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Students' Mathematical Creative Thinking Ability Judging from Self-Regulated Learning in MiC Learning with an Open-Ended Approach

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Abstract

The purpose of this study is to analyze the mathematical creative thinking ability of class VIII students in terms of Self-Regulated Learning. This research method is mixed-method research with a sequential explanatory design. The research population is class VIII SMP Futuhiyyah Mranggen Academic Year 2020/2021. The sampling technique of self-regulated learning uses simple random sampling by taking 6 subjects. The results show that students with high Self-Regulated Learning can have a smooth flow of thought, can produce uniform ideas, can give answers that are different or unusual from the others, and can develop, add, and enrich an idea. Students with Self-Regulated Learning can have a smooth flow of thought and can develop, add, and enrich an idea. Students with low Self-Regulated Learning are only able to have a smooth flow of thought

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INTRODUCTION

The educational revolution that occurred in many countries requires all human beings to follow the changes that are happening today. Creativity is the most important way to respond to a changing world. The purpose of education held in each educational unit refers to Law No. 20 of 2003 which is to develop students to become human beings who believe and fear God Almighty, have a noble character, are healthy, knowledgeable, capable, creative, independent, and become citizens who are good citizens. democratic and responsible. One way to achieve these educational goals is to include mathematics as a compulsory subject for students from elementary to higher education levels.

The importance of mathematical creative thinking is also found in the 2013 Curriculum. This is evidenced by Government Regulation Number 17 of 2010 in the 2013 Curriculum concerning Education Management and Implementation, which states that the purpose of primary and secondary education is to build a foundation for the development of students' potential to become good human beings. knowledgeable, capable, critical, creative, and innovative.

However, in reality, students' creative thinking skills are still low and not optimal. Fardah (2012) states that the attention to creative thinking skills of elementary and middle school students is still low. Purwaningrum (2016) in grade VIII students of one of the junior high schools in Pekalongan Regency showed that in problem-posing learning, students in the less creative and non-creative categories had difficulty in indicators of flexibility and novelty. Students in these categories need a long time to come up with ideas.

The success of the learning process cannot be separated from the ability of teachers to develop learning models, developed more interactive learning media oriented towards increasing the intensity of student involvement effectively in the learning process. In this case, researchers are more focused on improving the learning model.

The lack of understanding of a teacher's ability to understand these various conditions causes the model developed by the teacher to be unable to optimally increase the role of students in learning, and ultimately cannot make a major contribution to the achievement of student learning outcomes. Education is not just conveying material, but also needs to build creative abilities. Cahyaning & Asikin (2015) stated that mathematics subjects need to be given to all students starting from elementary school to equip students with logical, analytical, systematic, critical, and creative thinking skills, as well as the ability to work together.

According to Tohir (2019), the recently released 2018 PISA results. The study assessed 15-year-olds from 79 countries every three years. The study compared the math, reading, and science performance of each child. Indonesia's average score is 371, below the first rank occupied by China with an average score of 555..

From the survey results, it was found that Indonesian students were still under and many Indonesian students had difficulty in answering questions correctly. This shows that students' higher-order mathematical thinking skills such as creative thinking are still very lacking. So there need to be improvements to improve the quality of learning in Indonesia. Firdausi, Asikin, Solehuzain, and Dwidayati (2016) suggest creative thinking usually involves problem-solving, utilizing certain aspects of intelligence, for example, language, mathematics, and interpersonal. Akgul & Kahveci (2016) suggest that Vygotsky states that creativity is one of the important mechanical activities in constructing students' new knowledge. Creative thinking includes aspects of cognitive, affective, and metacognitive skills. Creative thinking skills are also related to the ability to generate many ideas (fluency), generate different ideas (flexibility), new products or ideas (originality), and develop or enrich other people's ideas (elaboration).

Rasnawati (2019) states that there are four components of creative thinking, namely: (a) Fluency, (b) Flexibility, (c) Originality, (d) Elaboration. Juwita (2019) states that students' creative thinking skills in solving contextual problems in mathematics are still being discussed. Because the word mathematics is still something that students are afraid of because the material is difficult it's not because of the difficult material, but the lack of student's creative thinking skills in problem-solving.

