

AN ANALYSIS OF STUDENT'S MATHEMATICAL CREATIVE THINKING ABILITY SENIOR HIGH SCHOOL ON GEOMETRY

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ABSTRACT

This study aimed to describe the ability of mathematical creative thinking students in solving the problem of geometry comprehensively. Research subjects of senior high school students 5 Padangsidempuan as many as 6 people consisting of each 2 students low, medium and high category. Creative thinking problems as a top priority to achieve the research objectives. it is important in learning mathematics education. Identify the problem of mathematical creative ability in solving a mathematical problem. What is the ability to think creatively in the mathematical learners in solving geometry problems? It is expected to result in study solutions to maximize the creative thinking ability of learners in learning. There is an absolute requirement that learners must fulfill in each category of ability to understand the material, and readiness to try and error in writing alternative solutions. The results show the students in three categories in the indicator of creative thinking ability. Students in the low category of students. Only able to load indicators of fluency and flexibility. Student B is capable of loading smoothness and authenticity. Students in the medium category of students C is able to contain fluency, flexibility, and authenticity. Student D is capable of loading flexibility, authenticity, and detail. Students in the high category of students E is able to contain fluency, flexibility, authenticity, and detail. Student F is able to contain fluency, flexibility, authenticity, and elaboration.

Keyword: *creative thinking, geometry, senior high school.*

1. INTRODUCTION

Education aims to provide an environment for students to be able to develop their abilities optimally. 21st century education brings the learning paradigm that requires graduates have high-level thinking skills that are logical, critical, creative and innovative thinking. This is also supported by Binkley, et al., (Abidin, 2016: 40) [1] states that the skills that should possess-the skills of thinking in the 21st century include creativity and innovation and metacognition. Trilling and Fadel (Abidin, 2016: 31-39) mentions the need for revitalization of learning through the the ability to think, digital lifestyle and instructional research. Learning paradigm requires individuals to prepare the ability, in order to be able to compete and collaborate in all aspects. Trilling and Fadel also mentioned the application of the 21st century learning framework is believed to be able to create a learning experience through creativity and innovation.

Ministerial regulation No 23 of 2006 on SKL for Basic and Secondary Education Unit that mathematics subjects need to be given to all levels of education to equip learners with logical, analytical, systematic, critical and creative thinking ability, and ability to cooperate. The SKL aims to enable learners to have the ability to survive in an ever-changing and competitive state. Munandar (2012: 12) creativity is very meaningful in life, it needs to be nurtured since early through proper education. Creativity (creative thinking) is the ability to find alternative answers that vary against a solution. Creativity focuses on quantity, usability, and diversity of answers. Laurence (Wijaya, 2012: 55) that creativity is a skill that can be learned. Further Rose and Malcom (2015: 276) the key to creativity is acquiring detailed background knowledge on the subject. Because almost all new ideas are a re-combination of existing ideas.

Meanwhile, according to Hevy (2014: 120-124) creative thinking is very important in the current global era, is needed when the complex level of problems from all aspects of life. In creative thinking there are two fundamental components required. These components include a balance between logic and intuition. Adams and Hamm (Wijaya, 2012: 55) mention that the ability to think creatively is a natural potential that is owned by humans and can be improved through awareness or awareness and practice or practices. The focus of creative thinking lies in the product of originality for oneself, not the invention of ideas that no one has ever known before. It can also be a combination of ideas into something more interesting. According to Munandar (2012), Hevy (2014) and Kusumah (2015: 19) the ability to think creatively contains indicators: fluency, flexibility, originality and elaboration. By Kusumah added indicator sensitivity. (1) fluency (the ability to express ideas); (2) flexibility (the ability to generate ideas or alternative solutions); (3) originality (the ability to produce original product, modification of old object into new object); (4) elaboration (developing ideas, detailing objects); (5) sensitivity (ability to produce problems in response to problems encountered).

