Mathematical Creative Thinking Ability Viewed By Self-Esteem In Problem-Based Learning With Open Ended Approach

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Article Info	Abstract
	This research was aimed (1) to know the effectiveness of the problem-based learning model with open-ended approach to mathematical creative thinking ability (MCTA) and (2) to find students' MCTA in solving problems viewed by self-esteem. This study was a mixed methods research with concurrent embedded design. The population of this study was 8th grade students of SMP Kesatrian 1 Semarang Academic Year 2017/2018. Subject taking by selecting six students based on their level of self-esteem consisting of three students of high self-esteem and three students of low self-esteem. Data was collected by questionnaire, observation, test, and interview. The results showed that (1) problem-based learning with open-ended approach is effective on students MCTA as indicated by the average students MCTA in the good category, the proportion of students MCTA who achieved good categories and very well met the criteria, students MCTA were better rather than control class students, students MCTA is increase, and (2) students' MCTA of high self-esteem can use their own language, new ways, and unique or originality is achieved by students. As for fluency, flexibility, and elaboration, they are different. Students' MCTA of low self-esteem still use the usual method or flexibility is not achieved by students. As for fluency, originality, and elaboration, they are different. By knowing students' self-esteem, the teacher can design learning strategies that are appropriate to the students' circumstances. The existence of a problem-based learning model with open-ended approach can train mathematical creative thinking ability.

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INTRODUCTION

The growth of science and technology has brought changes to all aspects of human life. However, these developments must be balanced with the human mindset itself so that using technology can provide benefits. This mindset can be formed in education. Mathematics is one way to change the human mindset. As stated by Khuzaeva (2014) that mathematics can give students with logical thinking, analytical thinking, systematic thinking, critical thinking, creative thinking, innovative, and independently. That is why the role of mathematics is considered important for the development of science and technology.

One of the goals of education according to Undang-undang Republik Indonesia No. 20 Tahun 2003 is to develop the potential of students to become creative human beings. According to Nadjafikhah & Yaftian (2013) creativity refers to a thinking style that will produce works or creative products and creative processes as stages needed to generate new ideas. And then, with the opinion of Aiken (2015) that the definition of creative thinking is the ability to produce genuine solutions or unusual of mathematical problem solving. Given that some mathematical problems can not only be solved in one way, need creative in solving problems to be students creative thinking. So students are familiar with the problems.

Based on the results of interviews with the mathematics teacher of SMP Kesatrian 11 Semarang that the teacher carries out learning with the aim of pursuing the minimum completeness target without considering the students' creative thinking ability. Therefore, mathematical creative thinking ability must be trained even in small portions. This is prove in the preliminary study by carrying out the test in SMP Kesatrian 1 Semarang on the precondition material of cubes and cuboid showed that students mathematical creative thinking ability were still low. The facts are in line with Nurlita' (2015) that mathematics teachers more often use questions with single answers and certain procedures. Even though such questions are oriented towards one type of idea while creative is closely related to various ideas so that they can solve problems in various ways.

Other facts from the interview were found, there were differences in students' self-esteem. Given that mathematics is closely related to abstract concepts that can make students difficulties in solving mathematical problems, the role of the teacher here is important to pay attention to students' self-esteem in mathematics learning. According to Hendriana, Rohaeti, & Sumarmo (2017) the fulfillment of self-esteem will result in an attitude of confidence, a sense of strength, and ability. Conversely if it is not fulfilled it will lead to a feeling of insecurity, not brave, do not believe in yourself. Another interesting thing to note is according to research (El-Anzi, 2005; Rosli, 2012; Saadat, 2012; & Adiputra, 2015) there is a positive correlation between academic achievement and self-esteem. The existence of these relationships may influence students to solve mathematical problems and the learning process in the classroom.

The results of the research by Khoiri, Rochmad, & Cahyono (2013) have a positive correlation between creative thinking ability and problem solving and Widodo, Budiarto, & Lukito (2018) that problem solving is one way to encourage creativity, a consideration for researchers to provide creative problem solving to students. Treatment is needed in this case is a problem-based learning model with an open-ended approach. The addition of the open ended approach is based on research (Fadillah, 2012; Fatah et al. 2016; & Patah et al. 2017) that there is an increase in mathematical creative thinking ability and self-esteem of students who get open-ended learning. Besides that, problem based learning with open ended approach is effective in improving students' creative thinking ability in solving mathematical problems (Patience, 2017; Fauziyah & Kartono, 2017; Ulfa & Asriana, 2018).

Based on the background, this study focused on the study of (1) the effectiveness of the problem-based learning model with open-ended approach to the achievement of students mathematical creative thinking ability and (2) students' mathematical creative thinking ability in solving problems viewed by self-esteem.

