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The Effect Of Blended Learning Model With Metacognitive Strategy On Mathematics Ability And Self-Regulated Learning Of Elementary School Students

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Abstract: This research is motivated by the low ability of mathematical understanding and self-regulated learning of school students in learning mathematics. This study aims to determine the effect of the blended learning model with metacognitive strategies on the mathematical understanding ability and self-regulated learning of elementary school students. The method used in this research is the experimental method with the object of research 30 elementary school students. The results showed (1) Students who received learning through blended learning with metacognitive strategies experienced an increase in their mathematical understanding ability better than students who learned through conventional learning. (2) Increasing the self-regulated learning of students who receive blended learning is better than students who receive conventional learning. Blended learning has a positive impact on students' enthusiasm for learning mathematics because formulating learning techniques is very fun, so students don't feel bored when studying the material.

Keywords: blended learning; mathematical understanding; self-regulated learning

1. Introduction

The results of the PISA tests and surveys in 2018 with scores of students' Reading, Mathematics, and Science abilities of 371, 379, and 396 positioned Indonesia in 75th position out of 80 countries that took tests and surveys [1], [2]. Furthermore, TIMSS shows that the average score in mathematics and science for Indonesian students is 397 with the position for mathematics at level 45 out of 50 countries and science at level 45 out of 48 countries participating in the assessment and survey. These results show that the ability of Indonesian students, in general, is still relatively low, especially in reading, mathematics, and science [3]. Furthermore, it was found that Indonesian students have difficulty understanding concepts, and solving problems related to concepts. The low ability of students' mathematical understanding is indicated by the learning process that has not provided opportunities for students to develop the ability to act and think critically so that students are unable to relate the knowledge they learn to the phenomena that occur [4]–[10]. This needs special attention from all elements related to the field of education in Indonesia.

Furthermore, learning is not only limited to providing knowledge but must be able to facilitate students to be able to construct their own knowledge and think critically [11]–[13]. This is so that students can utilize their knowledge optimally to be more intelligent and critical in receiving and processing information. Furthermore, mathematics is one of the exact fields of science that prioritizes student understanding compared to rote memorization [14], [15]. Based on this, mathematics learning aims to make students have the ability to solve mathematical problems, mathematical communication, mathematical reasoning,

mathematical connections, and mathematical representation [16], [17]. In addition, students are said to be proficient in mathematics when students have several potentials including mastering mathematical concepts, having logical reasoning, and having a good mathematical disposition.

Furthermore, the ability to understand mathematics is a basic ability that can develop other abilities. It is understood that good comprehension skills can contribute to improving problem-solving and mathematical communication skills so that it is known that mathematical understanding skills are needed to master other mathematical abilities [16]–[22]. Furthermore, student activities in the learning process do not only get information from the teacher, but students also have to be able to build their own concepts and principles that they learn [23]–[26]. Thus, independent learning is needed by students in building the concepts and principles learned. Based on this, self-regulated learning is an attitude not to depend on others in learning activities, accompanied by persistence in business, freedom to make their own choices, having initiative, acting effectively on their environment, and consequently in achieving the expected goals [27]–[34].

Furthermore, students are said to have independence if students take the initiative to learn, have the ability to determine their own destiny, diagnose learning needs, are creative, and take initiative in utilizing learning resources and choosing learning strategies as well as monitoring, regulating, and controlling learning [35]–[40]. It can be understood that learning independence is a condition of an individual having the initiative to learn, setting learning goals and learning strategies, and evaluating or self-reflection in his learning activities.

Some of the problems that occur in the classroom are that students are not used to building their own knowledge because they still depend on the teacher's explanations, and students tend to avoid learning mathematics. Learning mathematics in schools is still considered by students to be less attractive and less fun so that students are not motivated to learn and find it difficult to enjoy mathematics.

