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Submission date: 03-Jan-2021 09:01PM (UTC+0700)
Submission ID: 1482639684
File name: Sugeng_22.pdf (319.97K)
Word count: 2773
Character count: 15317

ANALYSIS OF MATHEMATICAL CREATIVE THINKING ABILITIES IN STUDENTS OF JUNIOR HIGH SCHOOL TOWARDS LINEAR EQUATIONS

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ABSTRACT: This research aims to describe students' creative thinking skills in solving problems in linear equation material at Al-Kautsar Middle School, Bandar Lampung. The method of this research was descriptive. The subject of this research was the Eight grade of Junior High School. It was determined based on the consideration of Mathematics Teacher, there are 29 students. The instruments of this research used test and interview guideline. The result of this research showed that creative thinking ability at Eight Grade reached the 4th Level (Very Creative) that was achieved by students who has High Level Ability. Students with Medium Ability Level are at the 4th creative thinking level (very creative) and 1st (less creative), while students with low ability levels are at the 0th level of creative thinking (not creative).

Keywords: Creative Thinking, Math, Linear Equations

1. PRELIMINARY

Education is a process or effort carried out by someone in order to develop knowledge, personality and ability as an effort to mature themselves both inside and outside of school. Education plays a role in creating intelligent, creative, skilled, responsible, productive and moral people. Through quality education, quality human resources will be created. Along with the development of the times, the quality of education will continue to change following the development of science and technology. Therefore, the renewal of education in Indonesia needs to be carried out continuously to create a world of education that is flexible to changing times in a process called learning.

Learning is basically a series of activities done by teachers as educators and students in teaching activities using existing educational tools and facilities to achieve the objectives set in the curriculum. One of the goals of mathematics learning at school is according to Minister of Education Regulation No. 22 of 2006 (Ministry of National Education Team, 2006) is that students have reasoning ability to draw conclusions on patterns and traits, make mathematical manipulations in making generalizations, compile evidence, or explain mathematical ideas and statements. Aside from being a goal of learning mathematics, NCTM (2000) states that creative thinking is one of the standard process in learning mathematics.

Siswono (2008) defines creative thinking as a habit of sharp thinking with intuition, moving imagination, revealing (to reveal) new possibilities, unveiling amazing ideas and inspiring unexpected ideas. Moma (2015) creative thinking in mathematics can be seen as an orientation

or disposition about mathematical instruction, including discovery and problem solving tasks. Based on the description of creative thinking and creative thinking of mathematics, it can be concluded that the ability to think creatively is the ability to generate new ideas that are marked by four aspects namely fluency, flexibility, originality and elaboration. The ability of creative thinking is very much needed by students in learning mathematics at school. This is appropriate with the opinion of Mahmudi (2010) that mathematics learning needs to be designed in such a way that it has the potential to develop students' creative thinking abilities. But in reality, teachers in schools have not been able to encourage students to think creatively. In the learning process in the classroom, there are still many teachers who do routines such as explaining lessons and giving examples of questions to students. When the teacher gives a task that is not the same as the example, they feel confused and have difficulty when completing it.

The fact shows that students' mathematical creative thinking abilities are relatively low. Based on the results of the Trend International Mathematics and Science Study (TIMMS), it was stated that the level of students' creative thinking skills in Indonesia was relatively low, because only 2% of Indonesian students could work on high and advanced category questions that needed the ability to think creatively (Mullis, 2015) .

Some researchers showed the lack of mathematical creative thinking abilities of students as revealed by Firdausi, Asikin, Wuryanto (2018) that the low ability of students in aspects of creative thinking can be influenced by errors in the way students learn. Every individual has a different way of learning. Each person cannot be forced to follow one way of learning. But in reality, many students do not realized of which learning style matches their personality. This learning style that is not suitable with the student's personality is what causes students to find it difficult if faced with complex and non-routine problems. Factors that cause the low influence of creative thinking ability are expressed by Sari (2014) who concluded that students pay less attention to teacher explanations, and many do activities outside of learning activities. This is because the teacher still applies a less varied and unpleasant learning model, which results in low enthusiasm for learning, enthusiasm, and student learning enthusiasm which can hinder the process of receiving learning.

