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Analyzing students' mathematical creative thinking ability on the material of sum and difference of sine and cosine

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Abstract

This research was conducted with the aim of knowing the mathematical creative thinking ability of class XI students of SMA N 2 Bantul with research subjects of class XI MIPA 6. This study used a test instrument to measure creative thinking skills. The indicators used in students' mathematical creative thinking are fluency, flexibility, authenticity/originality, detail/elaboration, and judging. The ability to think creatively is the ability to think with the aim of generating new ideas or various answers to a question by paying attention to the number of answers and the quality of the solution. The test instrument used was in the form of 2 written questions. The method used in this research is the descriptive qualitative research method. With data processing techniques, namely through data tabulation, then the percentage is calculated and then interpreted. The conclusion from the results of this study shows that the creative mathematical thinking of students in class XI MIPA 6 SMA N 2 Bantul has quite creative criteria.

Keywords: creative thinking ability, sum and difference of sine and cosine

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INTRODUCTION

Mathematics is very useful in everyday life and is a basic science of science development (basic of science). However, mathematics is a subject that is considered difficult for students to understand because it learns abstract concepts (Rahmawati, Bernard, and Akbar, 2019). In the 2013 curriculum, mathematics is one of the subjects that must be studied by high school students in all majors.

The 2013 curriculum is one of the changes in the learning paradigm from conventional learning to one that activates students and trains students' creative thinking skills. The 2013 curriculum is a competency-based curriculum that is formulated in an integrated manner covering the attitudes, knowledge, and skills competencies that students must possess. Creative thinking requires a child to have the ability to solve problems, have a variety of answers, have the ability to master a problem concept and convey ideas or ideas on a problem topic. Therefore, creative thinking is one of the skills developed in the 2013 Curriculum. The weak mathematical creative thinking ability of students can be caused by several factors (Martyanti, 2013). Factors that affect students' weak mathematical creative thinking skills are due to the lack of training or exploring thinking skills students (Hidayat and Yuliani, 2011; Sumarno et al., 2012; Tresnawati, Hidayat and Rohaeti, 2017; Dilla, Hidayat and Rohaeti, 2018; Aminulloh, Jupri, and Juandi, 2021). Creative thinking is also the result of student learning in using mathematical ideas and their implementation, which can be seen from their originality, fluency, flexibility, description, and assessment (Septiyati, 2019; DEA and Rahmawati, 2021).

The lack of mathematical creative thinking skills for students of class XI MIPA 6 SMA N 2 Bantul is because students are given multiple choice questions that only require students to find answers without knowing the exact steps of the process. This is reinforced by the results of an interview with one of the mathematics teachers of SMA N 2 Bantul. The problem that arises is

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the low creative thinking ability of students. During online learning, students are given multiple choice questions. Students often look for answers on Google. So that when face-to-face learning is carried out, students have difficulty working on questions.

Research conducted by Trisnawati, et al. showed that self-confidence had an effect on increasing mathematical creative thinking in students (Trisnawati et al., 2018). The higher the students' self-confidence, the students' curiosity will be stimulated and will increase their ability to think creatively and mathematically. It is better if students' self-confidence is lower than if students' curiosity is less encouraged, and this will have an impact on increasing mathematical creative thinking skills.

Research conducted by Gunawan et al. with the title Analysis of mathematical creative thinking skills of class XI students of SMA Islam Secang on trigonometry material (Gunawan et al., 2019). The results of the research conducted indicate that students who are in the category of moderate mathematical creative thinking are students with high learning outcomes, and in the category of low mathematical creative thinking, students are students with medium and low learning outcomes.

The research conducted with previous research is that in this study, researchers tried to raise more specific material, namely about the sum and difference of two angles in trigonometry. In addition, this research was conducted in a different school from the previous research, namely SMA N 2 Bantul.

RESEARCH METHOD

The research method used in this study is a descriptive method with a qualitative approach. This method is used to provide an overview of the creative thinking skills of students of class XI MIPA 6 SMA N 2 Bantul on the material of the sum and difference of sine and cosine.

This research was conducted at the end of January 2022 online through the Google Form application. This is due to the implementation of PPKM (Enforcement of Restrictions on Community Activities) at the school where the research is located, namely SMA N 2 Bantul. The subjects in this study were 2 students of class XI MIPA 6 SMA N 2 Bantul who were randomly selected and had different criteria for creative thinking abilities. This was done because the researcher wanted to analyze/describe students' mathematical creative thinking abilities.

This research was conducted through three stages, namely: (1) In The preparation stage, namely, the researcher made observations. Observations are carried out by studying the problems, compiling the background, compiling instruments and research permits; (2) the implementation stage, where the researcher gives creative thinking ability test questions on the number and difference of sine cosine material to the research subjects; (3) The evaluation stage, namely the researcher collects, processes, presents and concludes the research data.