Based on an interview with one of the mathematics teachers of SMP Futuhiyyah Mranggen, it was found that there are problems faced in learning mathematics, including: (1) students' abilities are still low, namely the ability to solve contextual problems; (2) Students still depend on the explanation of the material from the teacher even though the teacher has tried to apply cooperative learning; (3) students in solving questions answered with a single answer. Students have not been able to give various variations of answers, where when the teacher gives questions the students are only able to solve the problem with one answer, even though from these questions students can find variations of answers. This shows that students' mathematical creative thinking skills are not optimal.

While in learning mathematics, the difference between the sample questions and the form of the questions given by the teacher makes students have difficulty in solving the problem that students are confused and lazy to do it. The attitude of a students' dependence on teachers like this makes teachers have to give examples first they can work on the problem. This shows another problem in learning mathematics in the classroom, namely the lack of student learning independence. If you want to form a mathematical creative thinking pattern, it requires a more independent attitude of the student's in the learning process. Not only the cognitive aspect, but the thing that is no less important in mathematics is also the affective aspect.

Asih and Ramdhani (2019) argue that the attitude of independent learning plays an active role in the problem-solving process in other studies or everyday life, more specifically in the study of mathematics education. Robiana and Handoko (2020) state that the magnitude of the responsibility and initiative of students to always play an active role and plan to learn, learning processes, and evaluating learning is a determination of how much a student's level of learning independence is. According to Fadlemula, Cakiroglu, & Sungur (2015), Self-regulated learning (SRL) serves as a comprehensive framework for understanding how students become active learners in their learning process.

Realizing the importance of students having creative thinking skills and good learning independence, a teacher must be able to pursue learning that allows students to be facilitated by active learning conditions. The learning model used by the teacher must also be able to motivate students and encourage students to develop cognitive and effective students. Mathematics teachers at SMP Futuhiyyah Mranggen generally use the expository learning model with the consideration that this model is very easy to implement and efficient for delivering subject matter with the condition of a large number of students. One of the efforts to change the steps in learning is required to improve mathematical creative thinking skills through Mathematics in Context (MiC) learning where MiC is for junior high school students because the thinking level of junior high school students is higher so they don't have to use teaching aids and math problems took. through real-life which allows it to be more easily understood. In MiC learning, students will be faced with a problem and are required to solve problems by digging up information and finding solutions from the information that has been obtaining. To make it easier to solve problems, the problem given to students must be contextual or by reality.

Research conducted by Nanang (2018) stated that the application of the MiC approach in low-grade mathematics lectures at the PGSD STKIP Garut Study Program had a positive influence, namely the mathematical problem-solving ability of students who received the MiC approach better than students who received the conventional approach. Millaty (2019) states that MiC learning can be started by presenting material concepts from the environment and everyday life which are then directed to the actual learning concepts so that students can understand the benefits of the material they are learning and its relation to everyday life. According to Meyer (2001), the importance of learning MiC is that students can learn mathematics in any context, which makes students not bored to learn mathematics the motivation to learn mathematics can grow.

To grow so that students can think creatively, it is necessary to have questions or problems whose solutions are not single or varied so that they require the right approach, namely the Open-Ended approach. According to Ariani (2014), Open-Ended was expected to make learning activities more student-centered. The Open-Ended approach is

believed to provide more opportunities for students to gain more knowledge, experience discovery, recognize and solve problems because this approach designs problems with different methods and has more than one solution. Munroe (2015) revealed that the Open-Ended approach has a long history of successfully making Japanese students more skilled in developing open-ended problem-solving. Students who were previously required to work on highly structured tasks, tasks that only have one correct answer, and tasks that require reproductive thinking, can be asked to carry out divergent and imaginative thinking processes. Learning was expected to assist teachers in fostering a creative atmosphere in terms of students' self-regulated learning. Based on the description above, a study was conducted to analyze the mathematical creative thinking skills of class VIII students in terms of self-regulated learning through the Mathematics in Context (MiC) learning model with an Open-Ended (OE) approach.