The low mathematical creative thinking ability is also seen based on the results of preliminary research (interviews) with mathematics teachers and class VIII students at Bandar Lampung Al-Kautsar Middle School. Data showed that students have difficulty giving ideas in the form of answers to questions given by the teacher. Students could not provide solutions to problems presented by the teacher. Students had difficulty when giving examples of problems raised. Only three students could answer questions from the teacher, the answers were also the result of students seeing from the textbook, it was not the result of students' own thinking. Observation data showed that students tend to be less creative in thinking. Students had difficulty providing solutions when there are problems. When students were asked by the teacher to give their responses related to the subject matter delivered by the teacher, students could not digest the problem. Weaknesses of students in making new ideas to solve problems and circumstances when students are required to present solutions that are different from the usual conditions, it can be seen indications of problems found in class VIII. These problems were dominated by the low ability of students to think creatively.

Observation data related to learning showed that most students complained of the difficulty of understanding the material being taught. Students feel less understand with the material when the teacher uses the learning model as usual. Learning that students want is a lot of practical learning so that students understand more about the material. According to Siswono (2011) a person's creative thinking ability has levels. The intended level is according to the work

produced. Therefore, the level of students' creative thinking ability is used.

Table 1. The Level of Thinking Creative

TKBK	Indicator
Level 4 (Very Creative)	Students are able to show fluency, flexibility, and novelty or novelty and flexibility in solving problems.
Level 3 (Creative)	Students are able to demonstrate fluency and novelty or fluency and flexibility in solving problems.
Level 2 (Creative Enough)	Students are able to show novelty or flexibility in solving problems.
Level 1 (Less Creative)	Students are able to demonstrate fluency in solving problems.
Level 0 (Not Creative)	Students are not able to show all three aspects in solving problems.

(Resource: Siwono, 2011)

Based on the description above, the authors are interested in examining the Analysis of Mathematical Creative Thinking Ability of Grade VIII Students of Bandar Lampung Al-Kautsar Middle School in Linear Equations Subject.

2. RESEARCH METHODOLOGY

This type of research is descriptive research with a qualitative approach. This research was written to analyze and describe the mathematical creative thinking ability of 8th grade students of Bandar Lampung Al-Kautsar Middle School on the subject of Algebra Linear Equations which are guided by whether or not indicators of mathematical creative thinking are met. The research subjects were 29 students of Bandar Lampung Al-Kautsar Middle School. The time of research is held at the beginning of the odd semester of the 2018/2019 academic year. Data collection techniques in this study used several types of instruments, namely a set of tests of mathematical creative thinking skills.

The test was used as a way to obtain primary data about the mathematical creative thinking abilities of Grade 8 junior high school students. The scope of the test material was material in Linear Equations. The instrument used in this study is a test of mathematical creative thinking skills. Test questions were arranged in multiple choices in the amount of 4 questions to measure the level of mathematical creative thinking of students. Before being used in research, this question originated from the National Examination (National Examination) question, the question had been tested for validity, differentiation, difficulty index and also readability test by several students. Giving scores on student test results was based on indicators to be achieved. Furthermore, the overall score of the student and the score of the indicator were analyzed to determine the students' mathematical creative thinking skills. To provide an objective assessment on the test of mathematical creative thinking ability students were given scores for questions of mathematical creative thinking abilities guided by the Holistic Scoring Rubrics proposed by Bosch (Moma, 2015)

3. RESULT AND DISCUSSION

After students had been given the task, researcher analyzed the answers of each students using Scoring Rubric guided by holistic scoring rubrics proposed by Bosch (Moma, 2015). The results of the test are mathematical creative thinking skills of students based on existing indicators. The

data is then analyzed and interpreted in the form of a description as a description of the results of the study.

