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STUDENTS' ABILITY OF SMP TO SOLVE PROBLEMS MATHEMATICLLY CREATIVE THINKING

Nila Kesumawati (nilakesumawati@yahoo.com)
Universitas PGRI Palembang

Abstract

The purpose of this study is to determine the ability of SMP students to solve mathematically creative thinking problems. The research method is descriptive method. The participants of this research were 180 students in the Palembang. Methods of data collection using essay tests. The results showed that the ability of SMP students to solve mathematically creative thinking problems only 40,57 classified in low category.

Keywords: the ability, the questions, the material fractions, mathematically creative thinking.

INTRODUCTION

The ability of creative thinking is important for students to understand mathematics concept and solving problems. It is emphasized in the guidelines for preparing mathematics lesson plans based on 2013 curriculum, the learning outcomes will be achieved through cognitive learning activities, among others: the mathematization ability, abstraction ability, deductive thinking, higher-order thinking (critical thinking, and creative thinking) (Kemendiknas, 2013: xvi).

Creative thinking is a cognitive activity that is associated with sensitivity to issues, considering new information and ideas that are not usually with an open mind and be able to make some connections in solving the problems. Cognitive activities that can produce something or new ways in solving the problems that are also practical and useful. Siswono (2009) stated that creative thinking is a mental activity which is used to establish a person's ideas or the new ideas are fluent and flexible, in this case, or employ the correct ideas in solving mathematics problems or according to request. Meanwhile, according to Noer (2010: 4-5) creative thinking is a thinking process of the ideas of an issue or problem, playing with ideas or elements in mind and can be viewed as the product of the human thought or behavior.

McGregor (2007), stated that creative thinking is a thinking that lead to the acquisition of new insights, new approaches, new perspectives, new ways of understanding or something. The thinking that lead to the acquisition of new insights, new perspectives can be seen from the way students complete the given problems. Originality refers to the problem-solving strategies that are unique. The originality does not have to be associated with the idea of a completely new, but based on the new students. When a student is able to find a solution to the problem for the first time, he discover something new, at least for himself (Mahmudi, 2010: 27).

Based on the above explanation, it can be said that, each student must have a different creative potential. The problem is how to raise or develop the creative potential? One of the development of the creative potential is the significance of learning that can improve understanding, and understanding to underlay students' ability to transfer knowledge in solving problems. By solving non-routine problem-solving students will realize the usefulness of

mathematics. The usefulness will cause internal learning motivation of the student and the ownership of the mathematics (Kemendiknas, 2013: xiv).

According to Risnanosanti (2010: 3) the students are not familiar to solve open or non-routine mathematical problems that are, they just solve the problems as what is given by their teacher. Students learn in accordance with the example given by the teacher, such as problems with direct questions on the use of existing formulas or topic/matter. As a result, students lack of the opportunity to develop creative thinking and productivity. According to Ruseffendi (1991: 239) creativity will grow if the students are trained to do exploration, inquiry, discovery and problem solving.

In line with that, one way to promote students' mathematically creative thinking in this study is through the completion of questions to elicit students' creative thinking. The proposed questions are made based on the indicators of mathematically creative thinking abilities. The word "indicators" means something that can give you (be) clues or information (Dictionary of Bahasa Indonesia). The indicators of mathematically creative thinking in this study were (1) fluency characteristics that elicit many ideas, answers, solution of the problems, or questions; provide many ways or suggestions to do things; encourage students to think of more than one answer. (2) Elaboration characteristics are able to enrich and develop an idea or product; adding or itemize in detail of an object, idea, or situation so that it becomes more attractive. (3) Originality characteristics are able to create new and unique expression, think of unusual ways, able to create an unusual combination of parts or elements. And (4) flexibility characteristics are generating ideas, answers, or questions are varied; can look at a problem from the view point of different; look for alternatives or many different directions; able to change the approach or way of thinking (Munandar, 1999: 88).