The instrument used to collect data is a test instrument. The instrument is in the form of a test item description of the number and difference of sine and cosine, which is 2 questions that aim to determine creative thinking skills based on indicators of creative thinking ability (Munandar, 2004).

The research subjects were asked to complete 2 test questions, after which the results of student answers were analyzed based on indicators of mathematical creative thinking skills, namely fluency, flexibility, originality, elaboration, reformulation of a problem by way of and perspectives that are different from what is customary (Munandar, 2004).

Calculation of creative thinking ability test scores:

$$Value = \frac{total\ score\ obtained}{total\ score} \times 100\%$$

Table 1. Criteria for creative thinking ability

Value	Criteria
81,25%≤ Value ≤100%	Very Creative
62,5%≤ Value <81,25%	Creative
43,75%≤ Value <62,5%	Pretty Creative
25%≤ Value <43,75%	Less Creative

RESULTS AND DISCUSSION

This research was conducted on 19 students of class XI MIPA 6 at SMA N 2 Bantul. The test was given in the form of a description of the material on the number and difference of sine and cosine. In this study, a test instrument consisting of two test items was used.

Based on the results of the students' mathematical creative thinking ability test. The acquisition of students' mathematical creative thinking ability test scores regarding the number and difference of sine cosine is presented in Table 2.

Table 2 Obtaining Students' Creative Thinking Ability Scores

Question Number	Indicator	Respondent	
		R_2	R_9
1	1	2	4
	2	1	3
	3	1	3
	4	2	4
	5	1	3
2	1	2	2
	2	1	2
	3	1	2
	4	2	2
	5	1	1
Total score		14	26
Value		41,2	76,5
Criteria		Less Creative	Creative

From the acquisition of students' creative thinking skills scores, the percentages of creative thinking abilities per indicator are presented in Table 3.

Table 3 Percentage of students' creative thinking ability of each indicator

Number	Creative Thinking Ability Indicator	Percentage of Each Indicator	Criteria
1.	Fluent thinking skills	67,11%	Creative
2.	Flexible thinking skills	55,2%	Pretty Creative
3.	Original thinking skills	55,26%	Pretty Creative
4.	Detailing ability	67,11%	Creative
5.	Judging ability	43,42%	Less Creative
Percentage of Creative Thinking Ability		57,63%	Pretty Creative

Based on Table 3, shows that the creative thinking ability of students is in the criteria of being creative enough with a classical average value. The achievement of indicators in providing

answers or ideas correctly to the questions asked is the achievement of indicators producing varied answers with different points of view 55.26%, the achievement of indicators being able to provide answers according to their own thoughts is 55.26%, the achievement of indicators being able to detail an idea or the answer so that it is clearer is 67.11%, and the achievement of the indicator being able to conclude about the problem being solved is 43.42%.

Mathematical creative thinking ability with creative criteria

The results of the analysis of mathematical creative thinking skills on the material of the number and difference of sine cosine which have creative criteria, namely R9.

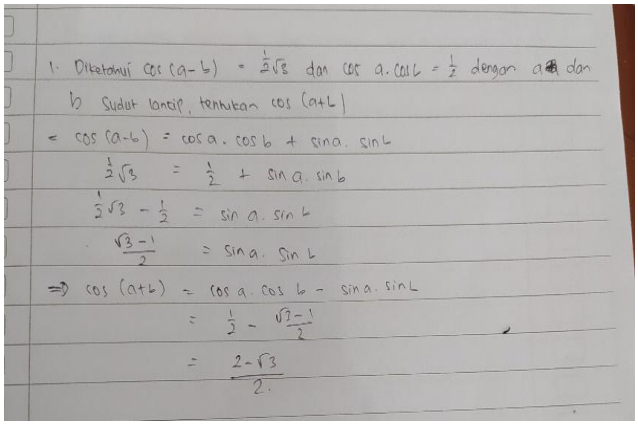

Figure 1. R9's answer to question number 1

Based on Figure 1 shows that R9 can answer the problem correctly and can write down the steps to solve it.