Table 1. Student Score Achievement in Each Indicator of Mathematical Creative Thinking Ability

No	Indicator	Average	
		Skala 4	%
1	Berpikir *orisinal (Originality)*	0.96	24%
2	Berpikir *lancar (Fluency)*	3.56	89%
3	Berpikir *luwes (Flexibility)*	4	100%
4	Berpikir *elaborasi (Elaboration)*	2.60	65%
	Sum of Creative Thinking		

Based on Table 1 of the 4 indicators of mathematical creative thinking, there were only 2 indicators that enter the high criteria, namely for the indicator of Flexibility of 100%, Fluency of 81%. Indicators that enter the criteria are moderate thinking indicators of Elaboration by 65%, and indicators that are included in the criteria of low are Indicators of originality (24%). Original thinking, which is able to provide new expressions and unique ideas, for indicators of fluent thinking, namely being able to produce ideas, answers, solving problems or questions that are smooth, while indicators think flexible (Flexibility) that is able to give ideas, questions or varied answers. Next for Elaboration Thinking Indicator (Elaboration) is being able to detail and develop an object.

Then the data was processed and analyzed based on the assessment rubric. The test given consists of 4 items of multiple choice questions and their methods.

Here's the number 1 display

Note the g line in Cartesian coordinates. The k line is perpendicular to the line g and intersect at the point (0, -20). The coordinates of the intersection of the x-line k line are .....
Use several ways to explain your answer!

A. (8, 0)
B. (12, 0)
C. (16, 0)
D. (20, 0)

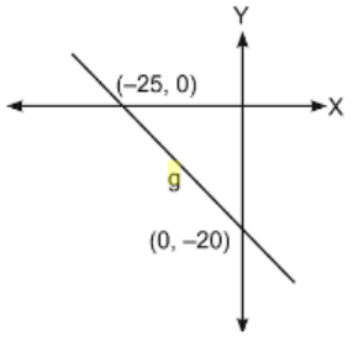

Figure 1. Problem number 1: Indicator of original thinking (Originality)

In question number 1, students were asked to be able to provide new expressions and unique ideas or original thinking. The following is an example of the work results of students who experience errors in completing questions number 1. Students found it difficult to understand the problem and estimate the solution, it was difficult to go home to follow the completion plan.

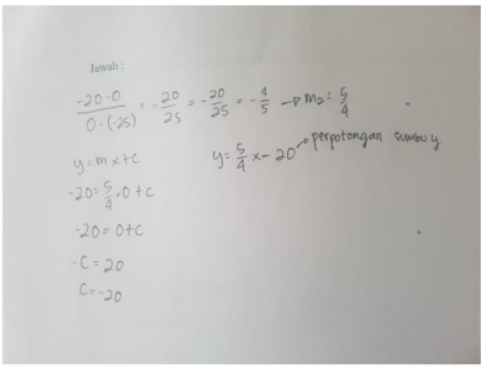

Figure 2. Answer from one student to question number 1

The line equation that is parallel to the line through points (2, 5) and (−1, −4) is ... Use several ways to explain your answer!

A. $y = -3x + 14$
B. $y = -\frac{1}{3}x + 6$
C. $y = \frac{1}{3}x + 4$
D. $y = 3x - 4$

Figure 3. Problem number 2: Indicator Thinking Fluency

In question number 2, students were asked to be able to produce ideas, answers, problem solving or questions that are fluent or think fluently. The following was an example of the work results of students who experience errors in completing question number 2. In question number 2 some students were negligent when working on it.

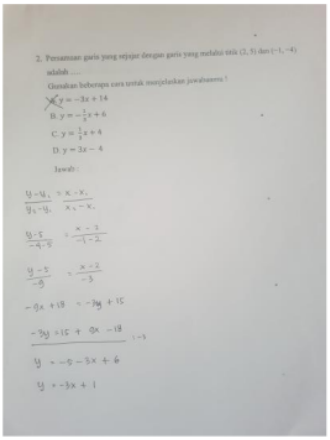

Figure 4. Students' wrong answers to problem number

The gradient of the line with the equation 3x + 8y = 9 is ...
Use several ways to explain your answer!