The problem in this study is "How is the ability of junior high school students in solving mathematically creative thinking problems?" The aim of this study is to determine the ability of SMP students in solving mathematically creative thinking problems.

The purposes of this study are (1) the teacher is expected to get a real experience to apply one example of a set of questions to determine the students' mathematically creative thinking abilities; (2) the researcher gets a valuable experience that can be considered to promote the mathematically creative thinking abilities at various levels of education; and (3) to support the developing mathematical abilities of mathematics education practitioners, such as lecturers, teachers, and student of mathematics, especially the ability to think creatively.

Methods

This research is a descriptive study that ought to describe the ability of SMP students solve the problems of mathematically creative thinking. The participants were students of class VII of SMP Negeri 1, 17, 40, and 44 in Palembang, academic year 2013/2014. The participants were 180 students. The details of the participants are on the Table 1 below.

Table **1**
The Participants of the Research

No	SMPN	male	Female	Total
1	1	11	20	31
2	17	40	39	79
3	40	17	21	38
4	44	14	18	32
Total		**82**	**98**	**180**

In this study, we choose SMP students grade VII, because the material in grade VII SMP are basic materials and there are also skills that support the material in the next class. The

test items contains fractions topic.

This research is a test instrument, comprising tests of mathematically creative thinking abilities. Creative thinking test is aimed to determine the students' ability to think creatively in solving mathematics problems. Therefore the test questions are based on four indicators of the ability to think creatively, i.e. fluency, elaboration, originality, and flexibility. Fluency and originality are indicated by a question "Determine, at least two other different answer?" Flexibility is indicated by a question "show two different ways to solve the problems?" The elaboration is indicated by the coherence of the given answer.

Analysis of the data to test the ability of mathematically creative thinking is done based on the students' answers and the description and assessment rubric, as elaborated in Table 2 below.

Table 2
Description and Rubric Scoring Mathematically Creative Thinking (CMT)

No	Indicator MCT	Description	Respon to the item	Scor
1	*Fluency*	(1) solve the problem and provide many answers to the problem; or (2) provide many examples or statements related to a specific mathematical concepts or situations	No answer	0
			Giving an idea that is not relevant with problem solving	1
			Giving ideas that are relevant with problem solving, but not finished	2
			Giving ideas that are relevant with problem solving, but the results is wrong.	3
			Giving ideas that are relevant with problem solving, but the results is true.	4
2	*Elaboration*	The ability to explain in detail and coherent to the mathematical procedures, answers, or certain mathematical situations.	No answer	0
			Developing ideas and give answers that are not detailed and wrong.	1
			Developing ideas and give answers that are not detailed but the results correctly	2
			Developing ideas and give a detailed answer but the wrong result.	3
			Developing ideas and give a detailed answer and correct results.	4
3	*Originality*	(1) using strategies that are new, unique, or unusual to solve the problem; or (2) giving examples or statements that are new, unique, or unusual.	No answer	0
			Giving their own opinion, but not to be understood	1
			Giving opinions but only modify the workmanship has been targeted but not finished	2
			Giving their own opinion but the result is wrong	3
			Giving their own opinions and the results are correct.	4

4	*Flexibility*	(1) using a variety of problem-solving strategies; or	No answer	0
			Giving ideas / answers that are not diverse and wrong	1
		(2) giving a variety of examples or statements related to a specific mathematical concepts or situations.	Giving ideas / answers that are not diverse but true	2
			Giving ideas / answers varied but wrong	3
			Giving ideas / answers are diverse and true	4

Modification from Noer (2010: 94) & Mahmudi (2010: 31-31)