Basic skill through activity is usually used by learners in learning Mathematics. These activities tend to be mathematical exercises that are algorithmic, mechanistic and routine. Supposedly, the challenge of learning mathematics now and in the future should seek high order thinking not just basic skills. Preliminary observations are based on consideration of school ranking factors. The goal is to anticipate every possible response that will arise from learners didactically and pedagogically. The fact of mathematics learning experienced by high school students is still dominated by training activities to achieve basic skills mathematics. The interview result stated that the teacher did not have time to analyze the creative thinking process of the students so that the teacher only gave the routine questions during the learning and evaluation. Observation in February 2017 focused on class X SMA N 5 Padangsidimpuan. The problem of creative thinking as a top priority to achieve research objectives. It is important in learning mathematics education. Identify problems as follows: Aspects of mathematical creative thinking ability in solving a mathematical problem. Focus on the fundamental issues that is: how the ability to think creatively mathematically students? . The goal is to describe the ability to think creatively mathematically learners in solving geometric problems comprehensively. It is expected to result in study solutions to maximize the creative thinking ability of learners in learning.

1.1 Creative Thinking

Creative thinking as a person's mental activity through internal factors manifested to get out of the comfort zone. Creative thinking is the potential of every individual. Creative thinking can combine to generate new ideas in response to a problem. Resolving the issue with a non-singular solution. It's said to be creative thinking if worth, worthy, useful and different from the product before. So it can be mentioned that creative thinking is one of the higher-order thinking skills.

1.2 Geometry

The study of geometry helps students explore creations. Geometry is an applicative material that needs to be studied in depth because it is useful in various situations and is related to mathematics and other subjects. Geometry related to geometric build up and its properties. The focused material is the position of dots, lines and plane in space.

2. RESEARCH METHOD

This type of research is considered qualitative descriptive that aims to describe the ability to think creatively mathematically students. This research data in the form of written answers learners obtained from written tests. Test as much as one item about the geometry of matter of position of point, line and field in space. This imaginative and

explorative test refers to each of the four indicators (fluency, flexibility of authenticity and detail). The test carried out 20 minutes. It Aim to describe the creative thinking ability of students in solving geometry problems. The subjects of this study were students of class X SMA N 5 Padangsidempuan, which consists of 6 students. Through this subject is expected to provide information related to the ability to think creatively mathematics. The students are drawn from the cognitive abilities of students based on the average value of daily repetition that has not been remedy consisting of 2 students with high math ability, 2 students with moderate math ability, and 2 students with low math ability.

The research procedure is a description of the implementation of research consisting of research steps from the beginning to the end of the study. The research procedure is designed systematically and clearly the implementation stage that is:

- a. Planning Stage:
Preliminary study (determining the research area, establishing a research permit, and coordinating with the mathematics teacher where the research is to determine the timetable of the research), identification of the problem, formulation of the problem and the preparation of research instruments (making creative thinking ability test: to ask outline question).
- b. Validation Stage:
Test of Creative Thinking Ability: by providing validation sheet to the validator. The validation sheet contains the conformity of the instructions, the content, the language, the time allocation and the working instructions, followed by analyzing the data obtained from the test validation sheet and then revising the test.
- c. Implementation Stage of Research and Data Analysis
That is (collecting data: by executing test to selected research subject) and analyzing data (result of student's answer is analyzed based on test result of creative thinking ability). So that is obtained conclusion to result of analysis which have been done in previous stage.

