

IMPROVING STUDENTS' CRITICAL THINKING SKILLS IN LEARNING MATHEMATICS USING PROBLEM POSING APPROACH

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ABSTRACT

This study aims to improve students' critical thinking skills in mathematics learning using a problem posing approach. This study was classroom action research conducted over two cycles. Researchers use tests of critical thinking skills and observation sheets for data collection techniques. The subjects of this study were 35 grade 8 students of SMPN 2 Candi. Data analysis techniques use a combination of qualitative and quantitative. The results of the study showed that based on the results of the critical thinking skills test, there was a significant increase in the percentage of classical completeness from the pre-action stage to cycle 1, and there was a slight increase from cycle 1 to cycle 2. In the pre-action stage, there were 68.57% of students completed, where students are said to complete if their level of mastery is in the category of sufficient or above. In cycle 1, there were 80% of students who completed and in cycle 2 there were 82.86% of students who completed. Based on the study results, it was concluded that students' critical thinking skills in mathematics learning have increased by applying the problem posing approach.

Keywords: Mathematics Learning, Critical Thinking Skills, Problem Posing, Classical Completeness

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Submission June 9, 2024	Revised July 22, 2024	Accepted August 6, 2024	Published August 10, 2024
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How to cite (in APA style):

Solikhah, P. P., Rosyidi, A. H., & Widiastuti, E. Y. S. (2024). Improving Students' Critical Thinking Skills in Learning Mathematics Using Problem Posing Approach. *Jurnal Pendidikan Matematika (JPM)*, 10(2), 192–199. <https://doi.org/10.33474/jpm.v10i2.21763>

INTRODUCTION

According to Law of the Republic of Indonesia No. 20 of 2003 concerning the national education system, education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious, spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves, society, developing all the potential of students through the process learning (Musliyono, 2020). The concept and direction of educational goals are inseparable from the curriculum as a standard for implementing learning activities at all levels of education. In 2021, the Ministry of Education and Culture launched a prototype curriculum, which was refined into a Merdeka Curriculum by allowing the implementation of freedom of learning. The Merdeka Curriculum has intracurricular learning that is more optimized for varied learning content, giving sufficient time to students to explore knowledge concepts and strengthen their competencies (Shalehah, 2023).

One of the subjects taught in the Merdeka Curriculum is mathematics. According to James and James (in Arham & Adirakasiwi, 2022), mathematics is a lesson that uses logic about the arrangement, form, and relationships between concepts. One of the essential factors in learning mathematics today is critical thinking skills. Critical thinking skills are the ability to process and evaluate information objectively and reach appropriate and practical decisions (Ariadila et al., 2023). Dewi and Wijayanti (2022) set out four critical thinking skills indicators: clarification (analyze the meaning of the problem), assessment (gather relevant information), inference (infer relationships between ideas), and strategies (describe problem-solving actions).

Critical thinking skills are one component of 21st-century intelligence issues. They are essential to master so that students are more skilled in drafting an argument, checking the credibility of sources, or making decisions. Critical thinking is also an element in "*Profil Pelajar Pancasila*". The *Profil Pelajar Pancasila* is a character trait and competence expected to be achieved by students, and it is based on the noble values of Pancasila. The Minister of Education and Culture of Indonesia, Nadiem Anwar Makarim, has made *Profil Pelajar Pancasila* one of the Ministry's visions and missions, as stated in *Permendikbud* number 22 of 2020 concerning the Ministry's strategic plan for 2020-2024.

Based on the results of PISA 2022 released by the Organization for Economic Cooperation and Development (OECD), Indonesia's ranking rose 5-6 compared to PISA 2018 (Lubis, 2023). However, despite the increase in rankings in PISA 2022, Indonesia recorded a decrease in scores in the reading, mathematics, and science assessment subjects. Regarding mathematical ability, the main topic at PISA 2022, Indonesia's average score fell 13 points to 366 from 379 in the previous edition. This figure is also 106 points adrift of the global average score. In Indonesia, the percentage of students who have achieved at least level 2 in mathematical ability is 18.35 percent, the lowest among the three assessment subjects. This figure is 50 percent below the OECD average of 68.91 percent. Based on the results of PISA 2022, it can be concluded that the critical thinking skills of Indonesian students are still relatively low. In addition, based on the observations I made in grade 8 of SMPN 2 Candi, students' critical thinking skills were relatively low, especially in inference and strategies indicators.

