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IMPROVING STUDENTS' MATHEMATICAL PROBLEM SOLVING ABILITY BY USING MACROMEDIA FLASH ON GEOMETRY MATERIALS

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Abstract

The purpose of this study was to determine and describe the increase in students' mathematical problem solving abilities after receiving learning using Macromedia flash at MTsN Model Banda Aceh. This research approach quantitatively through a quasi-experimental design and one group pretest-posttest design. The population was all students of class VIII MTsN Model Banda Aceh, while the sample was selected using a random sampling technique and selected students of class VIII-5 as the sample. The research data were collected through a mathematical problem solving ability test which included pretest and posttest questions. Furthermore, the data were analyzed through SPSS version 17 with paired sample t-test and percentage tests. The results showed that there was an increase in students' mathematical problem solving abilities after receiving learning using Macromedia flash on geometry material at MTsN Model Banda Aceh. While the increase in students' mathematical problem solving abilities in understanding problems is 41.6%, planning is 47.2%, carrying out is 58.3%, and re-examining is 41.7%. The use of Macromedia flash on geometry material is the right solution in visualizing abstract geometric objects into concrete forms, thereby accelerating the achievement of better students' mathematical abilities.

Keywords: Geometry; Macromedia Flash; Mathematical Problem Solving Ability.

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INTRODUCTION

The ability to think logically, analytically, systematically, critically, creatively, and the ability to cooperate can be provided to all students starting from elementary school through learning mathematics. Even students in finding new ideas or ideas that can be useful for technological developments in the future are also strongly supported by mathematics. Because learning mathematics not only requires calculating skills, but also requires thinking skills and reasoning mathematically in solving math problems and learning new ideas that students will

face in the future (Janah, et al, 2019). This is relevant to one of the general goals of providing mathematics education as stated in the content standards of BSNP (2006) which states that mathematics subjects aim to make students have problem solving skills. Besides, the government always makes improvements, reforms and pays attention to the development of education in Indonesia, especially mathematics, hence the making of 2013 curriculum that has tried to develop it in accordance with the demands of the times and international competitions such as TIMSS, PISA, PIRLS and others.

The 2015 TIMSS data for the mathematics studies placed Indonesia in 44th place out of 49 countries (Mullis, et.al, 2016) and the result of PISA in 2015 also placed Indonesia in 63rd place out of 70 participating countries (OECD, 2016) . Stacey (2011) also stated that in the PISA test, as many as 76.7% of Indonesian students were only able to solve low-level questions. Furthermore, Yunengsih (2008) added that the distribution of national exam questions is still required by students to do a lot of calculations by applying formulas without emphasizing problem solving.

Based on the empirical data above, it becomes one of the materials for teachers to make improvements in learning in schools, hence, the quality of Indonesian education is increasingly qualified, especially in an effort to improve students' mathematical abilities such as mathematical problem solving abilities. The improvement can be done by getting used to learning patterns that emphasize more on improving problem solving abilities and improving the process of evaluating learning outcomes.

BSNP (2006) states that to improve mathematical problem solving skills, it is necessary to develop skills to understand problems, create mathematical models, solve problems, and interpret solutions. While the indicators of mathematical problem solving ability are (1) identifying the adequacy of data to solve problems; (2) creating a mathematical model of a problem and solve it; (3) selecting and implementing strategies to solve various problems (homogen and new problems) within or outside mathematics; (4) explaining or interpreting the results

according to the original problem, and checking the correctness of the results or answers; and (5) applying mathematics in a meaningful way (Sumarmo, 2012)

One of the mathematical materials that must be mastered by students is geometry. NCTM (Petrus, 2017) states why geometry needs to be taught in schools because: (1) the world is built by form and space; (2) formal geometry is very helpful for students who have abstraction problems; (3) help to solve problems in other scope of mathematics; and (4) help students' visual thinking. Furthermore, NCTM (2000) also states that the purpose of geometry taught in schools is so that children can use visualization, have spatial abilities and geometric modeling to solve problems. However, Hidayat and Mirza (Nursyahidah, 2016) said that there are many students who still have difficulty in learning geometry. The results of interviews with mathematics teacher who teaches in class VIII MTsN Model Banda Aceh also mentiones that the dominant students' difficulties in geometry are spatial geometry and solving problem related to geometry.

