of the Discovery Learning model.

Therefore, in the implementation of the learning process, students should familiarize themselves with metacognitive skills. Not just a cursory thought. But with the activity of metacognition ability is very important for students because it can train to think at a higher level and can be able to plan, control and reflect on all thinking activities that have been done. The learning process by using metacognitive abilities during learning will help students to be able to obtain long-lasting learning in students' memory and understanding. Knowledge of metacognitive abilities, students will be aware of the advantages and limitations in learning. This means that when students know their mistakes, they are aware to admit that they are wrong, and try to correct them.

RESEARCH METHOD

The population of this study were all eighth grade students of SMP Negeri Lasten Kab, Gayo Lues for the 2020/2021 academic year which were spread out in 9 classes. Sampling was done by using *purposive sampling technique,* one class was selected, namely class VIII-1, with a total of 32 students. The sample is determined based on the relatively equal value when the student's initial ability test is carried out. The implementation takes place in mid- January to February for 3 weeks .

The type of research applied is a *Quasi Experimental Research* with *One Group Pretest-Posttest Design.* The data analysis technique was carried out by testing the normality of the pretest data using SPSS version 22. The data used to test the hypothesis were tested for prerequisites, namely normality and homogeneity. After the prerequisite test is done, the data is tested according to the needs of each hypothesis test. Data collection was carried out using instruments in the form of an initial mathematical ability test and a metecognition ability test. This design was used because the study involved only one experimental class and was carried out without a comparison class. The design model used is as follows:

Table 1. *One Group Pretest-Posttest*

Pretest	Variabel Terikat	Post Test
O_1	X	O_2

The steps in the study are: 1) calculating the average protest score, namely the students' initial mathematical ability, 2) normality test carried out using *Kolmogorov-Smirnov* with the provision that the criteria used in decision making is if the value is $t_{calculated} > t_{table}$, then H_0 is rejected, and if the value of $F_{count} < F_{table}$ then H_0 is accepted, if the significant value is < 0.05 then the distribution is not normally distributed, if the significant value is > 0.05 then the distribution is normally distributed, 3) done homogeneity test using infrensial statistical analysis test using multivariate test (MANOVA) using *one sample T test* using *SPSS 22.00 for windows syntax* .

RESULTS AND DISCUSSION

The purpose of this research is to analyze that there is the effectiveness of the *Discovery Learning model on* students ' metacognitive abilities. In addition, the interaction between learning models and metacognitive abilities was also disclosed. Data Processing and Analysis Mathematical Aptitude Tests are designed to group students according to their baseline abilities in order to differentiate between low, medium and high baseline students and then treat them as a learning model. Hopefully, with the Discovery Learning model of learning therapy, there will be a change where students who initially have low math skills can progress to intermediate or advanced levels.

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Through this study, a series of data were obtained, including: (1) initial math ability test results, (2) metacognitive ability test results, (3) metacognitive ability final test results experimental class using discovery learning model (4)) scoring results.

1. Early Mathematical Ability

To get an idea of the students' initial math skills, the mean and standard deviation were calculated. The calculation results are shown in Table 2 below:

Table 2. Normality Test of Early Mathematical Abilities

		Kolmogorov-Smirnov [a]			Shapiro-Wilk		
	Group	Statistics	df	Sig.	Statistics	df	Sig.
Score	DL	.137	30	.165	.929	30	.056

Table 3. Hypothesis Test Results from Normality of Early Mathematical Abilities

Class	Statistic test			Hypothesis testing
	Kolmogorov-Smirnov	df	*Sig.*	
DL Experiments	0.155	30	0.128	H_0 Accepted

From the normality test in Table 2, it can be seen that the significance level of Kolmogorov-Smirnov is 0.165. In Table 3, although the hypothesis test results for early math skills were greater than the significance level of 0.128 at the 0.05 significance level, H_0 was accepted and the others were rejected. In this way, H_0 is acceptable, which means that the sample is from a normally distributed population of experimental class DL.