One way that can be done to improve students' critical thinking skills is to implement a problem posing approach. This is supported by research by Rahim & Ayop (2023), which shows that applying a problem posing approach can improve mathematics critical thinking skills. Problem posing is an approach that directs students to ask new problems from the given problem situation. Sengul & Katranci (in Putri & Mukhni, 2023) show that problem posing is suitable for use in mathematical problems, and all problems can be solved because the problems posed are predictable, simple, and well structured so that they are easy to understand. Following this description, researchers want to conduct classroom action research entitled "Improving Students' Critical Thinking Skills in Learning Mathematics Using Problem Posing Approach" to improve the critical thinking skills of grade 8 students of SMPN 2 Candi.

METHOD

The research conducted is classroom action research. Classroom action research is research conducted by teachers as researchers or collaborating with others to plan, implement, and reflect on learning (Sari, 2024). The primary purpose of this classroom action research is to improve learning practices previously carried out in the classroom. This classroom action research was conducted at SMPN 2 Candi in collaboration with one of the mathematics teachers in that school. The subjects of the study were 35 students of class 8.

This research was carried out in 2 cycles. Each cycle consists of several stages: planning, implementation, observation, and reflection. The planning stage includes all

preparations for supporting research activities, such as preparing teaching modules, observation sheets, and test instruments. The implementation phase includes implementation at the planning stage. At this stage, researchers implement a problem posing approach to learning mathematics about triangular and quadrilateral materials. The observation stage is used to observe the process of implementing actions during the learning process, observation in the form of student activities in discussing, working on problems, and others. The reflection stage aims to find problems and causes of problems and find solutions to problems from the results of actions as a form of improvement for the next cycle.

Research instruments include written tests of critical thinking skills and observation sheets. Data analysis in this study is a combination of qualitative data and quantitative data. Qualitative data is in the form of qualitative descriptions obtained from observations of student activities. Quantitative data contains quantitative descriptions obtained from the results of students' critical thinking skills tests at the end of each lesson. The test results are analyzed based on indicators of critical thinking skills. Here is a table indicator of critical thinking skills.

Table 1. Critical Thinking Skills Indicator

Indicator	Description	Sub-indicator
Clarification	Analyze the meaning of the problem.	1. Understand the questions given. 2. Write down the information contained in the questions. 3. Write down what is asked in the questions.
Assessment	Gather relevant information.	1. Write down relevant concepts/ideas to solve problems. 2. State the formula that will be used to solve problems.
Inference	Infer relationships between ideas.	Conclude each step of problem-solving
Strategies	Describe problem-solving actions.	Make generalizations from the conclusions that have been obtained on the problem correctly.

(Source: Dewi & Wijayanti, 2022)

After the test results are analyzed, the scores obtained by each student are used to calculate the level of mastery of indicators. The level of mastery of indicators is processed using the following formula:

$$\text{Level of mastery of indicators} = \frac{\text{Score obtained}}{\text{Maximum score}} \times 100\%$$

The level of mastery of indicators is used to determine individual completeness, where students are said to be complete if the level of mastery of indicators is in the sufficient category or above with a minimum percentage of the level of mastery of indicators is 55%. The categories of students' critical thinking skills based on the level of mastery of indicators can be seen in the following table.