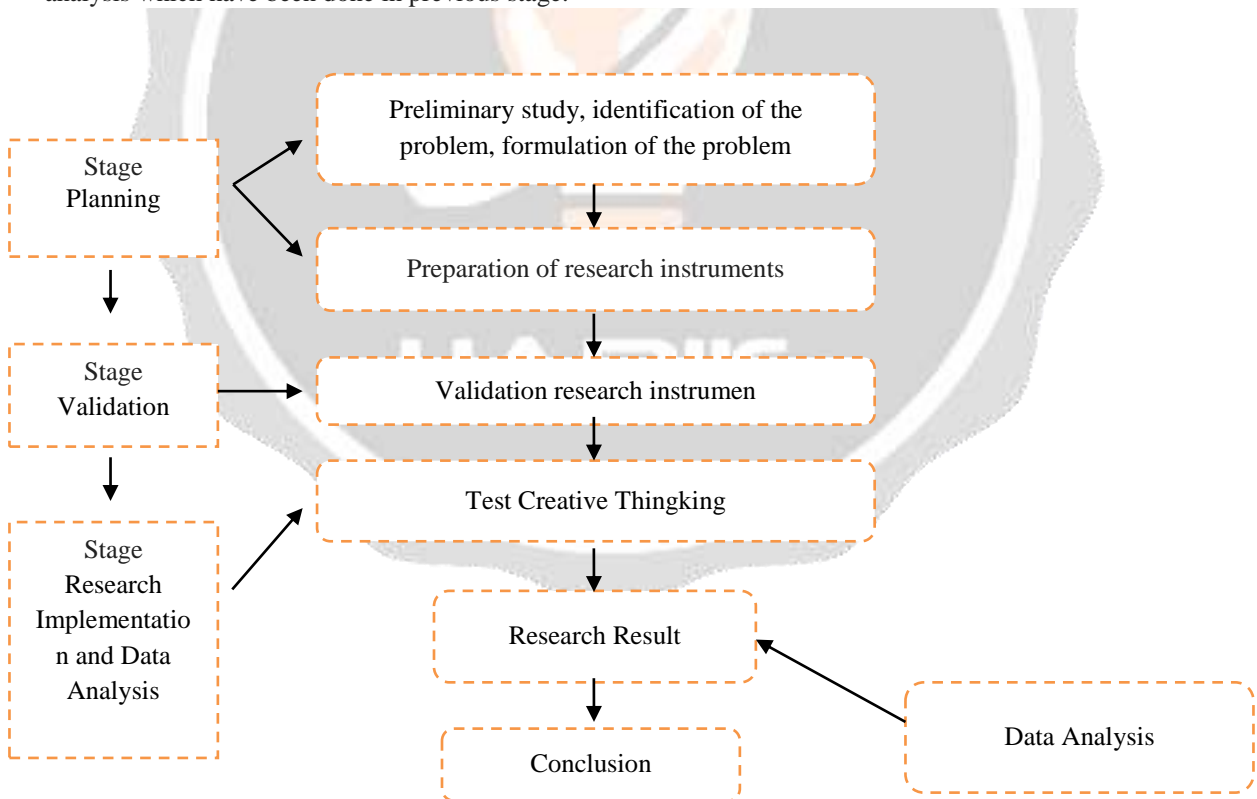


Figure -1: Research Procedur

3. RESULT

The purpose of this research to describe the ability to think creatively mathematically students in solving geometric problems comprehensively. The validation result of the instrument by the five validators is obtained by the total mean including the category worthy of use. In the category worthy means no re-validation is necessary. However, only revisions are made to grammar, the procedure of writing in accordance with the proposed revisions provided by the validator. So the question can be used and worthy given on the subject and the instruments that have been made can be used for research.

Table -1: The Results of the Feasibility Test Problem

Aspect/ indicator		Frekuensi evaluation Valid by Validator	
Aspect	Indicator	Agree	Disagree
Instruction	1. Test instruction explicit	5	0
Contents	1. Object test appropriate basic competence and indicator	4	1
	2. Kinds of question accommodate creative thinking mathematical	5	0
Language	1. Object test not use multiple meaning sentence	5	0

General of Evaluation	Conclusion		
	LD	LDP	TLD
Evaluation test creative thinking	√		