METHOD

This research is a type of combination research (mixed method) type sequential explanatory design. The research design used in quantitative research is truly experimental in the form of Pretest–posttest control group design. This design involves two groups (experimental and control) where the experimental group was given treatment and posttest while the control group was only given pretest and posttest. By using this design the experimental group and control group have the same characteristics because they are taken randomly from a homogeneous population also. It's just that the pretest in this design was replaced with an initial ability test for mathematical creative thinking. For taking research subjects in the experimental class, they were selected using a simple random sampling technique, namely the selection of samples from the population which was carried out randomly without regard to the strata in the population, this method could be done if the population was homogeneous.

Initial data analysis includes normality test and homogeneity test. While the final data analysis includes normality test, homogeneity test, hypothesis testing.

The first hypothesis is about the average completeness test using the One-Sample T-Test with a significance level of 5%. The second hypothesis is about the classical completeness test. The third hypothesis regarding the average difference test using SPSS Independent Sample T-Test with a significance level of 5%. The hypothesis regarding the effect test uses simple regression with a significance level of 5%.

To account for the credibility of this research, the researcher triangulated. Triangulation carried out in this study is the triangulation of time and source. The triangulation results are used as a reference in achieving transferability. The dependability test on the data analysis of the characteristics of mathematical creative thinking was carried out by conducting an audit of the entire research process. The confirmability test is a test of the results of the analysis of the characteristics of mathematical creative thinking associated with the research process carried out by researchers. Data analysis in this study uses the Miles and Huberman model which includes: (1) data reduction (data reduction), (2) data presentation (data display), (3) conclusion drawing/verification (Sugiyono, 2013).

At the data reduction stage, the researcher corrected the students' work by scoring, dividing students' self-regulated learning into three categories, conducting interviews with research subjects, and compiling the results of interviews in standard language. Conclusions in this study were obtained from students' answer sheets by paying attention to aspects of students' mathematical creative thinking. These aspects are compared with the self-regulated learning category according to the assessment rubric. So that a combined analysis obtained in the form of mathematical creative thinking skills based on the category of students' self-regulated learning.

RESULTS AND DISCUSSIONS

The research was conducted from 9 to 28 November 2020 with 6 meetings. The concept of the MiC learning model with an Open-Ended approach has nine stages, namely (1) analyzing textbooks for other subjects related to the learning material being taught, (2) communicating learning objectives, (3) solving contextual problems, (4) developing mathematical topics and concepts. needed for

mathematical models and solutions, (5) determine problem-solving models, (6) formulate solutions to a problem, (7) determine appropriate solutions, (8) interpret the solution in terms of situational contexts, (9) Draw conclusions and demonstrate.

The use of the final TKBKM consists of 4 essay questions with a time allocation of 40 minutes. The questions have been selected based on 8 test items and the validity, reliability, level of difficulty, and distinguishing power are calculated.

Based on the normality test and homogeneity test from the results of the initial and final TKBKM, was concluded that both classes had the same initial ability. Hypothesis testing has also been carried out by researchers. So that information is obtained that the MiC learning model with an Open-Ended approach is effective in improving students' mathematical creative thinking skills.

This can be seen from the first individual completeness test obtained t count = 7.531 and t table = 1.69. Because 7.531> 1.69 then t count > t table, meaning that H_0 was rejected. So, the average mathematical creative thinking ability of students who receive MiC learning with an open-ended approach is more than 70. An average of 70 was obtained from the calculation of the school KKM. Both classical completeness tests obtained z_hitung = 1.77 and z_table = 1.64. Because 1.77>1.64 then z_hitung>z_table, meaning that H_0 was rejected. So the ability to think creatively mathematically in learning the MiC model with an open-ended approach achieves classical completeness, namely the number of students who reach the KKM more than 70%. The three different tests obtained an average sig (2-tailed) of 0.000. Because the value of sig(2-tailed) < 0.05 then H_0 is rejected. So, students' mathematical creative thinking skills in MiC learning with an open-ended approach are more than students' mathematical creative thinking skills taught by expository learning.