Table 2. Categories of Students' Critical Thinking Skills

Level of Mastery of Indicators (%)	Category
85 - 100	Excellent
70 - 84	Good
55 - 69	Sufficient
50 - 54	Less
< 50	Very lacking

(Source: Andriani et al., 2021)

Ennis (in Gusliani et al., 2021) said that students are said to be classically complete if there are 80% to 89% of students who complete. The formula for determining classical completeness is as follows.

$$\text{Classical completeness} = \frac{\text{Number of students who completed}}{\text{Total number of students}} \times 100\%$$

If the classical completeness of students has reached 80%, then their critical thinking skills have classically increased, so this study can be said to be successful. In addition, other criteria make this study said to be successful, namely that there are at least 80% of students who show active participation and give a positive response to the use of the problem posing method in mathematics learning.

RESULTS AND DISCUSSION

Before conducting research, researchers collected preliminary data on students' critical thinking skills by conducting writing tests. Here are the results of students' critical thinking skills before being given action (pre-action).

Table 3. Pre-action Research Results

Level of Mastery of Indicators (%)	Category	Pre-action	
		Complete	Incomplete
85 - 100	Excellent	7	-
70 - 84	Good	4	-
55 - 69	Sufficient	13	-
50 - 54	Less	-	1
< 50	Very lacking	-	10
Total		24	11
Percentages (%)		68,57%	31,43%

Based on Table 3, it can be seen that there are still many students whose critical thinking skills are in the category below sufficient. In contrast, out of 35 students, as many as 31.43% (11 students) are in the less and very lacking categories. At the same time, 68.57% (24 students) are in the sufficient, good, and excellent categories. In this activity, students are still found to have answers that are out of the context of the questions. In addition, some students do not fill out the answer sheet. This is because students do not understand the problem asked. In pre-action observation, mathematics learning is still dominated by using a direct learning model centered on teachers. Students tend to be passive when learning takes place, so students' critical thinking skills are not optimal. Researchers plan to improve students' critical thinking skills using a problem posing approach based on these pre-action data.

Furthermore, researchers applied mathematics learning using a problem-posing approach in cycle 1. The material studied is the characteristics of triangles. At the end of the

lesson, students take test questions to measure their critical thinking skills after being given action. Here are the results of students' critical thinking skills after getting action in cycle 1.

Table 4. Cycle 1 Research Results

Level of Mastery of Indicators (%)	Category	Cycle 1	
		Complete	Incomplete
85 - 100	Excellent	12	-
70 - 84	Good	8	-
55 - 69	Sufficient	8	-
50 - 54	Less	-	1
< 50	Very lacking	-	6
Total		28	7
Percentage		80%	20%

Based on Table 4, it can be seen that the critical thinking skills of students in cycle 1 out of 35 students, as many as 80% (28 students), are in the adequate, good, and excellent categories with a minimum score of 55 while students who reach the less and very lacking categories as much as 20% (7 students). Using the problem posing approach, it can be seen that students' critical thinking skills after being given action in cycle 1 have increased significantly compared to pre-action.

Furthermore, researchers applied mathematics learning using a problem-posing approach in cycle 2. The material studied is the characteristics of quadrilaterals. At the end of the lesson, students take test questions to measure their critical thinking skills after being given action. Here are the results of students' critical thinking skills after getting action in cycle 2.

Table 5. Cycle 2 Research Results

Level of Mastery of Indicators (%)	Category	Cycle 2	
		Complete	Incomplete
85 - 100	Excellent	18	-
70 - 84	Good	9	-
55 - 69	Sufficient	2	-
50 - 54	Less	-	-
< 50	Very lacking	-	6
Total		29	6
Percentage		82,86%	17,14%