Based on the problems above, we need a learning model that can increase student independence which has an impact on learning outcomes, one of which is the Blended Learning model. Blended Learning is learning that combines the application of traditional learning in the classroom with online learning that utilizes information technology and is flexible [41]–[44], in addition to the use of e-learning or online learning. is one form of flexible learning examples in the Blended Learning model [45]–[48].

Research on blended learning has been carried out by previous researchers. The results showed that blended learning succeeded in engaging students critically [49]–[52]. Furthermore, other research results show that the Blended Learning learning model is used to improve critical thinking skills, learning achievement, increase students' motivation and level of understanding, mastery of concepts, increase logical thinking skills, learning outcomes [53], [54], [63], [55]–[62]. However, there has been no previous research that has looked at the effect of the blended learning model with metacognitive strategies on the mathematical understanding ability and self-regulated learning of elementary school students.

Based on the above background, researchers need to conduct a scientific study on the effect of blended learning models with metacognitive strategies on the ability of mathematical understanding and independent learning of elementary school students. The objectives of this study are (1) to determine the effect of a blended learning model with a metacognitive strategy on the ability of elementary school students to understand mathematically, (2) to determine the effect of blended learning model with a metacognitive strategy on the self-regulated learning of elementary school students.

2. Methods

2.1 Research design

This study aims to determine how the effect of blended learning models with metacognitive strategies on the ability of mathematical understanding and self-regulated learning of elementary school students. This type of research is quasi-experimental (quasi-experimental) with a pretest-posttest control group design. Pretest-

posttest control group design consists of two groups selected at random (random), then given a pretest before learning and posttest after learning, which determines whether there is a difference between the control group and the experimental group. The experimental class was given treatment using blended learning with metacognitive startegies, while the control class used conventional teaching models. The results of the pretest and posttest in the experimental and control classes were compared.

2.2. Respondent

Fourth-grade elementary school students were selected as the participants of this study. The sampling technique used in this study was the purposive sampling technique (purposed sample). Purposive sampling is a sampling technique with specific considerations. The reason for using the purposive sampling technique is because it takes two classes that are homogeneous in their abilities and can represent the characteristics of the population. The sample that was selected was 30 student respondents.

2.3. Instruments

The instrument used in this study is a mathematics learning device with blended learning. The following learning device used is a lesson plan, student worksheets, and practice questions.

2.4 Data analysis

Data collection in this study was obtained by conducting a pretest and posttest. The pretest is used to measure the initial ability before learning begins, and the posttest is used to measure students' ability after learning is complete. The pretest and posttest were given to the control class and the experimental class. Then the average difference test on the initial performance in each experimental group was carried out. This is done to determine whether there is a difference in the average for the initial achievement of the two groups. The test used is the independent sample t-test with a significance level of 0.05.

3. Results

3.1 mathematical understanding ability

Prior to the difference test (t-test), a prerequisite test for data analysis was carried out by conducting a normality test, namely the experimental class, and the control class must be normally distributed, after knowing the normality of the data, then the data is tested for homogeneity after the data is normally distributed and homogeneous, the data can be tested for effectiveness. using t-test. The following are the results of the requirements test for the data analysis of the normality test and the difference between the two averages (t-test) which can be seen as follows:

Table 1. Data from the normality test of mathematical understanding ability

Class	**Kolmogorov-smirnov**		**Conclusion**
	N	**Sig.**	
Experiment	30	0,051	Normal
Control	30	0,200	Normal

The results of the normality test above, it shows sig. For the data gain for the class that uses blended learning with metacognitive strategies is 0.051, and the class that uses blended learning is 0.200. Both values are greater than 0.05. That is, the experimental and control classes gain data that come from a normally distributed population. Furthermore, the homogeneity test can be seen below:

Table 2 .Data on Homogeneity Test Results of Mathematical Comprehension Ability

Class	Uji Levene		Conclusion
	N	Sig.	
Experiment	30	0,272	Homogen

Control	30

It can be understood that the data shows sig. obtained is 0.142 and the value is greater than = 0.05. Thus, it can be concluded that the variance of the two classes is homogeneous. Furthermore, the results of the average difference test (t-test) can be seen as follows:

Table 3. Mathematical Comprehension Ability Difference Test

Class	Sig. Uji-t (1-party)	Conclusion
Experiment Control	0,020	There is a difference

The data above shows that sig. t-test on the data gain of 0.02 is smaller than 0.05, then the average gain of the experimental class is higher than the average gain of the control class. It is concluded that the improvement of students' mathematical understanding skills using blended learning with metacognitive strategies is significantly better than students whose learning uses conventional learning.

3.2 self-regulated learning

Before carrying out a different test on self-regulated learning, the researcher conducted a prerequisite test for data analysis by conducting a normality test. The following are the results of the normality test of self-regulated learning data:

Table 4. Normality test of self-regulated learning

		Kolmogorov-Smirnov[a]		
	Class	Statistic	df	Sig.
Self-regulated learning	Experiment	.088	30	.200*
	control	.159	30	.052

From the results of the normality test analysis above, the significance value in the experimental class is 0.200 > 0.05 and the significance value in the control class is 0.52 > 0.05, thus the data in the experimental class and control class are normally distributed. Furthermore, the analysis of the homogeneity test can be seen below:

Table 5. homogeneity test of self-regulation learning

		Levene Statistic	df1	df2	Sig.
Self-regulated learning	Based on Mean	.041	1	58	.841
	Based on Median	.035	1	58	.853
	Based on Median and with adjusted df	.035	1	57.797	.853
	Based on trimmed mean	.048	1	58	.828

Based on the data above, it shows that the significance value of the results of the posttest homogeneity test for the experimental class and the control class is 0.841. This shows that the significance value is more than 0.05 (sig 0.05), then the variance of the two samples are declared the same (homogeneous). Furthermore, the results of the influence test can be seen as follows:

Table 6. simple linear regression test self-regulation learning

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.628[a]	.795	.373	2.49852

Based on the calculations in the simple linearity test table, it can be seen that the value of the correlation or relationship (R) is 0.628. From these results, the coefficient of determination (R square) is 0.795. Based on the explanation above, it can be concluded that there is an effect of the Blended Learning Model with metacognitive strategies on self-regulated learning of 79.5%.

4. Discussion

Based on the results of the research described above, it is known that the guided learning model with metacognitive strategies can improve students' mathematical understanding abilities and learning independence of elementary school students. The assessment of students' mathematical understanding abilities and learning independence is generally used to review the suitability of the material with basic competencies and indicators, the suitability of the material with the level of student knowledge. This is in line with the opinion that learning independence is the ability of students to carry out learning activities alone without depending on others which are carried out with patience and lead to the achievement of the desired goals of students.

This is in line with the statement that Blended learning is a learning model that combines a personal learning model (synchronous) and an independent learning model that can be done anytime (Asynchronous) [64]–[67]. The blended learning model is considered the best solution for distance learning. Thus, the advantages of Blended Learning compared to other models this one learning model can also be developed flexibly [68]–[71]. Students can access easy learning materials because they are done online, while facilitators and teachers can deliver materials using various methods [72]–[74].

The application of the Blended Learning model is able to increase mutuality and the quality of learning. Furthermore, this learning can show better differences in terms of motivation, interest, and student learning outcomes than other models especially models of indirect learning. Based on this, the Blended Learning model is able to create a student-centered learning process. In the implementation process, with involvement and participation in the learning process, Blended Learning can increase students' sense of responsibility. In addition, the interaction in the Blended Learning model creates a motive for students to compete in learning.

5. Conclusion

Based on the results of the research and the discussion that has been described by the researcher, it can be concluded that (1) Students who learn through blended learning with metacognitive strategies experience an increase in their mathematical understanding ability better than students who learn through conventional learning. (2) Increasing the learning independence of students who receive blended learning is better than students who receive conventional learning.

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