A. 8/3
B. 3/8
C. −3/8
D. −8/3

Figure 5. Question number 3: Indicator Thinking Flexibility

In question number 3, students were asked to be able to give ideas, questions or answers that are varied or flexible (Thinking Flexibility). Here are examples of work results students can work on the problem correctly without any errors.

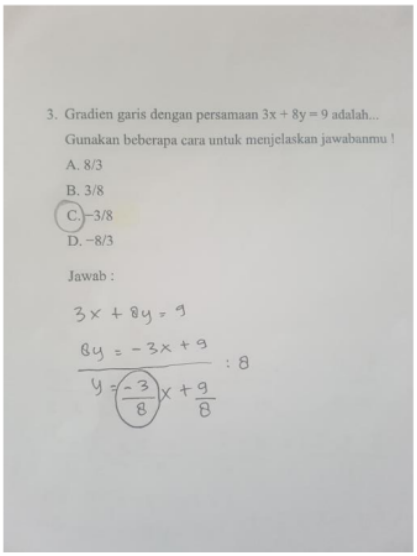

Figure 6. Correct student answers to problem number 3

The line equation that passes through points (2, −5) and (−3, 6) is ...
Use several ways to explain your answer!

A. 11x − 5y = −3
B. 11x + 5y = −3
C. 11x + 5y = 3
D. 11x − 5y = 3

Figure 7. Problem number 4: Indicators of elaboration Thinking

In question number 4, students were asked to be able to detail and develop an object or Elaboration. The following is an example of the work results of students who experience errors in completing question number 4. In question number 4, students have more difficulty understanding the problem and estimating the solution, and when they form a settlement plan they do not know whether the method they gave is correct or not yet.

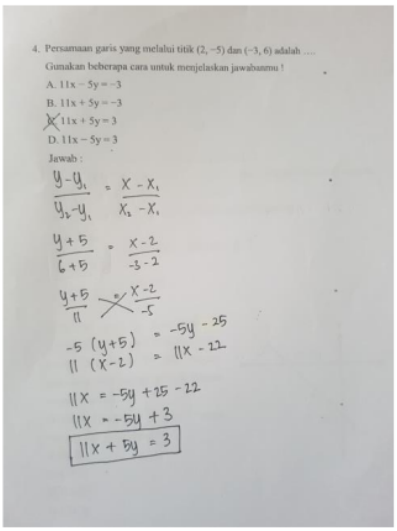

Figure 8. Students' wrong answers to problem number 4

4. CONCLUSION AND SUGGESTION

Based on the description and analysis of the results of the research that has been done, it can be concluded that the mathematical creative thinking skills of 29 junior high school students in solving problems with Straight Line Equations are sufficient. This is supported by data from 4 indicators of mathematical creative thinking, there are only 2 indicators that enter high criteria for Flexibility Thinking indicators, which are able to give ideas, questions or answers that vary by a percentage of 100%, for Fluency Thinking able to produce ideas, answers, problem solving or smooth questions by 81%, while the Elaboration Thinking (Elaboration) indicator is capable of detailing and developing an object by 65% for an Original Thinking indicator which is able to provide new expressions and unique ideas with a percentage by 24%.

Creative thinking is an important skill for everyone, not only when studying at school, but also when facing the world of work. Developing learning that involves divergent thinking can improve students' creative thinking skills. The teacher can give more opportunities to students to explore various kinds of answers and ways of solving by paying attention to aspects of flexibility, originality, fluency, and elaboration. Teachers and researchers can also make comparisons or see the influence of other aspects of creative thinking such as gender, ethnicity, learning achievement, or other aspects.

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