METHODS

This study is part of a study of mixed methods strategy concurrent embedded with qualitative research as the primary method. The population of this study is 8th grade students of SMP Kesatrian 1

Semarang academic year 2017/2018. From the population a sample of 2 classes was taken. The experimental class is class VIII C and the control class is class VIII E.

This research consists of two stages, the pre-field stage and field work stage. In the pre-field stage researchers prepare syllabus, lesson plans, problem sheets, self-esteem questionnaires, interview guidelines, and mathematical creative thinking ability tests. All research equipment was consulted with the supervisor and specifically for problems of mathematical creative thinking ability tested first.

At the stage of the field work begins by giving a self-esteem questionnaire and conducting interviews with the experimental class. Each category of self-esteem was chosen by three students to find out the achievement of mathematical creative thinking ability. The chosen subjects are the subjects who best meet the characteristics of each level of self-esteem. Furthermore, the researcher conducted two lessons in the surface area and volume of cubes and cuboid using a problem-based learning model with open-ended approach.

RESULT AND DISCUSSION

The Effectiveness of The Problem-Based Learning Model with Open-Ended Approach to Students Mathematical Creative Thinking Ability

The results of the final test analysis, the normality test of the initial data shows that the data comes from a normal distributed population, while the homogenity test also shows that the data has the same variances, and there is no difference in the average of the two classes.

The effectiveness of learning is determined based on the results of the calculatuion of the average test, proportion test, t test, and normalized gain test. The significant level or α used is 0,05. The average test showed $t = 5,0994 > 2,0345 = t_{table}$, it means the average mathematical creative thinking ability of students is more than 6,5. Also show by the average score 7.3, it means students' mathematical creative thinking ability are in a good category.

The proportion test showed $z = 1,78 > 1,64 = z_{table}$, it means the proportion of students using problem-based learning model with open ended approach more than 75% students reaches a minimum category is good. Also show with students in good categories as many as 25 students or 73.53% and very good categories as many as 5 students or 14.70% so that there are 30 students or 88.23% in the minimum category is good.

The t test showed $t = 2,0461 > 1,9971 = t_{table}$, it means the mathematical creative thinking ability of students using problem-based learning model with open-ended approach is better than students mathematical creative thinking ability with expository learning. It was also known from the mathematical creative thinking ability test results that the average score of the experimental class students was 69.05 and the control class students were 64.36.

The normalized gain test showed that the classical average of normalized gain value is 0,46 it means that the interpretation of students' mathematical creative thinking ability is increasing in the medium category.

Based on the results, it shows that the problem-based learning model with open-ended approach is effective on achieving students' mathematical creative thinking ability. This is because in learning process, students are faced with problems that require them to solve in unusual ways, unique, and detailed. Besides that, the ideas by students and the other can be different depending on each student's perspective in solving the problem so that it can be different in the ways or final results. Therefore, the achievement of students' mathematical creative thinking ability can increase.

The results of this study are in line with research (Nugroho, Chotim, & Dwijanto, 2013; Happy & Widjajanti. 2014; Solehuzain & Dwidayati, 2017) that problem-based learning model with open-ended approach is effective on students mathematical creative thinking ability.

Description of Mathematical Creative Thinking Ability

Based on the results of the study, students' mathematical creative thinking ability viewed by high and low self-esteem is different. Achievement of students' creative thinking ability viewed by high self-esteem can be seen in Table 1.

Table 1. Students Creative thinking Ability Viewed by High Self-esteem

Creative Thinking Aspects	Subject of Research		
	E-1	E-2	E-3
Fluency	Understanding the information in the problems, understanding what is done, being able to solve the problem correctly	Understanding the information in the problems, understanding what is done, being able to solve the problem correctly	Understand the information on the problems but have not been able to solve the problem correctly
Flexibility	Use unusual problem solving strategies	Still using the problem solving strategies that are usually taught by the teacher	Able to bring up unusual problem solving strategies
Originality	Do it yourself, the solution is different from other friends, and unique	Do it yourself, the solution is different from other friends, and unique	Do it yourself, the solution is different from other friends, and unique
Elaboration	Detailing the answers according to what was thought and related to the questions asked	Have not been able to detail the answers and have not been able to connect the ways with the questions asked	Although the answer has been directed to the question asked, there is no relationship between the method and the final result

The findings of the achievement of mathematical creative thinking ability on the three subjects, subject E-1, E-25, and E-29 are students can use their own language, new ways, and unique or in other words originality is achieved by students. Only originality is fulfilled because they assume there is no role of teacher or friend when testing so that the resulting answers are honest and unique.

The uniqueness of the answer according to Richardo, Mardiyana & Saputro (2014) could be a way of combining students' prior knowledge. This appears on the results paper of the three subjects.