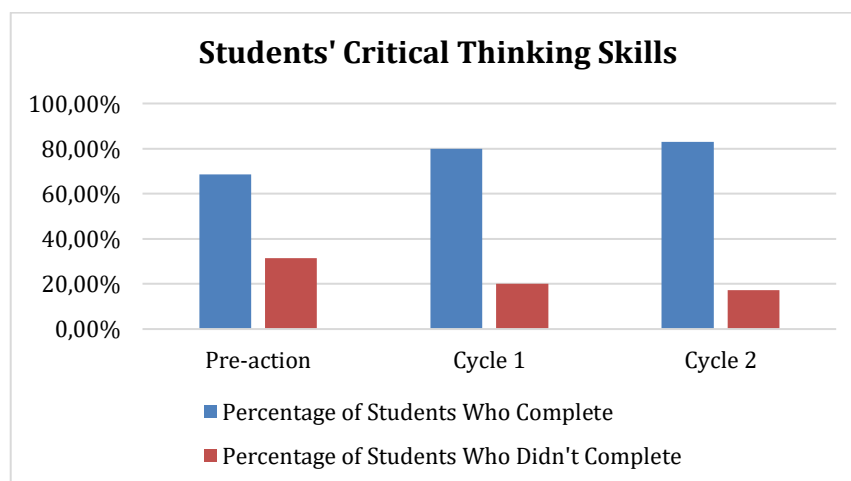


Figure 1. Graph of Improvement of Students' Critical Thinking Skills

Table 5 shows that students' critical thinking skills have slightly improved compared to the test results in cycle 1. Of the 35 students who achieved the sufficient, good, and excellent categories, as many as 82.86% (29 students) had a minimum score of 55, while students who reached the less and very lacking categories, as many as 17.14% (6 students). Furthermore, Figure 1 shows that students' critical thinking skills have increased significantly after being given action compared to pre-action. The classical completeness of students in cycle 2 is 82.86%, so it can be said that students' critical thinking skills have classically improved.

The data analysis results show a significant difference between classical completeness from the pre-action stage to cycle 1 and a slight increase in cycle 1 to cycle 2. From these results, it can be concluded that learning mathematics using a problem-posing approach can improve students' critical thinking skills. Based on the researchers' observations during class research, students tend to be more active in the learning process when using a problem-posing approach individually and in groups.

This study's results align with research by Sapta et al. (2019), which said that problem posing is better used in learning because it can improve students' critical thinking skills. With the increase in critical thinking skills, learning outcomes also increase. Research by Susanti (2020) also said that the problem posing approach has a significant influence on improving students' critical thinking skills. The problem posing approach positively impacts students' critical thinking skills. Students are stimulated to actively ask questions to improve their critical thinking skills in solving problems.

The problem-posing approach requires students to compile their questions or solve a problem to become simpler questions that refer to solving the problem. This approach occupies a strategic position in mathematics learning because it can activate students, develop their problem-solving thinking skills, and create a positive attitude toward mathematics lessons. This differs from the direct learning model, which tends to be teacher-centered in that students are less active in learning activities.

The description above illustrates that teaching using the problem-posing method positively influences students' critical thinking skills because they can learn actively. Problem-posing can help students find new topics and provide a deeper understanding. In addition, problem-posing can also encourage the creation of new ideas derived from any given topic.

CONCLUSION AND SUGGESTIONS

Based on the research carried out for two cycles, it can be concluded that students' critical thinking skills in mathematics learning can be improved using a problem posing approach. The increase can be seen in the percentage of classical completeness from pre-action, cycle 1, and cycle 2. The results of students' critical thinking skills in the pre-action stage reached a classical completeness of 68.57%, with 24 students completing it. In cycle 1, classical completeness increased significantly to 80%, with 28 students completing it. Then, in cycle 2, classical completeness slightly increased to 82.86%, with 29 students completed.

The suggestion for future research is that other researchers are expected to continue to develop this classroom action research because classroom action research aims to improve the quality of learning.

ACKNOWLEDGEMENTS

In compiling this research, the author realizes that many challenges and obstacles are faced. However, all of them can be done thanks to guidance and assistance from various parties. Therefore, the author would like to thank various parties involved in preparing this research, including Abdul Haris Rosyidi, M.Pd., as a supervisor who has provided time and input for the author and Dra. Endang Yayuk Sri Widiastuti, M.Pd., a mathematics teacher of SMPN 2 Candi,

has been willing to help carry out research in class. In addition, I would also like to thank my family, who have supported and prayed for me so that this research can run smoothly.

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