

IMPROVING STUDENTS' MATHEMATICAL CRITICAL THINKING ABILITIES USING LKPD WITH THE PROBLEM BASED LEARNING MODEL

Ratih Apriliyani¹, Budi Murdiyasa²

^{1,2} Mathematics Education, Muhammadiyah University of Surakarta

e-mail: a410190174@student.ums.ac.id

Abstract

The aim of this research is to improve students' critical mathematical thinking skills by combining LKPD with a problem-based learning (PBL) approach. A two-cycle classroom action research methodology was used in this research. Research findings show that students' critical thinking abilities increased from cycle I to cycle II. Based on observation data, it is known that students' critical thinking abilities have increased. For example, in cycle I students were able to formulate the core of the problem with an increase of 53.33%, and in cycle II the same ability increased to 72.33%. Apart from that, in cycle I students were able to solve a problem with relevant information by 59.66%, and in cycle II this percentage increased to 87.33%, choosing arguments that were logical, relevant and accurate was 72.33% and increased to 94.66%, students were able to identify tendencies that might emerge based on different points of view in cycle I as much as 63.66% and increased to 89.33%, students analyzed the consequences of a decision or statement taken in cycle I as much as 71.33% and increased to 86.39%. The learning process and evaluation results show that grade VIII from SMP Negeri 1 Gondang can improve their critical thinking skills by using LKPD learning through the PBL paradigm. The aim of this project is to improve students' critical mathematical thinking skills by integrating LKPD with problem-based learning (PBL) methodology.

Keywords: critical thinking, problem-based learning, LKPD, mathematics, education

INTRODUCTION

Education has a crucial role in the progress of a country and in facing global competition in the current era. This is in line with the learning objectives outlined in the National Education System Law no. 20 of 2003, precisely in Article 3 which states that the development of the nation's skills, character and culture is the nation's main means of achieving educational goals. This has an achievement goal, namely to maximize the potential that each student has so that he can grow into a human being with noble character, faith, knowledge, health, independence, ability, creativity, and also being able to socialize as a responsible and democratic citizen. Referring to the learning process, mathematics learning has a fundamental role to achieve *output* the.

Mathematics plays a crucial role in education as a subject that promotes the development of students' cognitive, analytical and problem-solving skills. In accordance with Minister of National Education Regulation no. 58 of 2014 for the field of Mathematics, this aims to ensure that all students, from preschool to post-secondary education, are able to develop teamwork skills in addition to the ability to think analytically, logically, critically,

systematically, creatively and also inventively. Referring to the 2013 curriculum, one of the targets of mathematics learning is to introduce students to the thinking process in a mathematical context. In order to achieve this goal, educators can increase students' mathematical creativity by choosing appropriate teaching models and materials, thereby providing space for students to develop their creative thinking.

Critical thinking is the capacity to consciously, proactively and deeply solve problems by applying reasonable reasoning and evaluating all information obtained (Ardianingtyas et al., 2020). Critical thinking skills are essential skills in human life. Students' lack of responsiveness and tendency to memorize concepts rather than understand them explains that students' critical thinking skills are not well trained. Active role students are still lacking, which is reflected in the small number of students who actively seek and express their opinions. This shows that students tend to focus on their teachers without analyzing, criticizing or evaluating what they are taught.

Applying an appropriate learning model can provide assistance in improving critical thinking skills. The Problem Based Learning (PBL) model is a student-centered approach. Through PBL, students are stimulated to learn actively and collaborate in groups to find solutions to contextual problems. The problems presented aim to arouse students' interest and enthusiasm in the learning process. Students are faced with problems that require understanding of concepts or material related to the problem they must overcome (Aini et al., 2020).

This explanation allows the identification of general themes. The Problem Based Learning (PBL) model encourages active student involvement in overcoming realistic problems by working together in groups to find a solution, while building new learning experiences. The application of a problem-based learning model has the potential to improve students' critical thinking skills and conceptual understanding.

Research (Setyo, Anang, M Fathurahman, 2020) argues that the purpose of PBL learning in education is to encourage students' in-depth analysis and creative problem solving abilities without reducing their understanding of the subjects being taught. This is achieved by presenting students with a variety of context-based problems that are closely related to real-world problems. Using a PBL framework in the classroom can improve

students' problem-solving skills, independent learning motivation, collaborative abilities, and broader knowledge.