Another reason is because students with high self-esteem tend to be confident in handling tasks assigned and have an optimism that they can complete the task. This is in line with the research of Aisyah, Yuwono, & Zuhri (2015) that there is a positive relationship between self-esteem and future optimism. This can be interpreted that students with high self-esteem perceive themselves capable and believe that they will be able to solve problems or questions given

including questions about mathematical creative thinking. The results of the study by Fardah, Suyitno, & Rochmad (2013) that students who have high creative thinking ability produce highly original creative thinking products compared to other classmates.

The other findings are the variation in the creative thinking ability based on high self-esteem as indicated by students' achievement in aspects of fluency, flexibility, and elaboration. This is due to the way they process information and the level of accuracy in answering questions. This can happen because the mastery of the material relating to the problem so that it can choose which information can be used directly or calculated first. As for the other side which results in the level of accuracy in answering questions on the three subjects is an understanding of the material or material relating to the problem and the type of problem given.

There was no converged to the achievement of all indicators uniformly. This is because basically

individual ability with various characteristics as well. There are students who are proficient or feel challenged in terms of solving problems related to surface area, volumes of building space, or constructing a space in a container. If students are given such problems they will feel challenged and can write down their ideas until they arrive at the right final answer. On the other hand, there are students who are just some of them or one of these problems. This is what causes the achievement does not lead to a certain indicators of mathematical creative thinking even though they understand the problem given.

While the achievement of students' creative thinking ability viewed by low self-esteem can be seen in Table 2.

Table 2. Students Creative Thinking Ability Viewed by Low Self-esteem

Creative Thinking Aspects	Subject of Research		
	E-24	E-30	E-32
Fluency	understanding the information on the question, being able to solve the problem correctly.	write down is known and asked correctly but doesn't solve the problem correctly.	have not been able to use other concepts outside the material so they cannot solve the problem correctly.
Flexibility	Using the usual method, even just remembering the formula, done without thinking about the conditions or situations in the problems.	Just think of a formula that has been studied without thinking of alternative solutions and does not consider the conditions in the problems.	Just think of a formula that has been studied, only include what is known as raw, do not consider the formula with the conditions in the problems.
Originality	Not fully working alone, the solution is the same as other friends	More likely not to try to solve it yourself. If anything is done alone the results are careless and unwarranted.	Able to provide answers with their own language and unique. Think of things that are simple and accordance with the problem given
Elaboration	Not able to detail, continue, and expand the ideas.	Not able to detail, continue, and expand answers.	Able to detail, continue, and expand answers.

The findings of the achievement of mathematical creative thinking ability on the three subjects, E-24, E-30, and E-32 are students still using the usual method or in other words flexibility is not achieved by students. This is because creative thinking is related to producing unusual ideas and they have not been able to do so. Suppose there are instructions from the teacher, they use this method without thinking about whether or not there are other alternative ways. Suppose other alternative ways of thinking, the problem cannot be solved perfectly.

Another finding is that there is a variation in the creative thinking ability on low self-esteem, which is indicated by students' achievement in aspects of fluency, originality, and elaboration. This is because students understanding of the problem, the seriousness of working on the problem sheet at the time of learning, the belief in each individual that he is capable or not to solve problems, and the readiness of the three subjects in the test.

The other findings on subject E-24 and E-30 is that the achievement of creative thinking ability is still

far from expectations. This is because students with low self-esteem are pessimistic and assume that what they are doing must be wrong. They sometimes try to do but not yet earnestly. Besides that, the questions given were unexpected, causing them to think harder. While the subject E-32 is different from the other both of two subjects. When subject E-24 and subject E-30 feel unable to produce their own creative ideas that they have never been given. In other words, they often reason about the difficulty of solving problem. Subject E-32 was able to get out of all the reason but the result was still not perfect. Subject E-32 prefers to try to think about how to do the problem given rather than complaining about the problem is difficult. In the teacher's opinion, subject E-32 includes students who are mediocre but he shows that he has the potential in mathematical creative thinking.

CONCLUSION

Based on the results and discussion, the following conclusions are obtained (1) problem-based learning with open-ended approach effective on the achievement of students MCTA as indicated by the average students MCTA in the good category, the proportion of students MCTA who achieved good categories and very well met the criteria, students MCTA were better rather than control class students, students MCTA increase, and (2) the achievement of students' mathematical creative thinking ability of high self-esteem is students can use their own language, new ways, and unique or in other words originality is achieved by students. As for fluency, flexibility, and elaboration, it is different. The achievement of students' mathematical creative thinking ability of low self-esteem is students still use the usual method or flexibility is not achieved by students. As for fluency, originality, and elaboration, it is different.

By knowing students 'self-esteem, the teacher can design learning strategies that are appropriate to the students' circumstances. The existence of a problem-based learning model with open-ended approach can train mathematical creative thinking ability. The achievement of mathematical creative thinking ability of 8th grade students viewed by self-esteem is different. This needs to be explored further the reason for the difference by giving other similar questions or adding research subjects to each level of self-esteem.

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