RESULTS AND DISCUSSION

The analysis of student creative thinking test is given to students of class VII SMP in Palembang. Tests of mathematically creative thinking involved 180 students, which consisted of 82 boys and 98 girls students. The data are analyzed mathematically based on the four components that comprise the creative thinking, i.e. fluency, elaboration, originality, and flexibility. The results of the tests is presented in Diagram 1 below.
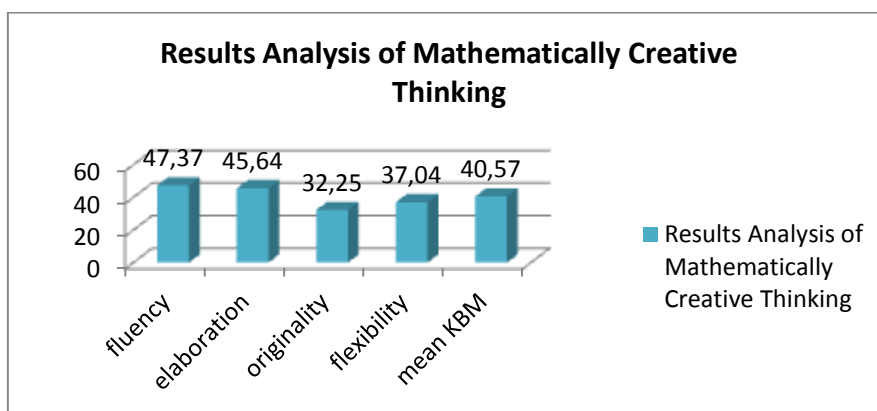

Diagram 1
Mean Mathematically Creative Thinking

Based on the result on conducting the test of mathematically creative thinking, Subject can be seen that the average of the students' mathematically creative thinking abilities, generally can be classified as low category, 40.57. It is also similar that for every indicator of MCT, the result shows that for fluency is 47.37; elaboration is 45.64; originality is 32.25; and flexibility is 37.04. This is consistent with the results of the research that has been conducted by Ratnaningsih (2007: 231) based on the average score of mathematically creative thinking abilities. The students who got unstructured contextual learning and structured contextual learning showed that the students' weak point is on the flexibility and originality. While the student who is learning the fourth aspect of the conventional have the weak point in the mathematics creative thinking abilities.

Furthermore, it can be seen an example of the students' answers to question number 3. Problem number 3 is as follows.

"In a zoo known $\frac{1}{3}$ part is a sheep, $\frac{1}{4}$ part is a horse, $\frac{1}{5}$ part is cow, $\frac{1}{6}$ part is the deer, and 5 rabbits. What is the total number of animals at the zoo!"

Students' answers

| **Picture 1a** | **Picture 1b** |

Problem number 3 is to measure aspects of fluency, elaboration, and originality.

1. Fluency aspects demonstrated by the ability of the construct appropriate fractions and correct.
2. Elaboration aspects related to the ability to provide detailed explanations of the answers given, for example, by using the related concepts, such as the whole animal is a part, can then summing all parts of the animal and its completion. Elaboration aspects also related to the coherence explanation give.
3. Originality aspect demonstrated by the use of ideas or new concepts. The originality also shown how step a given type of explanation. For example, a type of explanation that is given only by less than 10% of students in the class that is categorized as a new explanation. For the students' answers on the picture 1a only 1 student, means the type of answer / explanation is only $\frac{1}{180} \times 100\% = 0,6\%$. For the students' answers on the picture 1b are 14 students, means the type of answers / explanations are $\frac{14}{180} \times 100\% = 7,8\%$.