Based on the results of a preliminary study in class VIII MTsN Model Banda Aceh, it was also found that 61% of students had difficulties in solving problems that required mathematical problem solving skills. One of the reasons is that students are not accustomed to solve problems that require high-level thinking and apply mathematics in a meaningful way. Stacey (2012) states that the lack of ability of students in the process of solving mathematical problems will have an impact on the development of fundamental mathematical abilities that must be possessed by every student.

The importance of reforming and improving students' mathematical problem solving abilities because mathematical problem solving is the heart of mathematics. Problem solving ability is a basic ability in teaching mathematics, thus helping students to develop analytical skills, helping students to be critical and creative, and to improve other mathematical abilities (Hendriana, et al, 2018). The importance of mathematical problem solving is also expressed by Beigie (2008) who says that through mathematical problem solving students can learn about deepening their understanding of mathematical concepts by working through

carefully selected problems and applying mathematics to real problems. The development of mathematical problem solving skills can also equip students to think logically, analytically, systematically, critically, and creatively.

One alternative that is possible to help students improve their mathematical problem solving skills on geometry material is to design learning using Macromedia flash. This is because macromedia flash can make learning more interesting and make it easier for students to imagine in understanding spatial properties that are useful in solving geometric problems.

Macromedia flash is an application that is used to design presentation devices, publications, or other applications that require the availability of a means of interaction with the use of projects built with flash, which can consist of text, images, simple animations, videos, or other effects (Wahono, 2002).). Simbolon et. al (2017) also said that the use of macromedia flash can help teachers to design and develop learning media in the form of animations that can be played with flash movies, the aim is to make it easier for students to understand and identify mathematical problems given by the teacher.

The results of Guzel & Gunhan's (2010) research on Prospective Mathematics Teachers' Views about Using Flash Animations in Mathematics Lessons conclude that teachers agree on the importance of using flash animation in mathematics lessons. The results of the three teachers interviewed showed a paradigm shift in using flash animation in mathematics lessons from the pre-interview and post-interviews which showed the importance of integrating technology into mathematics learning. The results of research conducted by Simbolon, et al. (2017) on The Efforts to Improving the Mathematical Critical Thinking Student's Ability through Problem Solving Learning Strategy by Using Macromedia Flash also obtained results: (a) the application of learning with a problem-solving approach using Macromedia flash can improve students' critical thinking skills. This can be seen from the achievement of increasing learning outcomes obtained by 40% in the first cycle to 60% in the second cycle, and 80% in the third cycle. b) the ability of teachers to manage learning with a problem-

solving approach using Macromedia flash in the good category in the third cycle with an achievement of 87.5%. However, this study tries to apply Macromedia flash media in an effort to improve other mathematical competencies, namely the ability to solve mathematical problems that are specialized in geometry.

Based on the opinions and results of previous studies above, the use of Macromedia flash in mathematics learning on geometry material is possible to improve students' mathematical problem solving abilities. The formulation of the problem in this study is how to increase students' mathematical problem solving abilities after getting learning using Macromedia flash on geometry material at MTsN Model Banda Aceh.

METHOD

This study uses quantitative approach with quasi-experimental research design with one group pretest posttest design. Arikunto (2010) states that the one group pretest posttest design is an experimental model that is carried out in one group only by comparing the results of the initial test with the final test. The population in this study were all students of class VIII MTsN Model Banda Aceh, while the sampling used random sampling technique and the samples were students of class VIII-5.