Information: LD : suitable for use, LDP: repair, TLD: no suitable for use

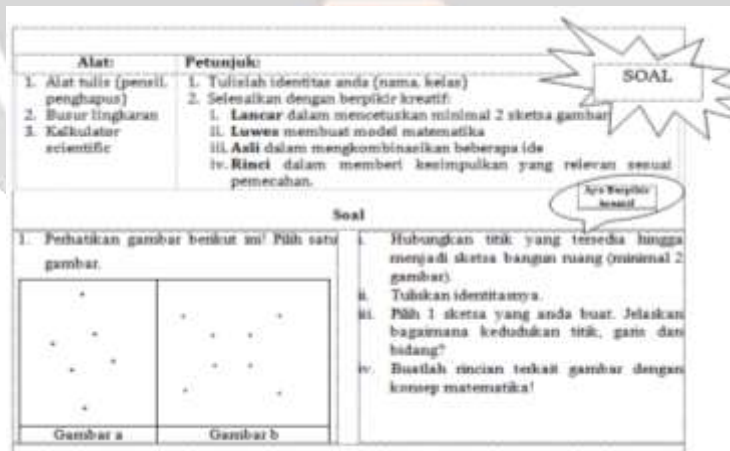


Figure-2: Creative Thinking Problem

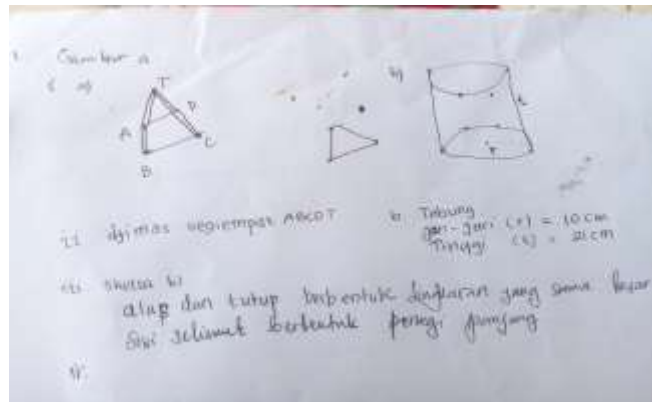


Figure-2: Answers learner Without of elaboration



Figure-3: Answers learner with of elaboration

In fact, The creativity of people in solving problems will vary depending on the knowledge and point of view of each of students, then the creativity of students in the solution will be different depending on the knowledge and ability of each of them. This difference of creative thinking process needs to be studied in depth so that it can be used as a reference for teachers in developing mathematics learning.

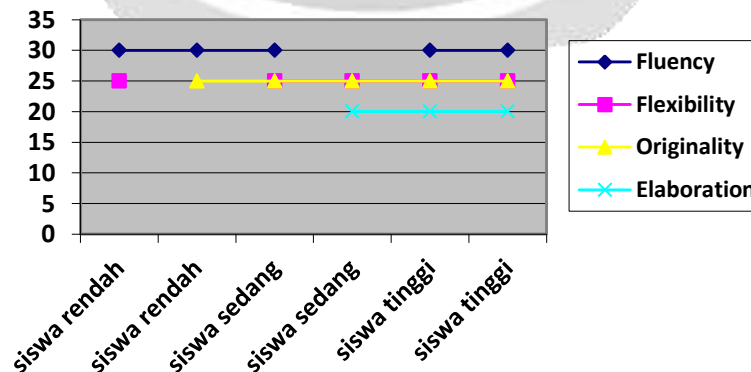


Chart -2: Creative Thinking Student with four Indicators and Maximal Point

From above diagram, it is known that for each indicator (fluency, flexibility, authenticity, and detail) with the ability of the students categories (low, medium and high) through a maximum score of 100 (30 points for smoothness, 25 points for flexibility, 25 points of authenticity and 20 point for detail). Each of student categories will be described below. The students are 2 in the low category, they are student A and B. Student A is only able to load smoothness and flexibility. Student B is capable of loading smoothness and authenticity. Next, Students C and D are in the medium category. Student C is able to contain fluency, flexibility, and authenticity. Student D is capable of loading flexibility, authenticity, and detail. Last, students E and F are in the high category. Students E is able to contain fluency, flexibility, authenticity, and detail. Student F is able to contain fluency, flexibility, authenticity, and elaboration.

