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The Effect of Problem-Based Blended Learning Models on the Mathematical Problem Solving Ability of Middle School Students

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Abstract
This study aims to analyze the effect of problem-based blended learning models on problem solving abilities. The sample of this study were 64 students who were grouped into two classes, namely class VIII A as BLBM class and class VIII B as Direct class. Data obtained through KAM tests, and tests of students' problem solving abilities. Data were analyzed using two-way ANAVA. Based on the results of the analysis using two-way ANAVA research results obtained problem solving abilities taught by problem-based blended learning models are better than direct learning. The significance value obtained from anava is 0.004 <significance level value of 5%. This shows that there are significant differences in problem solving skills in both learning, then obtained the significance value of the learning model and KAM of 0.607> a significance value of 5%. So there is no interaction between the learning model and KAM on the ability to solve problems. The research findings recommend a problem-based blended learning model to be one of the learning approaches used in secondary schools.
Keywords : Problem Based Blended Learning, Mathematical Problem Solving Ability, KAM
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1. PRELIMINARY

The development of science and technology today is felt to have an impact on education. Education has a very decisive role for the development and realization of individual self, especially in creating quality human resources (Suntoro, 2009: 1). In an effort to improve the quality of education, it is carried out in an innovative and measurable manner. Learning is expected to create an interactive, inspiring and fun atmosphere and motivate students to play an active role in learning, develop talents, interests and physical and psychological development with the creativity and independence of students. To develop the quality of education towards a better view of the achievement of educational goals.

According to Hasratuddin (2014: 30) that "one of the educational programs that can develop the ability to think critically, systematically, logically, and creatively is mathematics". Mathematics is able to construct systematic ways of thinking and guide students in investigating problem solving. That way students will experience what is called meaningful learning. One of the goals of learning mathematics is that each student has the ability to solve mathematical problems. Based on its development, the problems faced in learning mathematics are increasingly complex and lead to creative 21st century educational goals, so that according to Purba (2017: 3) learning that "it is very necessary to understand the ability in mathematics and problem solving in mathematics and mathematical communication, to be able to solve mathematical problems ". For a teacher in developing the ability to understand in mathematics and the ability to solve problems in students is not easy, but should not be quick to give up because the way a person can understand and think is very much determined by the environment in which he lives.

Sumarmo (2005: 21) defines problem solving as activities to solve story problems, solve problems that are not routine, apply mathematics in daily life or other circumstances, and prove or create or test conjectures. Then Suherman (2003: 89) states that problem solving is part of a very important mathematics curriculum because in the learning process students are able to gain experience using the knowledge and skills they already have to apply to problem solving problems that are not routine. Based on this understanding, in solving mathematical problems seen the existence of mathematical power development activities towards students. Thus the ability to solve problems becomes a general goal of learning mathematics and is the core goal of learning mathematics. The ability to solve problems prioritizes the processes and strategies undertaken by students in solving a problem that usually only prioritizes the final results. So that students' skills in analyzing problems and the process of solving them become basic abilities formed from learning mathematics.

Polya (1973: 3) defines problem solving as an effort to find a way out of a difficulty, achieve a goal that is not immediately attainable. Problem solving is a psychological process that involves not just the application of the postulates or theorems learned. A simple understanding of problem solving is the process of accepting problems as challenges to solve them. Indicators of the ability to solve mathematical problems according to Polya, namely; (1) Understanding the problem (Understanding the problem), (2) Planning a solution (devising a plan), (3) Implementing the problem solving plan (carrying out the plan), (4) Re-checking the truth of the completion (looking back).

Whitelock & Jelfs (2003) provides several definitions of blended learning, namely (1) a combination of traditional learning with a web-based learning approach, (2) a combination of media and tools in an e-learning environment, (3) a combination of several learning approaches, use of learning technology.

Carman (2005: 2) explains that there are five keys to implementing learning with blended learning, namely: 1) Live Events, 2) Self-Paced Learning, 3) Collaboration, 4) Assessment (assessment), 5) Performance Support Materials. These five things are key components in the application of blended learning, which of course must exist in its implementation.

The syntax of the Blended learning model according to Grant Ramsay (2001): Phase 1: seeking of information, Finding information from various sources of information available on ICT (online), books, and delivery through face to face in class. Phase 2: acquisition of information, Interpreting and elaborating information personally and communally. Phase: synthesizing of knowledge, Reconstructing knowledge through the process of assimilation and accommodation based on the results of the analysis, discussion and formulation of conclusions from the information obtained.

Arends in Trianto (2009) states that Problem Based Learning not designed to help teachers convey large amounts of information to students, however Problem Based Learning designed prioritized to help students develop thinking skills, problem solving skills, and intellectual abilities, learn the process of maturity by experiencing it through various real situations or situations that are simulated and become independent and autonomous students.Problem-based learning can be applied by referring to the following steps: 1) Students' orientation to problems, 2) Organizing students to learn, 3) Guiding individual or group investigations, 4) Developing and Presenting Work, 5) Analyzing and evaluating problem solving processes (Trianto, 2009: 28).