The learning instruments used are lessons plan, student worksheets, and teaching materials in the form of Macromedia flash. While the data collection instrument is a test of mathematical problem solving ability in the form of description questions which is developed based on indicators of mathematical problem solving ability. Furthermore, the data was collected through a test consisting of a pretest and posttest which was then continued by analysis using SPSS version 17 and the statistical test used was paired sample t-test after the test of data normality requirements had been met at a significance level of 5%. The paired t-test formula is as follows.

$$t = \frac{\bar{D}}{\frac{SD}{\sqrt{n}}}$$

Description:
$\overline{D}$ = Average difference of measurement
SD = Standard deviation
n = Lots of data (Sudjana, 2005)

RESULT AND DISCUSSION

This research was carried out for four meetings with a meeting for the implementation of the pretest, then two learning meetings with Macromedia flash media on prism and pyramid material. Where the lesson plans were developed for two meetings with Macromedia flash as a learning medium that has been designed in the form of flash which can be directly practiced by students through computers during learning, especially in completing student worksheets activities. At the fourth meeting, students were given a posttest to see the development and improvement of students' mathematical problem solving abilities.

Based on the results of pretest and posttest data analysis, the average mathematical problem solving ability of students on geometry material before and after learning using Macromedia flash was 44.92 and 88.08. The results of the normality test of the pretest and posttest data also showed that the data were normally distributed. Furthermore, an analysis was carried out to know the improvement of students' mathematical problem solving abilities after receiving learning using macromedia flash using the paired sample t-test at a significance level of 5%. The research hypothesis tested in this study is that there is an improvement of students' mathematical problem solving abilities after having Macromedia flash in learning of geometry material at MTsN Model Banda Aceh.
The formulation of the statistical hypothesis is as follows:

H_0 : There is no improvement of students' mathematical problem solving abilities after learning by using Macromedia flash on geometry material at MTsN Model Banda Aceh

H_a : There is an improvement of students' mathematical problem solving abilities after learning by using Macromedia flash on geometry material at MTsN Model Banda Aceh.

The results of data analysis using paired t-test can be seen as presented in Table 1 below.

Table 1. Hypothesis Test Results with Paired Samples t-Test

		Paired Differences					t	df	Sig.(2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Dev.	Std. Error Mean	Lower	Upper			
Pair 1	Pretest - Posttest Result of Students' Mathematical Problem Solving Ability	-43.16	5.11	.85	-44.89	-41.43	-50.60	35	.000

Based on the results of the hypothesis test presented in Table 1 above, it can be seen that the value of sig. < 0.05, so based on the test criteria H_0 is rejected or H_a is accepted. As a result, it can be concluded that there is an improvement in students' mathematical problem solving abilities after learning by using Macromedia flash on geometry material at MTsN Model Banda Aceh. The results of this study indicate that students' mathematical problem solving abilities can improve after learning by using Macromedia flash on geometry material. This is also supported by the research results of Simbolon, et al. (2017) the application of learning with a problem-solving approach using macromedia flash can improve students' critical thinking skills. The study (Liberna & Nusantari, 2018; Umam & Yudi, 2016) that there was an improvement of students' mathematics learning achievement after being taught using Macromedia flash.

The improvement of students' mathematical problem solving abilities in this study is also inseparable from the advantages contained in Macromedia flash which can create interactive buttons with a movie or other object, make changes to color transparency in movies, make animation changes from one form to another, create animated motions by following a predetermined path, and can be converted and published into several types including .swf, .html, .gif, .jpg, .png, .exe, .mov. Things that happened in learning by using Macromedia flash at the time of this research attracted students' interest, curiosity, and motivation to learn due to the

display of easy-to-understand learning materials with animations running on their own by clicking on each icon the students wanted.

Another effect of the design of teaching materials in the form of Macromedia flash is also very helpful for students to learn geometry material easily, especially in spatial geoemtry materials and students can also learn independently from teaching materials that have been made in Macromedia flash flexibly and what students imagine can be seen visually. This is relevant to Pesonen's statement (Guzel & Gunhan, 2010) that using Macromedia flash is an important beginning in connecting abstract mathematics to concrete ones or vice versa, so that mathematics learning is more meaningful.

The improvement of students' mathematical problem solving abilities based on the steps in solving mathematical problems before and after learning using Macromedia flash can be seen in Figure 1 below.