Table 4. Results of Homogeneity Test of Early Mathematical Abilities

		Levene Statistics	df1	df2	Sig.
Score	Based on Mean	.364	1	30	.549
	Based on Median	.260	1	30	.462
	Based on Median and with adjusted df	.260	1	29,833	.462
	Based on trimmed mean	.351	1	30	.556

It can be seen from Table 4 above that the significance value is 0.549, that is, the significance level greater than 0.05. Thus, H0 representing equal variances in each group is acceptable.

2. Students' mathematical metacognition ability

Mean and standard deviation were calculated for a comprehensive understanding of students' mathematical metacognitive abilities. The calculation results are shown in Table 5:

Table 5. Normality Test of Students' Mathematical Metacognition Abilities

		Kolmogorov-Smirnov [a]			Shapiro-Wilk		
	Group	Statistics	df	Sig.	Statistics	df	Sig.
Score	DL	.167	30	.175	.921	30	.086

Table 6. Hypothesis Test Results from Normality of Students' Mathematical Metacognition Ability

Class	Statistic test			Hypothesis testing
	Kolmogorov-Smirnov	df	*Sig.*	
DL Experiments	0,215	30	0.127	H_0 Accepted

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As can be seen from the normality test in Table 5, the significance level of Kolmogorov-Smirnov is 0.175. And Table 6 shows the results of the hypothesis test of students' mathematical metacognitive skills. The significance level is 0.127, which is greater than the significance level of 0.05. H_0 is accepted and others are rejected. In this way, H_0 is acceptable, which means that the sample is from a normally distributed population of experimental class DL.

Table 7. Results of the Homogeneity Test of Students' Mathematical Metecognition Ability using the *Discovery Learning learning model*

		Levene Statistics	df1	df2	Sig.
Score	Based on Mean	.376	1	30	.449
	Based on Median	.288	1	30	.487
	Based on Median and with adjusted df	.288	1	28,903	.469
	Based on trimmed mean	.315	1	30	.556

Based on table 7 above, it can be seen that the significance value is 0.449 which means it is greater than the significance level of 0.05. So that H0 which states the variance in each group is the same can be accepted.

3. Students' Mathematical Metacognition Ability Model *Discovery Learning*

The results of the Discovery Learning Model's Student Homogeneity Test and Mathematics Metacognitive Abilities Test are as follows:

Table 8. The results of the test of metacognition ability seen from the aspect of metecognition ability using the *Discovery Learning Model*

	Test Value = 75					
	t	df	Sig. (tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
DL Met.	5.144	30	.004	7.754	5.47	10.22

As can be seen from Table 8, the results of students' mathematics metacognitive skills are at the significant level of 0.04.

4. Multivariate Test (MANOVA)

To see it can be done with *a one sample t test* through table 8 below:

Table 9. T One Test Results Sample Metacognitive Ability *Discovery Learning Model*

	Test Value = 0					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
KM	63,482	31	.000	79.250	76.70	81.80

t_{count} = 63,482 > t_{table} = 2,040 based on the results of analysis of learning data using the discovery learning model to improve metacognitive skills. Hence H0 is rejected. This means that the learning model was found to be effective in improving metacognitive skills.

5. Analysis of the Effectiveness of the *Discovery Learning Model on students' mathematical* metacognition skills

When determining the effectiveness, it can be measured from three aspects: the completeness of classic students' learning, the achievement of learning objectives and the learning time. Below is a discussion of each metric that measures the effectiveness of a discovery learning model for learning activities.

a. Classical Student Learning Completeness

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One of the ways to see the effectiveness of a learning model is to see how well students mastered after implementing the learning model. In this study, students' proficiency in using the Discovery Learning Model was assessed through a mathematical metacognitive test of the students. Use the discovery learning model shown in Table 10 below to describe outcomes for students' mathematical metacognitive skills:

Table 10 Description of Mathematical Communication Ability Results in Experiment Class I

Information	**Score**
The highest score	95
Lowest Value	70
Average	83.75

As can be seen from Table 10 above, the average post-test score for math metacognitive abilities of students using the Discovery Learning Model was 83.75. In addition, the classical mastery results of students' mathematical metacognitive skills using the Discovery Learning Model are shown in Table 11 below.