In research (Blyznyuk, 2019) argues that PBL design aims to enable students to practice their critical and analytical thinking skills. Teaching and learning activities begin by providing contextual, real world problems. By going through various kinds of problems, the learning stages can empower students to solve problems and find new and relevant information. Through a problem-based learning approach, students are required to solve given problems by identifying relevant information, then analyzing it to find solutions. For this reason, teaching materials are needed that can support the development of students' problem solving abilities.

According to (Syafuruddin Nurdin, H., 2016) teachers have the ability to develop student worksheets (LKPD) as part of the teaching material. LKPD is a learning tool that includes documents, summaries and instructions to guide students in completing tasks designed to develop basic skills (Andi Prastowo, 2011).

LKPD is a method that supports and facilitates the learning process with the aim of creating efficient interaction between teachers and students, while increasing student participation in improving the achievement of learning outcomes. It is important to develop teaching materials to ensure their quality which is expected to support learning effectiveness (Cahyadi, 2019). This research was carried out based on evidence that the use of Student Worksheets (LKPD) has had quite an impact in increasing students' critical thinking capacity (Elfina & Sylvia, 2020). So the aim of this research can be formulated to analyze the application of learning media in the form of LKPD on a basis *Problem Based Learning* in order to improve students' critical mathematical thinking skills.

Interview findings with the Class VIII Mathematics Subject Teacher at SMP Negeri 1 Gondang showed that there was one class that lacked interaction when teaching mathematics. So the mathematics subject teacher at the school also suggested that researchers develop creative LKPD to attract students' interest in learning mathematics. For this reason, in this study the researcher will design learning materials in the form of LKPD for students at SMP Negeri 1 Gondang. Thus "Increasing Mathematical Critical Thinking

Ability of Gondang 1 Middle School Students Through Model-Based LKPD *Problem Based Learning*" is the title chosen for this study.

METHODS

The Classroom Action Research (CAR) approach used in this research and research. Each cycle requires 3 meetings. The research subjects were 30 students in class VIII of SMP Negeri 1 Gondang for the 2022-2023 academic year. Before taking action, an initial assessment is first carried out to measure the critical thinking abilities of students and pupils. The goal is to understand the basic elements of students' critical logical thinking abilities. There are many ways to see indicators of students' critical thinking abilities, according to (Khasanah & Ayu, 2017), including:

- 1) Compile the essence of the problem
- 2) Using appropriate data to solve problems.
- 3) Sort out arguments that make sense, fit the context, and are appropriate.
- 4) Recognize potential biases that arise from multiple perspectives.
- 5) Assess the impact of a decision or statement made.

According to (Aris, 2017) the steps in the PBL learning model are arranged with;

- 1) The teacher communicates learning objectives, provides information about necessary preparations, and inspires students to actively participate in selected problem-solving activities
- 2) Teachers provide guidance to students in determining topics, assignments, schedules, and other aspects related to the learning task at hand
- 3) Teachers encourage students to collect relevant information, carry out experiments, collect data, formulate hypotheses, and design solutions to the problems they are facing.
- 4) Teachers provide assistance to students in planning and preparing final products, such as reports, and encourage them to work with classmates to complete assignments.
- 5) The teacher accompanies students in reflecting or evaluating their investigation process and the steps taken in solving the problem.

Kemmis and Mc Taggart's research model is used as the basis for this Classroom Action Research (Sulastri, 2016). In general, the stages of classroom action research include:

- 1) Planning
- 2) Action
- 3) Observation
- 4) Reflection

This stage emphasizes that before starting to implement actions, researchers need to plan the instruments that will be used, namely creating learning scenarios, creating infrastructure and classroom support equipment needed in this example research to create LKPD-based PBL teaching materials. After making a plan, the second step is to take action. Next, while carrying out these actions, the researcher observes the implementation process and the resulting impact. Then, based on these observations, the researcher reflects on the actions that have been taken. If the results of the reflection show the need for improvement in the actions taken, then the planning for the action needs to be improved so that the next action does not just repeat what was done previously. This process continues until the problem under study can be solved in an optimal way.

RESULTS AND DISCUSSION

Through the implementation of PBL-based LKPD, classroom action research to improve the critical thinking abilities of class VIII A students at SMP Negeri 1 Gondang in learning mathematics. The study was divided into two cycles, with the first cycle including three sessions. In the first and second sessions, PBL material was presented using LKPD and PowerPoint media. Topics discussed include various types of flat-sided shapes and their nets.