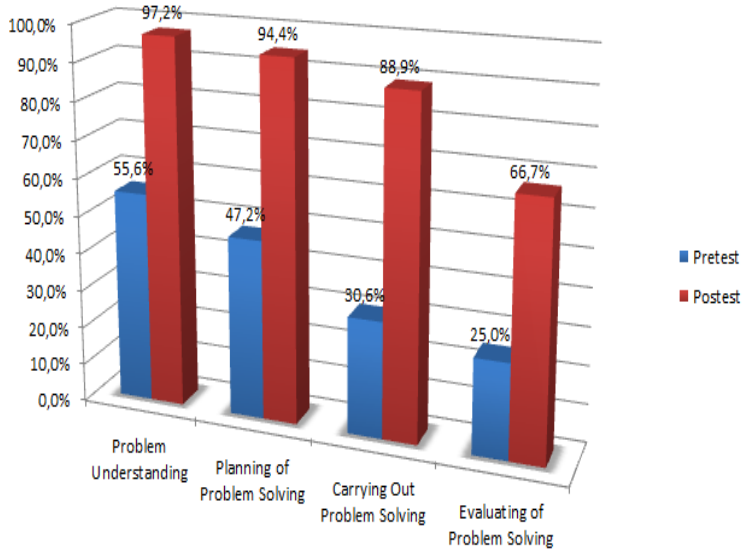

Figure 1. Percentage of Students' Ability in Solving Mathematical Problems

Based on the bar chart above, it can be seen that the mathematical problem solving ability of students in understanding problems before learning using Macromedia flash is 55.6% and after learning is 97.2% with an improvement of 41.6%. Students' mathematical problem solving ability in planning of problem solving before learning using Macromedia flash is 47.2% and after learning is

94.4% with an improvement of 47.2%. Students' mathematical problem solving ability in carrying out problem solving before learning using Macromedia flash is 30.6% and after learning is 88.9% with an improvement of 58.3%. Students' mathematical problem solving ability in evaluating problem solving before learning by using macromedia flash is 25% and after learning is 66.7% with an improvement of 41.7%.

The improvement in students' mathematical problem solving abilities in understanding problems by 41.6% cannot be separated from learning by using Macromedia flash which always begins with displaying what is known and asked of each problem solved on the problem understanding icon, so that students are familiar with identifying the adequacy of data from each problem to be solved and focus on the information provided and on the expected solution. This is relevant to the statement of Polya (1973) which states that in understanding mathematical problems students must be accustomed to writing or asking what is known and asked and whether the data provided is sufficient?. While the improvement of students' mathematical problem solving abilities in planning of problem solving by 47.2% is also influenced by learning using Macromedia flash which has an icon to plan problem solving in each case studied and solved in student activities.

The increase in student' mathematical problem solving abilities in carrying out problem solving by 58.3% is also strongly influenced by the Macromedia flash factor used in learning. As a result of the appearance and design designed in Macromedia flash which can be displayed gradually, which makes students think before proceeding to the next stage and is strengthened by student activities in carrying out problem solving for different cases contained in macromedia flash. While the increase in students' mathematical problem solving abilities in evaluating problem solving by 41.7% is also inseparable from students' habituation to re-examine each step of completion that has been done in solving mathematical problems. The habit of verifying or evaluating each step of problem solving is also contained in the Macromedia flash display and student activities during learning.

CONCLUSION

Based on the results of data analysis and discussion that has been described, the following conclusions can be obtained: (1) There is an improvement of students' mathematical problem solving abilities after learning using macromedia flash on geometry material at MTsN Model Banda Aceh. (2) The improvement of students' mathematical problem solving abilities based on the steps in solving mathematical problems in understanding problems by 41.6%, planning of problem solving by 47.2%, carrying out problem solving by 58.3%, and evaluating of problem solving by 41.7%.

There are several things that can be suggested based on the findings in this study, they are: (1) Teachers are expected to be able to realize dynamic learning conditions by applying models, methods, approaches or using relevant media, hence, they can improve the expected mathematical abilities of students, especially mathematical problem solving abilities. (2) Learning using macromedia flash can be used as an alternative technology-based learning media that can be used in learning mathematics, especially on geometry material. (3) As an effort to improve students' mathematical problem solving skills, alternative problem solving offered by Polya can be used as a form of problem solving that can be used because it can make students think systematically and think convergently.

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