Table 11 Classical Completeness Level of Mathematical Communication Ability

Category	Mathematical Communication Ability	
	Total students	Percentage
Complete	29	90.62%
Not Complete	3	9.38%
Amount	32	100%

Thus, post-test results of students' mathematical metacognitive skills using the Discovery Learning Model met the criteria for classical proficiency.

The average of each student's proficiency on the mathematical metacognitive indicators using the discovery learning model is shown in Table 12 below.

Table 12. Average Student Mastery Level of Each Indicator on *Posttest Results*

No	Indicator	Question	Average per question	Average per-indicator
1	*Stimulation* (stimulus / giving stimulation)	1a	6.13	6.36
		2a	6.75	
		3a	6.21	
2	*Problem statement* (statement/problem identification) into a mathematical model	1b	6.75	6.38
		1c	6.13	
		2b	6.21	
		2c	6.87	
		3b	6.21	
		3c	6.13	
3	*Data collection* (data collection) and *Data processing* (data processing)	4a	6.87	6.4 6
		4b	6.21	
		5a	6.06	
		5b	6.13	
		5c	6.75	
4	*Verification*	4b	6.42	6.42
5	*Generalization* (draw conclusions)	5 b	6.36	6.36

From table 12 above, it is known that student mastery for the third indicator obtained the highest score with an average per indicator of 6,46. While the lowest indicator is the first indicator and the fifth indicator, which is getting an average value per indicator of 6.36.

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b. Achievement of Learning Objectives

For the post-test questions on mathematical metacognitive abilities, the achievement of learning objectives was analyzed to determine the percentage of achievement of learning objectives. See Table 13 for the achievement of the learning objectives after the Math Communication Ability Test of Experimental Class I.

Table 13. Achievement of Learning Objectives on Mathematical Metacognition Ability

No	Learning objectives	Mathematical Communication Ability	
		% Achievement of Learning Objectives	Information
1	Learners can: 1. Know examples of the Pythagorean theorem in everyday life 2. Understand the application of the Pythagorean theorem in everyday life	95% (Problem 1)	Achieved
2	Learners can: 1. Give an example of the Pythagorean theorem 2. Presenting the Pythagorean theorem problem into a mathematical model	89.25% (Problem 2) 90.36% (Problem 3)	Achieved
3	Learners can: 1. Solving problems in real life 2. Solve problems related to the application of the Pythagorean theorem	92.65% (Problem 4) 87.54% (Problem 5)	Achieved
4	After following the learning process through group discussions, students can: Do daily tests.	90.9% (Overall Question)	Achieved

c. Study Time

The result of the learning time of the experimental class using the discovery learning model was four lessons or 8 × 40 minutes, and the learning time of the experimental class was no different from the actual learning time compared to the normal learning performed so far. Complete normal study time. Therefore, it is known that the learning time achieved in the experimental class using the discovery learning model is the same as ordinary learning by the conventional method, i.e. four 8 × 40 minute lessons. The experimental teaching of the learning mode of discovery learning is realized.

CONCLUSION

According to the results of data analysis and discussion, it is concluded that the learning model is found to effectively improve metacognitive ability by obtaining $t_{count} > t_{table}$, that is, 63,482 > 2,040. Improve metacognitive skills by using discovery learning models that are more effective than learning models that teachers can do. The discovery learning model can be used as an alternative method to improve math skills so that it can be used as input in schools to develop effective learning strategies for other math subjects.

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