In the sub-chapter various examples can be given: bricks can be likened to blocks, dice can be likened to cubes and so on. In the sub-chapter, nets can be exemplified by cardboard laid out. When shaped, it can become a block or cube shape. Then students are faced with a question and are asked to name objects in the form of flat-sided shapes found in the classroom. Students observe various kinds of objects in the classroom and begin to name these objects such as books, erasers, and so on. Students are also given a cardboard sheet and asked to make a net and then have to look at it and process it to form a flat-sided

shape. Once everything is complete, the resulting data will be studied and evaluated according to the targets of this research. At the third meeting of cycle I, a test was carried out to measure critical thinking abilities. The findings from this research show that the typical proportion of critical thinking abilities in cycle I is 64.06%, with the criteria for the level of ability being categorized as moderate.

Cycle II consists of on 3 convention. At the first and second meetings it was presented with a focus on the concepts of perimeter, area and volume of flat-sided shapes. Teaching is carried out LKPD and the help of PowerPoint media. Then students are asked to measure the width, length and height of the flat-sided geometric nets that were made in cycle I. After knowing the length, width and height, they can then calculate the perimeter, area and volume of the flat-sided geometric shapes. Once everything is complete, the resulting data will be studied and evaluated according to the targets of this research. At the third meeting of cycle II, a test was carried out to measure critical thinking ability in cycle II which was 86.39%, which indicated a very high level of ability.

Table 1. Recapitulation of Each Aspect of Critical Thinking Ability from Pre-Action, Cycle I and Cycle II

NO	Aspects of Critical Thinking Ability	Pre Action		Cycle I		Cycle II	
		%	Criteria	%	Criteria	%	Criteria
1	Compile the essence of the problem	26,66	Very low	53,33	Moderately	72,33	Height
2	Utilize relevant information to solve a problem	38,33	Very low	59,66	Moderately	87,33	Very high
3	Choose arguments that are logical, relevant, and	43,33	Low	72,33	Height	94,66	Very high

	accurate						
4	Identify trends that may emerge based on different points of view	25,33	Very low	63,66	Moderately	89,33	Height
5	Analyze the consequences of a decision or statement taken	47,66	Low	71,33	Height	88,33	Very high
	Percentage average critical thinking ability	36,26	Very low	64,06	Moderately	86,39	Very high

Overall, the research went smoothly. The learning process in each cycle follows the stages set out in the Problem Based Learning (PBL) model. Data from the critical thinking ability test shows that the proportion is 36.26% at stage pre-action (very low threshold). The proportion increased to 64.06% (medium criteria) in the first cycle and then changed to 86.39% (very high criteria) in the second cycle. Table 1 shows that there has been a significant increase in the average percentage of students who have critical thinking skills.

The findings in this research are different from the results of research conducted by (Ika Deana Fatmawati, 2022) In her research, the average percentage of critical thinking skills in the first cycle of the first meeting and the second cycle was included in the high criteria. Meanwhile, in this study, the average percentage in the first cycle was in the medium criteria and in the second cycle the criteria were very high. This difference in results may be caused by variations in research objects, which cause each individual's thinking response to be different.

Research in (Shofiyah Maqbullah, 2018) resulted that in cycle I initially only one indicator reached the critical level. Although there was an increase in taking action in cycle II, it was still seen as very important. Next, actions are taken in cycle III to achieve maximum results.

The results of this research are different from the results of the research I conducted because the research (Shofiyah Maqbullah, 2018) had to use 3 cycles to achieve the maximum limit or goal of learning. Meanwhile, in the research I conducted in the first and second cycles, the results reached the expected criteria.

Results of this research no In line with research that has been conducted (Nurul Aini, 2020), this claim states that students' critical thinking abilities in cycle I are still considered quite low because they have not yet reached the minimum completion criteria score with a percentage of only 50%. However, in the second cycle it was included in the very good category because the percentage increased to 90% and students could be categorized as having very high critical thinking abilities, whereas in this study the average percentage in the first cycle was in the medium criteria and in the second cycle the criteria were very high. . The results of this research are different from my research because the research object is different, which causes the answers from each individual's thoughts to be different.

CONCLUSION

Conclusions can be obtained from the results of research and cooperative discussions between researchers and class VIII A mathematics teachers at SMP Negeri 1 Gondang is as follows: (1) students' critical thinking skills have increased as a result of the use of the Problem Based Learning (PBL) model in mathematics learning, especially in flat-sided geometric material. This is proven by the change in the average percentage of students' critical thinking skills from the very low category before action to the medium category in cycle I, then to the very high category in cycle II. This improvement was also seen in various aspects of critical thinking skills. (2) with an increase in the average percentage in each cycle, the Problem Based Learning Model (PBL) for mathematics learning from the medium category in the first cycle to very high in the second cycle.