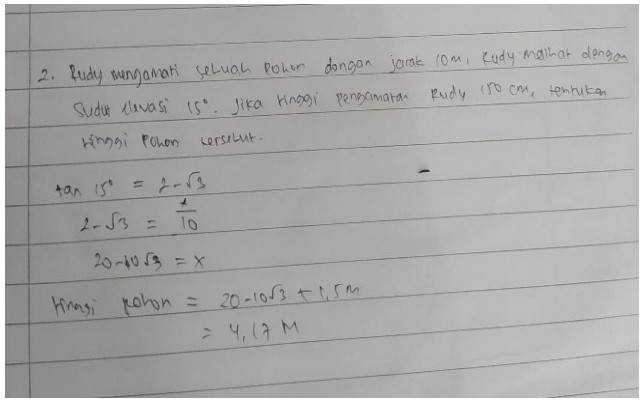

Figure 2. R9's answer to question number 2

Based on Figure 2 shows that R9 cannot answer the problem correctly. The indicator gives answers or ideas correctly to the questions posed R9 cannot write down the correct way of solving it. After an interview with R9, it was said that R9 had difficulty in solving the problems given. In solving these problems, R9 looked for solutions on the internet. Based on the answers to the mathematical creative thinking ability test and the interview results, the researcher can conclude that R9 has the ability to think creatively mathematically with creative criteria.

Mathematical creative thinking ability with less creative criteria

The results of the analysis of mathematical creative thinking skills on the material of the number and difference of sine cosine, which have less creative criteria, are R2:

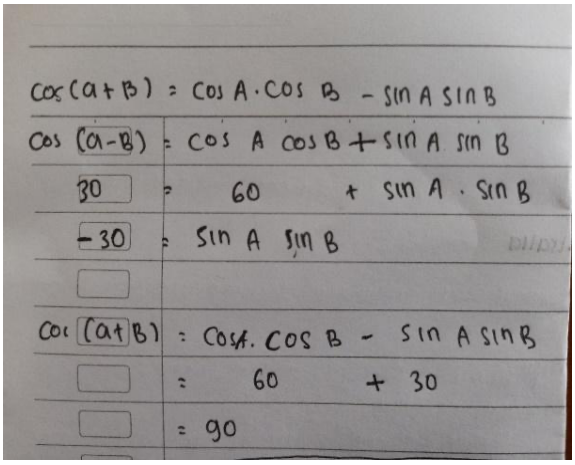

Figure 3. R2's answer to question number 1

Based on Figure 3 shows that R2 can identify the problems given, but R2 cannot answer the questions correctly. R2 can write down the solution steps, but it is not correct.

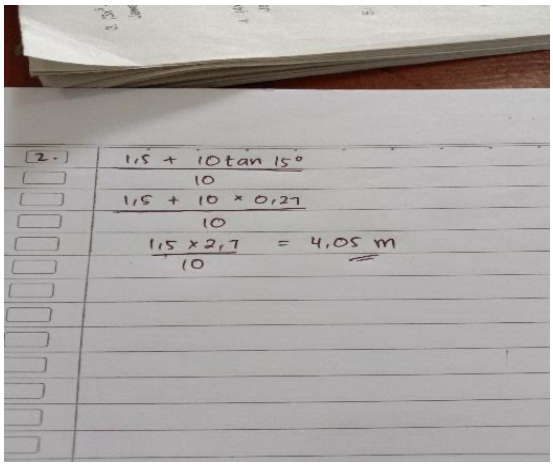

Figure 4. R2's answer to question number 2

Based on Figure 4, R2 can identify the given problem and write down the correct solution. However, R2 is less careful in solving the problem. It can be seen that R2 immediately writes tan 15° without describing the solution steps.

After the interview with R2, it was conveyed that R2 could solve the problems given by using his own thoughts. For question number 1, R2 still does not understand to describe problem-solving. It was also stated that R2 could not solve the problem given carefully. Based on the answers to R2's mathematical creative thinking ability test and the results of interviews, researchers can conclude that R2 has mathematical creative thinking skills with less creative criteria.

The description above shows that of all students answering the question of creative thinking skills, it was concluded that all students belonged to the criteria of being quite creative with an average of 57.63% and classified as moderately capable of creative thinking skills, in accordance with those in table 1 about the criteria for creative thinking skills. It is also reinforced by the results of research conducted by Septi Nur Rizki, et al., which shows that the results of the completion of students' answers pay attention to indicators of creative thinking, namely fluency, flexibility, originality, and detail/elaboration. (elaboration) (Rizki, Septiani, and Zanthy, 2020).

In addition, the research conducted by Gunawan et al. showed results that students who were in the medium category were students with high learning outcomes, and in the low creative

thinking category were students with moderate and low learning outcomes (Gunawan et al., 2019).

CONCLUSION

Based on the research on the mathematical creative thinking ability of students in class XI MIPA 6 SMA N 2 Bantul, the material for the number and difference of sine cosine is still quite creative. By looking at the average percentage of 57.63%, the achievement of indicators providing answers or ideas correctly to the questions asked is 67.11%, the achievement of indicators producing varied answers with different points of view 55.26%, achievement of indicators that can provide answers according to their own thoughts are 55.26%, the achievement of indicators that can detail an idea or answer so that it is clearer is 67.11%, and the achievement of indicators of being able to conclude about the problem being solved is 43.42%.

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