The analysis is the students that have the ability to read good enough. Students have understood the material. Students are also able to apply the concept of mathematics. The application of mathematical concepts is essential for developing the creative potential of the individual. Because each individual has a different and unique creativity. There are students who are able to complete with 4 indicators shown and there are students who are only able to indicate 3 authenticity. The cause of the students has not been optimal in creative thinking that is the fear of failure, the difficulties in the image aspect and the solution with different variation. The reason for the difficulty is caused by the students have not mastered to write fluently information owned, alternative settlement and not yet detailing problem related to explanation. When learning process, teacher focuses only on mastery of the material so that it has not focused on the ability of creative thinking.

There are 2 students who can write in several ways (at least two ways) but not yet complete write down the information. The majority of the students responded in two ways when the command about the listed answers varied. The students spent over time. Then, additional time is 10 minutes. From the answers of students can be shown and seen that the creative thinking ability of learners uniquely.

4. DISCUSSION

Creative thinking is the potential of every individual is also one of the high-level thinking skills. As a person's mental activity through internal factors manifested to get out of the comfort zone. Creative thinking can combine to generate new ideas in response to a problem. Terms of creative thinking if it is worth, worthy, useful and different from the product before. Learning paradigm is supposed to support the ability of high-level thinking that is logical thinking, critical, creative and innovative. Learning is directed to master the material through the ability of creative thinking. It is advisable to examine other aspects of mathematical creative ability to be developed.

Some of the important points that need to be revised so that creative thinking ability can be applied in at the school is in terms of delivery of material, in terms of learning objectives that focus the ability to think creatively, teaching materials that focus on the ability to think creatively, there are activities that build awareness of thinking, Test create / designing. According to Getzed and Jackson (Elly's M. M, et al, 2014) open ended questions provide more than one answer to find out the creativity in the field of mathematics. It should be an open ended problem as the core of creative thinking skills.

Adams and Hamm (Wijaya, 2012: 55) Creative thinking ability can be enhanced through awareness and practice. Students have optimal potential. The main control of thinking activity is consciousness. The awareness of thinking is relevant to metacognitive terms. Learning that creates awareness behavioral thinking and values diversity is a metacognitive strategy. Lester (1975: 14-25) metacognition which includes awareness of cognitive processes and regulation is an important part of solving activities. Metacognitive strategies can lead students to understand the process of thinking experienced. This helps students to be more skilled at thinking. Metacognitive introduced by Flavell in 1976 (Sastrawati, 2011: 1-14) is the thinking person's consciousness, about the thinking process itself. Metacognitive is related to the students' awareness of their ability to develop various ways that may be pursued. Metacognitive contains 3 components namely: planning, monitoring and evaluation. Metacognitive strategies are provided through planning, monitoring and evaluation questions that can elicit creative thinking of students. Metacognitive questions appear to be aware of, regulate the way he thinks in solving a problem. The goal produces varied answers.

5. CONCLUSIONS

Creative thinking ability need to be uniquely trained. The causes of creative thinking ability are rarely trained in school through unstructured interviews in educators mentioning the learning process tends to be limited to partial cognitive strategies. That's oriented to the achievement of specific cognitive goal. Students are guided to remember and master the material so that students become smart theoretically. Mathematical exercises are algorithmic, mechanistic, and routine. The available learning activities are not yet conscientious in constructing students' sense of awareness, as they focus on cognitive through routine issues. Ongoing learning tends to emphasize aspects of mathematical procedures so that the ability to memorize formulas and procedures is more important. It is also mentioned Guilford (Munandar, 2012: 7) that educational emphasis is more on memorizing and looking for the right answer to the questions given. So the process of creative thinking is rarely trained. Nurul F., (2015) mentions the error of students in solving mathematical problems include incorrectly changing the information given into the mathematical expression because the students did not pay attention to the meaning of the problem. So that, errors that may also come from students tend to only memorize the formula so quickly forget the formula that has been given. Finally, misconception errors on the students

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