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The Effectiveness of Materials Based on Metacognitive Skills

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Abstract: ***This study aims to determine the effectiveness of teaching materials based on metacognitive skills in learning mathematics. The research variable is the result of learning by treatment of applying learning materials based on metacognitive skills. The study population was all class XI student of SMAN 2 Parepare Academic Year 2016/2017. The sample selection was made randomly. Research data were analysed by descriptive statistical analysis and inferential statistical analysis. The results showed the average score of learning result of experiment class of 83.67. The mean rating of control class learning outcomes of 77.58 from ideal score 100. In this study also found that in the experimental class, of 24 students obtained 21 or 87.5% of students who have completed the study. In the control class from 24 students, 15 or 62.5% of students who have finished the study. The learning activity of the experimental class is more active than the control class. Thus it is concluded that teaching materials based on metacognitive skills are effectively applied in mathematics learning.***

Keywords: Teaching materials, metacognitive skills, experimental class, control class

1. Introduction

An important component of mathematics learning that must be mastered and always improved is the problem-solving ability. As stated in Regulation of the Ministry of National Education no. 22 of 2006 on Content Standards that one of the objectives of learning mathematics is that learners have the ability to solve problems [1]. The ability to solve mathematical problems is needed by society, and the heart of mathematics is problem-solving [2], [3].

Data Trends in International Mathematics and Sciences Study [4], Indonesian students ranked 38 out of 45 countries in the field of mathematics. While the 2015 Program for International Student Assessment (PISA) data, Indonesian students are ranked 54th out of 72 countries in mathematics [5]. Another fact shows, more than 50% of high school students in Parepare have the ability to solve mathematical problems that are low. The data indicate that the problem-solving ability of Indonesian students mathematics is still in low category.

The reality suggests that the ability to solve math problems in schools has not been trained optimally. The ability to solve mathematical problems is influenced by many factors, including the teaching materials that will be taught. One of the learning materials that can be applied is teaching materials based on metacognitive skills. Teaching materials based on metacognitive skills are educational materials that train students to solve math problems in a structured way by (1) predicting, (2) designing, (3) monitoring, and (4) evaluating.

Metacognitive skills and mathematical problem-solving skills of learners are two issues that are always strung together in a learning system. In general, when the application of teaching materials based on metacognitive skills in learning well, then the tendency of math problem-solving ability is also high, and vice versa. The results of [6], [7] indicate a positive relationship between metacognitive skills and the ability to solve mathematical problems of learners. Students who have good metacognitive skills will show real learning achievement as well as students who have little metacognitive skills [8], [9].

The effectiveness of learning is a useful result obtained after the implementation of teaching and learning process; efficiency can be viewed as an achievement of desired or targeted goals [10]. The process of achieving the goal required a plan to regulate how much learning can be absorbed by the learner or how the effect on the students. Effectiveness indicators according to Suherman (2003) consists of (1) mastery learning, (2) learning activities, (3) teachers' ability in managing to learn, (4) student's response to learning. So the effectiveness referred to in this research is the success of education can be seen from 4 indicators above. It is said to be effective, if it meets the three criteria of the indicator, the knowledge mastery must be fulfilled.

2. Research Method

This type of research is true-experimental design. The variables of this research are the result of study and treatment by applying teaching materials based on metacognitive skills. The study design used is randomized control group design:

R	***E***	T_1	Q_1
R	***K***	T_2	Q_2

Figure 1: Randomized Control Group Design

Information:

R : Random (random selection of control and experiment class)

T_1 : Treatment for the experimental class (using teaching materials based on metacognitive skills).

T_2 : Treatment for control classes (without using teaching materials based on metacognitive skills.
Q_1 : Learning outcomes for the experimental class.
Q_2 : Learning results for the control class.
E : Experimental class.
K : Control class.

The population of this study are all students of class XI-IPA SMA Negeri 2 Parepare academic year 2016/2017 consisting of four categories. The sample of this study is the students of class XI-IPA 2 as the experimental class and class XI-IPA 4 as the control class. The sample was obtained by using cluster random sampling technique. This sampling is done because the population members are assumed to be homogeneous. The instruments of this research are learning achievement test sheet, observation sheet (student activity and teacher learning manager ability), and student response questionnaire. Data of learning result collected by using test technique, data of student learning activity and the ability of the teacher to manage to learn managed by using observation technique, while student response data obtained by questionnaire of student response. The data collected were analysed using descriptive statistics and inferential statistics. The descriptive statistical analysis is used to analyse the data mastery learning, student activities, and student responses. Interpretation of learning completeness done as defined by the school.

Table 1: Standard Category of Completed Learning Outcomes of Mathematics Students Class XI-IPA SMA Negeri 2 Parepare

Score	Completed Learning Category
$0 \leq x < 75$	Not completed
$75 \leq x \leq 100$	Completed

Interpretation of learning activities carried out refers to Arikunto (2006).

Table 2: Interpretation of Learning Activities

Percentage of Learning Activity	Category
0% ≤value < 20 %	Very less
20% ≤value < 40 %	Less
40% ≤value < 60 %	Enough
60% ≤value < 80 %	Good
80% ≤ value ≤100 %	Very good

While inferential statistical analysis is used to (1) test the normality of the population by using the Kolmogorov-Smirnov Normality Test and Shapiro-Wilk Test. (2) Test homogeneity of population variance using Levene's Test for Equality of variance (Santoso, 2000)

3. Result and Discussion

The result of descriptive analysis of mathematics learning outcome data for experimental class and control class as in Table 3.