REFERENCES

- Aini, N., Surya, Y. F., & Pebriana, P. H. (2020). Peningkatan Kemampuan Berpikir Kritis Dengan Menggunakan Model Problem Based Learning (Pbl) Pada Siswa Kelas Iv Mi Al-Falah. *Jurnal Pendidikan Dan Konseling (JPDK)*, 2(2), 179-182. <https://doi.org/10.31004/jpdk.v2i1.126>
- Andi Prastowo. (2011). *Panduan Kreatif Membuat Bahan Ajar Inovatif*. DIVA Press.

- Ardianingtyas, I. R., Sunandar, S., & Dwijayanti, I. (2020). Kemampuan Berpikir Kritis Siswa SMP Ditinjau dari Kemampuan Pemecahan Masalah Matematika. *Imajiner: Jurnal Matematika Dan Pendidikan Matematika*, 2(5), 401–408. <https://doi.org/10.26877/imajiner.v2i5.6661>
- Arikunto, S. (2010). *Penelitian Tindakan Kelas*. PT. Bumi Aksara.
- Aris, S. (2017). *68 model pembelajaran inovatif dalam kurikulum 2013* (R. KR (ed.)). Ar-Ruzz Media.
- Blyznyuk, T. (2019). Formation of Teachers' Digital Competence: Domestic Challenges and Foreign Experience. *Journal of Vasyl Stefanyk Precarpathian National University*, 5(1), 40–46. <https://doi.org/10.15330/jpnu.5.1.40-46>
- Cahyadi, R. A. H. (2019). Pengembangan Bahan Ajar Berbasis Addie Model. *Halaqa: Islamic Education Journal*, 3(1), 35–42. <https://doi.org/10.21070/halaqa.v3i1.2124>
- Elfina, S., & Sylvia, I. (2020). Pengembangan Lembar Kerja Peserta Didik (LKPD) Berbasis Problem Based Learning (PBL) dalam Meningkatkan Kemampuan Berpikir Kritis Siswa Pada Mata Pelajaran Sosiologi di SMA Negeri 1 Payakumbuh. *Jurnal Sikola: Jurnal Kajian Pendidikan Dan Pembelajaran*, 2(1), 27–34. <https://doi.org/10.24036/sikola.v2i1.56>
- Fatmawanti, I., & Istihapsari, V. (2022). Peningkatan Kemampuan Berpikir Kritis Melalui Model Problem Based Learning Berbantuan LKPD Materi Segiempat Segitiga. *Jurnal Inovasi* ..., 1–11. <http://journal.rafandhapress.com/index.php/jipm/article/view/32%0Ahttps://journal.rafandhapress.com/index.php/jipm/article/download/32/9>
- Khasanah, B. A., & Ayu, I. D. (2017). Kemampuan Berpikir Kritis Siswa Melalui Penerapan Model Pembelajaran Brain Based Learning. *Ekspone*, 7(2), 47–53.
- Nurul Aini, Y. F. (2020). Peningkatan Kemampuan Berpikir Kritis Dengan Menggunakan Model Problem Based Learning (PBL) Pada Siswa Kelas IV M Al-Falah. *Jurnal Pendidikan dan Konseling*, 179-182.
- Setyo, Anang, M Fathurahman, & Z. A. (2020). *Strategi Pembelajaran Problem Based Learning*. Yayasan Barcode.

- Shofiyah Maqbullah, T. S. (2018). Penerapan Model Problem Based Learning Untuk Meningkatkan Kemampuan Berpikir Kritis Pada Pembelajaran IPA Di Sekolah Dasar. *METODIK DIDAKTIK*, 106-112.
- Sulastri, A. (2016). Penerapan Pendekatan Kontekstual dalam Pembelajaran Matematika untuk Meningkatkan Pemahaman Konsep Matematis Siswa Sekolah Dasar. *Jurnal Pendidikan Guru Sekolah Dasar*, 1(1).
- Syafruddin Nurdin, H., 1951- (pengarang). (2016). *Kurikulum dan pembelajaran / Prof. Dr. H. Syafruddin Nurdin, M.Pd, Adriantoni, M.Pd.*