Qualitative research was conducted to describe mathematical creative thinking skills based on self-regulated learning. The sample of this study was 32 students and chose six students as research subjects. The selection was obtained from the results of the TKBKM and self-regulated learning questionnaires given in the experimental class.

Based on the simple linear regression test, it can be seen that sig. = 0.000 <0.05 means that H_0 is rejected with R square = 0.941 = 94.1%. That means that there is an effect of self-regulated learning on students' mathematical creative thinking abilities. Purwanti & Ahmad's research (2016) states that there is a positive effect on increasing students' learning independence about mathematics who get learning using a mind map-assisted problem-posing approach than students who get learning using problem posing learning without a mind map. The following is a description of students' mathematical creative thinking skills in various categories of self-regulated learning.

a. Students' mathematical creative thinking ability in terms of high self-regulated learning

The upper group is dominated by smart students. They can fulfill the four indicators of mathematical creative thinking skills well, namely being able to have a smooth flow of thought, able to produce uniform ideas, able to give answers that are different or unusual from others, and able to develop, add, and enrich an idea. This is following the research of Widiastuti & Putri (2018) which states that students with high creative thinking skills during learning activities focus on solving problems given by the teacher and always ask and submit their opinions.

Upper group students solve each problem with clear and coherent steps because they have a good understanding of the material so that when faced with a problem, students understand well the method or concept used to solve the given problem. Upper group students are groups of students who have high mathematical creative thinking skills have a high level of self-regulated learning. This is because students with high creative thinking skills tend to have a good understanding of mathematics so when faced with a mathematical problem, these students will work on their abilities. Kurniyawati (2019) states there's a positive and significant relationship between problem-solving skills and students' mathematical learning independence. Students in the upper group often help their friends who have difficulty in learning mathematics. They feel very satisfied when they can solve the problem and feel happy and always excited when discussing with their group mates.

b. Students' mathematical creative thinking ability in terms of moderate self-regulated learning

Based on the final test of mathematical creative thinking skills, students in this group can meet two indicators of mathematical creative thinking skills well, namely being able to have a smooth flow of thought and able to develop, add, and enrich an idea. They can work on all the items on the final test of students' mathematical creative thinking skills given, but there are few errors or incompleteness in some items. Herdani and Ratu (2018) suggest that students of SMP Negeri 1 Getasan who have moderate abilities show that their levels of creative thinking abilities are different.

The problem that was often faced by students in the middle group in solving problems is the incomplete completion of the steps in doing calculations. Students in this group tend not to write conclusions from the questions. Students in the middle group often repeat the material when they have difficulty in learning mathematics and they always try to do math problems. They also checked the answers before they were collected.

c. Students' mathematical creative thinking ability in terms of low self-regulated learning

Based on the final test of mathematical creative thinking skills, they can only meet one indicator of mathematical creative thinking ability well, namely being able to have a smooth flow of thought. Students in this group can work on some of the final test items for the students' mathematical creative thinking skills given, but some questions cannot be solved, have few errors, or are incomplete. They tend to have difficulty understanding problems in the form of stories.

A study from Arifin & Herman (2018) states that students' learning independence is due to, among other things, lack of confidence in their abilities, lack of motivation to learn on their own, and not getting a conducive environment to develop their learning independence. Students who have good independence will be more responsible in their learning so that this will have an impact on the high and low learning outcomes. This is in line with the research of Yuliani, Praja, and Noto (2018) which states that learning mathematics needs to develop high-quality learning attitudes, namely independent learning. Independent learning makes students not dependent on others during learning.

CONCLUSION

Based on the results of the study, the average value of the mathematical creative thinking ability of students who received MiC learning with the Open-Ended approach was more than the minimum completeness criteria, the proportion of students in the experimental class reached more than 70% and the average mathematical creative thinking ability that was subjected to the learning model. MiC with the Open-Ended approach is higher than the mathematical creative thinking ability of students who are subject to the Expository learning model. In addition, it found that there was a significant effect between self-regulated learning on students' mathematical creative thinking skills in MiC learning with an Open-Ended approach.

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