Table 3: Description of Mathematics Learning Outcomes in Experiment Class and Control Class

Statistics	Value	
	Experiment Class	Control Class
Sample size	24	24
Maximum score	100	100
Average score	83,67	77,58
Standard deviation	7,66	9,69
Variance	58,67	74,67
Score range	28	34
Minimum value	68	60
Maximum value	96	94

Students' mathematics learning outcomes are grouped into five categories as in Table 4.

Table 4: Results Categories of Student Mathematics Learning in Experiment Class and Control Class

		Experiment Class		Control Class	
Score	Category	F	(%)	F	(%)
0 - 54	Very low	0	0	0	0
55 - 64	Low	0	0	4	17
65 - 79	Moderate	7	29,2	10	42
80 - 89	High	10	41,6	7	29
90 - 100	Very high	7	29,2	3	12
Total		24	100	24	100

The categorization of the results of the students' mathematical learning mathematics analysis is presented in Table 5.

Table 5: Categorization of Student Learning Mathematics Completion in Experiment Class and Control Class

Score	Category	Experiment Class		Control Class	
		F	(%)	F	(%)
0 - 74	Not Completed	3	12,5	9	37,5
75 - 100	Completed	21	87,5	15	62,5

The results of data analysis of student activity in the experimental class and control class showed that students who were taught by applying teaching materials based on metacognitive skills were more effective than students who were taught without using the metacognitive skills-based learning materials. The data shown on the percentage of student activeness is increasing.

The inferential statistical analysis used to test the research hypothesis is independent samples test. Before the independent samples test is done the first test the normality and homogeneity of variance in each class.

Testing the normality of mathematics learning outcomes of students of class XI SMA Negeri 2 Parepare using the following criteria (Santoso, 2000):
1) The value of significance or probability value < 0,05 is abnormal distribution.
2) The value of significance or probability value > 0,05 is normal distribution

The result of data analysis on experimental class and control class by Kolmogorov-Smirnov test obtained sig value 0,200. Since the sig value is 0.200 > 0.05, it indicates that the

mathematics learning result data for both classes come from a normally distributed population. Meanwhile, if using Shapiro-Wilk test the sig value in the experimental class is 0.713 which means 0.713 > 0.05 and the sig value in the control class is 0.655 this means 0.655 > 0.05. So it can be concluded that the mathematics learning outcomes for the two categories of the normal distribution population.

Homogeneity Test

Homogeneity test of population variance using Levene's Test for Equality of variance test with the following criteria (Santoso, 2000):

1) Significance value or probability value > 0,05 then homogeneous population variance.
2) The value of significance or probability value < 0.05 then the population variance is not homogeneous.

Based on the results of data analysis seen that the sig value for Levene's Test for Equality of variance of 0.231. From the results, it is seen that for the sig value > 0.05. So it can be concluded that the data of mathematics learning outcomes for both groups came from a homogeneous population.

Hypothesis testing

The independent test samples test used is t-test for Equality of Means, with the test criteria, are [14]:

1) If Statistics Count > table-t, H_0 is rejected
2) If Statistics Count < table-t, H_0 is accepted

The results obtained t value = 2.413 and t-table value = 1.68. Therefore t count> t-table, then H0 is rejected. The average of experimental student learning result is higher that is 83,67 from the mean of control class learning result that is 77,58. It was concluded that learning outcomes by applying teaching-based materials to metacognitive skills were better than those without implementing metacognitive skills-based teaching materials at a significance level of 5%.

Teaching materials based on metacognitive skills have an emphasis on cooperative learning and student autonomy. With the use of teaching materials based on metacognitive skills allows for high-level interaction. Because the learning occurs in a variety of interactions between teachers and students, between students, even with media and learning resources. A learning outcome is a value obtained by students after following the learning process by using the test sheet. Learning outcomes were measured using tests. The effectiveness of learning can be measured from the students' learning mastery and student activeness in the learning process. Criteria of learning ability can be seen from the achievement of student learning outcomes. Student learning outcomes otherwise completed individually when reaching a value Mastery Minimum criteria established by the school that is ≥ 75, and otherwise completed classical if ≥ 85% of students in the class reaches 75.

Descriptive analysis results show there are 21 of 24 (87.5%) students in the experimental class has been thoroughly studied. While the control class there are 15 out of 24 (62.5%) students who have completed the study. The average score of student learning outcomes that were taught by applying teaching materials based on metacognitive skills was 83.67 (in the high category) while being taught without using metacognitive skills-based teaching materials the average score is 77.58 study results (in the category of "moderate." The average percentage of students in the experimental class activity was 44.57% (in the category enough), the 38.2% control class (in the less category).

The results of the inferential statistical analysis show that the results of the t-test = 2.413 and t-table value = 1.68 to obtain the value t count > t-table, then H0 rejected H1 accepted. From the results of the analysis shows that the results of mathematics learning of students who are taught by applying the teaching materials based on metacognitive skills is better than the result of learning mathematics of students who are taught without using the materials based on metacognitive skills on math materials at the level of significance $\alpha = 5\%$.

Research results obtained by the statement Mas'ud and Dirawan (2015) that mathematics is taught in schools aims to support the achievement of the objectives of national education. Because mathematics as an organized structure plays an important role in shaping the mindset of students that is critical, systematic, logical, and creative. This mindset can help people solve problems in everyday life. Relation to mathematics learning in school, math facilitate the formation of students' skills in problem-solving both in daily life and in education in schools.

4. Conclusion

Based on the results of research and discussion, it is concluded that the teaching materials based on metacognitive skills are effectively applied in the learning of mathematics. With metacognitive skills-based learning is expected to solve the problems of students in SMA Negeri 2 Parepare that can improve students' ability in solving math problems.

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