Proceedings of International Conference on Teacher Profession Education
Yogyakarta, 29 July 2023

ISSN: 3025-020X

Improving Students' Critical Thinking Ability through Model-Based Learning (PBL) in Mathematics Learning in Class V of Golo Elementary School

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1. Abstract

This article discusses the effectiveness of the problem-based learning (PBL) learning model in improving students' critical thinking skills. With this learning model, students can learn to solve problems using their existing knowledge. Problem-based learning, or PBL, is an approach to the teaching and learning process that uses a real-life problem as a context for exploring critical thinking knowledge. The research was conducted in the form of Classroom Action Research (CAR) using the Kemmis model research design. and Mc. Taggart. The research was conducted in SD Negeri Golo. Twenty-five grade V (five) students participated in the study. In the pre-cycle, before the introduction of problem-based learning (PBL), they showed critical thinking skills with a classical completeness of 46% and an average of 68.5. In cycle I, after the introduction of problem-based learning (PBL), they showed an increase in critical thinking skills with a classical completeness of 62% and an average of 68.05. In contrast, in cycle II, the classical completeness score was 83% with an average score of 75.2. The problem-based learning (PBL) model as a whole can improve students' critical thinking skills, which has an impact on improving students' learning outcomes in the learning process.

Keywords: *critical thinking, problem-based learning, mathematics*

2. Introduction

Indonesia is entering the era of the 21st century, which is characterized by the use of technology. As educators, teachers naturally need to teach and train 21st century skills that their students need to master. 21st century skills are not just about imparting

ISSN: 3025-020X

knowledge, but also about how students are educated to solve problems that may arise in daily life. For this reason, learning in the 21st century is no longer teacher-centered, but is oriented around student learning activities, such as internships, problem-based learning, and project-based learning. (Jannah & Atmojo, 2022; Rahayu et al., 2022)

Education plays a role in producing quality human resources (HR) for the development of the nation and the state. Education plays an important role in training quality human resources that can keep up with the development of science and technology. Therefore, education must be carried out as well as possible to achieve maximum learning success. This can be achieved through timely and effective education to achieve the learning objectives (Trimahesri, & Hardini, 2019).

Conventional learning leads to students becoming passive because learning is focused only on the teacher. The habit of teachers to use the teacher-centered method, which is constantly carried out, will affect the poor quality of education, students are less creative and can not keep up in an increasingly advanced time (Laela, 2016). Especially in learning mathematics in school, which is a component of education that develops not only skills and abilities in the application of mathematics, but also problem-solving skills (Wijayanti, 2014). In learning mathematics, students' participation in the learning process is emphasized and subjects are interrelated (Mawardi, 2014).

In the wake of the developments that have occurred, the subject of mathematics is being removed from the Integrated Topic Booklet for grades 4, 5, and 6 of elementary school. Mathematics is a symbolic language, a science based on logical, critical, creative, innovative, and consistent thinking, and has abstract, objective objects, namely facts, concepts, operations, and principles (Vitasari, 2013). In addition, learning mathematics for basic education emphasizes the formation of attitudes, reasoning or logic, and skills (Wahyudi et al., 2012).

ISSN: 3025-020X

One of the skills that need to be developed in learning mathematics is the ability to think critically when solving or remediating problems. Critical thinking is an ability and willingness to critically evaluate a belief or faith, what assumptions underlie it, and what view of life those assumptions are based on (Tilaar, Paat, & Paat, 2011).

Based on observations made at Golo Elementary School, the problem was found that students do not respond to what is being taught by the teacher. For example, when the teacher explains something, students simply follow the teacher's steps without questioning the reasons for those steps. Students' critical thinking skills and learning outcomes in mathematics are rated low. The low level of students' critical thinking skills is caused by the use of learning models that are not very creative and innovative to engage students in the learning process. The results of the initial data on the proficiency level of learning outcomes with KKM 70 showed that only 9 students (36%) had achieved the KKM. Meanwhile, 16 students (64%) had not achieved the KKM, or in other words, the ability to think critically, and student learning outcomes were still low.

Critical thinking is a person's ability to find information and solve a problem by asking himself to dig up information about the problem at hand (Christina & Kristin, 2016). Learning outcomes are abilities possessed by students after they receive their learning experience (Asriyadin, & Fatkhulloh, 2012). The learning outcomes are score data or numbers obtained through evaluation sheets at the end of learning to see student achievement in each subject (Permatasari, 2017).