Table 1. Syntax of Problem Based Blended Learning Model

No	*Blended Learning*	*Problem Based Learning*
1	Phase: seeking of information	Student orientation to problems
		Organizing students for learning
2	Phase: acquisition of information	Guide individual or group investigations
3	Phase: synthesizing of knowledge	Develop and Present the work
		Analyze and evaluate the problem solving process

2. RESEARCH METHODS

This study uses a quasi-experimental method with a pretest-posttest control group to examine the effect of differences in problem solving abilities between two groups of students who are given Blended Learning Problem-based learning and Direct Learning.

This study uses two parallel classes by applying different learning. The first class is given the treatment of problem-based Blended Learning while the second class is not given treatment. The experimental design of this research can be seen in the table below:

Table 2. Research Design

Treatment group	*Pretest*	*Treatment*	*Postest*
Experiment	Q1	X	Q2
Control	Q1	O.	Q2

Source: modification from Lestari & Yudhanegara (2015)

Information:
Q1 : Pretest students' problem solving abilities.
Q2 : Postest student problem solving skills.
X : Treatment of the problem based Blended Learning model.
O. : no treatment

The population in this study were all grade VIII students of SMP N 4 Air Putih, Batu Bara Regency. There are 64 students. The study sample was selected in groups (cluster sampling). Considering the small population and study groups in the school for class VIII consisting of two classes, the researcher may not take students randomly to form a new class, because it will disrupt the learning process at school so the researcher takes the smallest sampling unit is the class. Two classes were selected, namely class VIIIA, VIIIB with 32 students in class VIIIA and 32 students in class VIIIB. Then from the two classes the selection is carried out so that class VIIIB is obtained by direct learning and class VIIIA with problem-based blended learning models.

This study uses test instruments in data collection. The test instruments take the form of pre-test and post-test mathematical problem-solving abilities. Each test consists of 5 items each containing four indicators of problem solving based on the steps of solving the problem polya.

This study uses inferential statistical analysis Analysis of variance of two paths or also called Anava more than one path. This inferential statistical analysis is used to test comparisons and regressions with two conditions fulfilling the requirements: the study sample is normally distributed and the sample research is homogeneous.

Anava can be used to determine whether the average value of two or more samples is significantly different or not. And to produce an F value that significantly shows the researcher that the sample under study is from a different population. Anava is also a univariat that can be used to determine the influence and interaction of two factors with one dependent variable, namely the interval, type ratio and several independent variables which are nominal or ordinal types.

3. RESULTS AND DISCUSSION

The grouping of students based on KAM (Early Mathematics Ability) is divided into three groups namely high, medium and low. The number of students in the experimental class and control class is the same, 32 students. The division of students is based on KAM for each class (experiment and control), namely: 6 students have high KAM, 20 students have medium KAM and 6 students have low KAM. the average KAM score of students in the experimental class in the high category was 88.5 in the medium category at 69.15, and in the low category at 46.3.

Pretest will be given to students before being given the problem-based Blended Learning model treatment and direct learning. The pre test consists of 4 items, each question has a weight of 12. For the posttest also consists of 4 items problem solving and each item has a weight of 12. so the maximum value that students will get in the pre test or posttest is 12 x 4 = 48.The results of descriptive analysis of the problem solving skills of students in the two learning groups based on the grouping of students' initial mathematical ability (KAM) categories are presented in Table 3 below:

Table 3. Data Description of the Problem Solving Ability of the Second Student Learning Group for the KAM Category

KAM category	Statistics	Learning					
		BLBM			Live		
		Pretest	Postes	*N-Gain*	Pretest	Postes	*N-Gain*
High	Total students	6	6	6	6	6	6
	Average	55.9	78.47	0.51	60.76	70.83	0.23
Is	Total students	20	20	20	20	20	20
	Average	31,146	67.08	0.51	35.21	56	.303
Low	Total students	6	6	6	6	6	6
	Average	13,19	50.69	0.423	14.58	45.1	.359

Based on the Hake category (1998), the average problem solving ability of students who obtain problem-based blended learning, high, medium and low KAM are included in the moderate N-Gain category $(0,3 < g \leq 0,7)$. As for direct learning the high KAM category is included in the moderate N-Gain category $(0,3 < g \leq 0,7)$ meanwhile moderate KAM and low KAM are included in the low N-Gain category $g \leq 0,3$.

The test results show that students' mathematical resilience comes from populations that are normally distributed with the variance of each pair of homogeneous data groups, then the ANAVA statistical analysis is then performed. Posttest data mathematical problem solving abilities

Table 4 Two-way ANAVA Hypothesis Test with SPSS Against the Problem Solving Ability

Tests of Between-Subjects Effects					
Dependent Variable: MATHEMATICAL TROUBLESHOOTING ABILITY					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5769.309a	5	1153,862	13,629	.000
Intercept	177296,609	1	177296,609	2094,104	.000
KAM	4268,418	2	2134,209	25,208	.000
MODEL	760,725	1	760,725	8,855	.004
KAM * MODEL	85,251	2	42,626	.503	607
Error	4910,550	58	84,665		
Total	253113,000	64			
Corrected Total	10679,859	63			
a. R Squared = .540 (Adjusted R Squared = .501)					

Can be seen in table 4, that learning model factors obtained Fcount value of 8.985 andthe significance value of the learning model 0.004 is smaller than 0.05 then H0 is rejected and Ha is accepted. So, there is influenceproblem-based blended learning and direct learning on students' problem solving abilities.