The results of the grouping for the number of students who meet the indicators of mathematical creative thinking abilities can be seen in diagram 2 below.
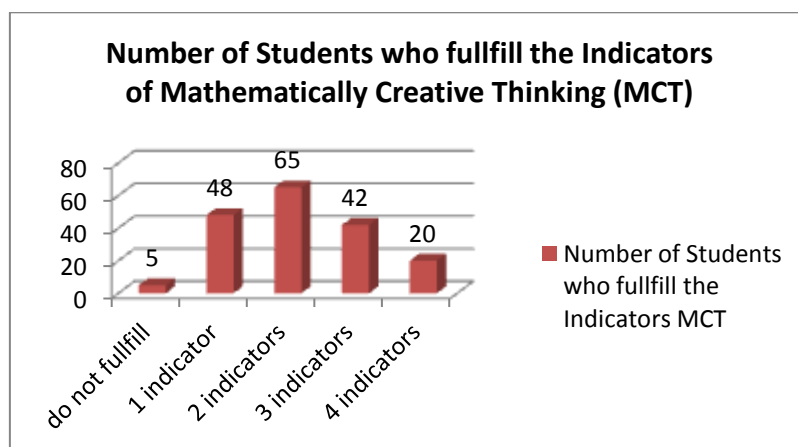
Number of Students who fullfill the Indicators of Mathematically Creative Thinking (MCT)

80	
60	48 65 42
40	
20	5 20
0	

do not fullfill   1 indicator   2 indicators   3 indicators   4 indicators

■ Number of Students who fullfill the Indicators MCT

Diagram 2
Number of Students who fullfill the Indicators of
Mathematically Creative Thinking (MCT)

There are 20 students who can reach the 4 indicators on mathematically creative thinking (fluency, elaboration, originality, and flexibility). The fluency indicated the students' ability to use mathematical strategies and procedures are appropriate and coherent in order to obtain a proper solution or intended ideas which is relevant to solve the problem and they were able to obtain the correct answers. The elaboration provided an appropriate and correct answers in details and coherently. The answer involves a concept associated with the use of mathematical operations precisely and accurately or developing the ideas and giving a detailed answer and correct solutions. There were 10% - 20% of students who express their own opinions and give the correct result which is shown the originality, and it is indicated by the use of mathematics strategy or provide explanations that are less prevalent or the use of strategy or giving explanation. The flexibility means that the explanations are varied in the matter and the students are able to solve the problems correctly or they give varied ideas / answers and that are true.

There are 42 students who meet the 3 indicators of creative thinking (fluency, elaboration, and flexibility). For the originality, there were more that 20% of students who got a score of 1, who has an answer that uses a strategy or provide a common explanation in terms of the concepts and its attributes and the context involved or using strategies or provides an explanation

There were 65 students who meet 2 indicators of creative thinking (fluency and elaboration). In this case the fluency of the students can be seen from the ability to use mathematical strategies and performing an appropriate procedures in order to obtain the correct answer. For indicators elaboration the students were able to provide the appropriate and correct explanation in detail and coherently. The explanation involves two or more concepts related to the use of mathematical variables precisely and accurately.

There were 48 students who meet one indicator of creative thinking. The students are able to resolve the matter of addition and subtraction of fractions form containing 2 variables correctly. The mathematically creative thinking abilities of the students for the fluency, students are able to use appropriate problem-solving strategies, but there is no correct mathematics procedure, the students can't obtain the correct solution.

There were 5 students who work on the problems incorrectly, which means that the students already use the strategies but they can't obtain the correct answers. Moreover, there were several students who give explanation or strategies which are difficult to be understood.

Therefore, based on the above analysis, it can be concluded that the creative thinking abilities of students of SMP in Palembang academic year 2013/2014 is still relatively low. This is evident from the number of students who have indicators of mathematically creative thinking.

CONCLUSION AND SUGGESTION

The results showed that the mean ability of SMP students solve the problems of mathematically creative thinking 40,57 classified in the low category. The mean of 47,37 for fluency aspects classified in the low category. The mean of 45,64 for elaboration aspects classified in the low category, it is associated with the explanation coherence given . The mean of 32,25 for originality aspects classified in the low category, this is indicated by the ability to use new or new ways for students to solve problems. The mean of 47,37 for flexibility aspects classified in the low category, this is indicated by the ability to focus on ways to resolve the matter with a few possibilities.

Based on the results obtained it is suggested that to improve the mathematically creative thinking abilities of students, the teacher should always give questions open, continuous and sustainable, as well as giving more time for students to practice solving problems.

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