Table 5. Effects of Learning on Problem Solving Capabilities

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.729a	.532	.517	9,051
a. Predictors: (Constant), Learning Models, KAM				
b. Dependent Variable: Problem Solving Ability				

From Table 5, the summary model above, it can be seen that the coefficient of determination R-Square is 0.532 (53.2%). This shows that 53.2% of the variation of the dependent variable (problem solving ability) can be explained by 2 independent variables (problem-based blended learning and direct learning), meaning that the influence of the independent variable on changes in the dependent variable is 53.2%, while the remaining 46.8% is influenced by other variables besides the independent variable.

Confirmation results using SPSS 20 are presented in Table 5 above. Based on the results of the two-way ANAVA test in Table 5, the information obtainedFcount value of 0.503 andthe significance value of the learning model and KAM 0,607 is greater than 0.05, which means Ha is rejected and H0 is accepted, it means that it can be concluded that there is no interaction between the learning model and KAM in influencing students' problem solving abilities. More details are presented in Figure 1. below:

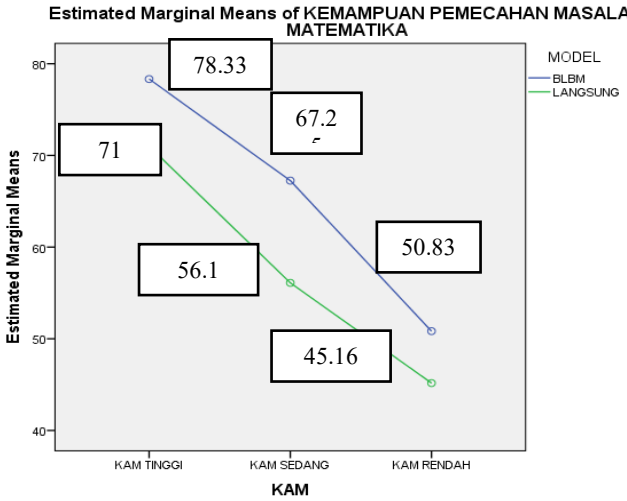

Figure 1. Graph of Interaction between Learning Model and KAM Against Students' Problem Solving Ability

Problem solving in mathematics is a psychological activity to find solutions to mathematical problems faced by using integrally all the stock of mathematical knowledge that is already possessed. In this case, the proposed problem must be meaningful and beneficial to improve students' ability to find solutions to problems.

In solving problems, it must refer to the steps or stages of problem solving. according to Polya (1973), there are four stages in solving problems namely; (1) Understanding the problem (Understanding the problem), (2) Planning a solution (devising a plan), (3) Implementing the problem solving plan (carrying out the plan), (4) Re-checking the truth of the completion (looking back).

Based on the results of descriptive data analysis before being given treatment, students in both classes have the ability to solve problems that are not significantly different. This can be seen from the average KAM BLBM grade test scores and direct respectively are 68.34 and 61.56. After being treated, the problem-solving ability of students who learn with a problem-based blended learning model is higher than students who learn by direct learning. This is shown from the dataaverage normalized gain scores of students' problem solving abilities taught with learning *blended learning* problem based amounted to 0.4977 higher than the average normalized gain score of students' problem solving abilities taught by direct learning that is equal to 0.3199.

In line with this delivered by Sumartini (2016: 18) that increasing the mathematical problem solving ability of students who get problem based learning is better than students who get conventional learning.

A similar sentiment was conveyed by Ekawati (2018) the application of blended learning with the edmodo application based on the PDEODE learning strategy can improve student achievement in class VIII-F MTs N Magelang. This is evidenced by the percentage of students' mastery learning that is pre-cycle to cycle 1 an increase of 31%, an increase from cycle I to cycle II of 62%, and an increase from pre-cycle to cycle II of 93%.

The results showed no interaction between KAM and the model on the ability to solve mathematical problems. A similar sentiment was also conveyed by Setiawati, Syahputra and Rajjagukguk (2013: 12). There was no interaction between the learning approach used and students 'initial mathematical abilities (high, medium,

and low) on improving students' problem solving abilities.

4. CONCLUSION

Based on the analysis results, mathematics learning both with problem-based blended learning and with direct learning has an influence on students' mathematical problem solving abilities. Some conclusions relating to learning factors, initial mathematical abilities, and students 'mathematical problem solving abilities, the following conclusions are obtained: 1) there is an influence of problem-based blended learning models on students' mathematical problem solving abilities. In this study the effect of increasing students 'mathematical problem solving abilities taught using blended learning models is better than students' mathematical problem solving abilities taught using direct learning models.

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