The ability to think critically also has several indicators. Sariayu, et. all. (2006:21) states that the ability to think critically in general can be measured by several indicators. In general, these indicators are:

1. Collect and organize the necessary information
2. Find ways that can be used to deal with problems

ISSN: 3025-020X

3. Analyze data

4. Draw the necessary conclusions and similarities.

Other indicators that can be used to measure critical thinking are as follows:

Indicator	**Operational words**
Give a simple explanation	Analyze questions, ask and answer clarifying questions
Build basic skills	Assessing the credibility of a source, researching, assessing, research results
Conclude	Reducing and assessing deductions, inducing and considering induction results, making and assessing valuable judgments
Make further explanations	Identify terms, assess definitions, identify assumptions
Setting Strategy and tactics	Deciding an action, interacting with others

Table. 1 Critical Thinking Indicator
Source: Ennis, 1980; Costa, 1985, in Tawil & Lilisari (2013: 9)

Rusmono (2014) states that the characteristics of mathematics that are objective or everyday events and deductive in nature, namely that mathematical theories or statements can be accepted as true, then Problem Based Learning is the model needed to promote the learning process with optimal learning outcomes for the development of all potential children.

According to Hamdayama (2014), the problem-based learning model can be interpreted as a set of learning activities that emphasize the process of solving scientific problems. Problem-based learning, or PBL, is an approach to the teaching and learning process that uses a real-life problem that occurs in life as a context for students to explore knowledge about critical thinking (Lestari et al., 2017).

With this learning model, students can learn to solve problems using the knowledge they already have (Yandhari et al., 2019). This process then leads to new knowledge and insights that are more relevant to students. The application of the

ISSN: 3025-020X

problem-based learning model includes the following seven steps: (a) problem orientation, (b) statement of learning objectives, (c) classification of concepts, (d) organization of student learning, (e) investigation and discussion, (f) report of the results of the discussion, and (g) analysis of the process to solve a problem (Vitasari et al., 2016). The purpose of this study was to determine the effectiveness of the problem-based learning model in improving students' critical thinking skills at Golo Elementary School.

3. Methods

The research design uses action research in the classroom based on Kemmis & Mc Taggart's model. The Kemmis & McTaggart model research design is a classroom action research model or design that consists of four phases, namely planning, taking action, observation, and reflection (Uno, Lamatenggo, and Koni 2011). This classroom action research was conducted in cycles, with each cycle consisting of planning, action, observation, and reflection activities.

The subjects were 25 students from Class V, 15 of whom were boys and 10 of whom were girls. This study was conducted in two cycles, with each cycle consisting of two meetings. Each meeting was scheduled for 3 x 35 minutes or three hours of instruction. Below is a diagram of the research procedures, shown in Figure 1.

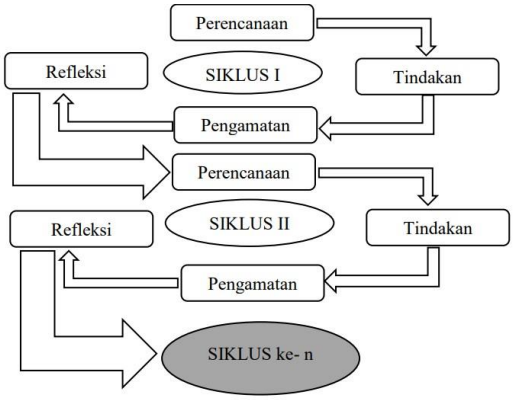

Figure 1. Research Procedure (Arikunto, 2013: 137)

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Data were collected by observation and interview, and by assessment tests. Data were analyzed quantitatively and presented in tabular form. The data analysis technique used in this study is an interactive analysis model. The Miles & Huberman (1984) interactive analysis model is included in (Sugiyono, 2015: 338), namely the data analysis technique model, which includes four phases, including the phases of data collection (data gathering), data reduction (data reduction), data presentation (data display), and drawing conclusions (inference/verification).

To obtain a score for students' critical thinking skills using the problem-based learning model, the following formula is used:

= a/b 100%

Information:
N = The value of mathematical critical thinking skills
a = The total score obtained on all indicators
b = The ideal total score for all indicators

Criteria for critical thinking can be seen in Table 2.

Gain scale	Criteria for critical thinking
70 – 100	High
50 – 69	Currently
0 – 49	Low

Table. 2 Criteria for critical thinking
(Sourch : Arikunto and Jabar, 2009 : 35)

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4. Results and Discussion

Results

This Classroom Action Research (PTK) uses the Kemmis model, whose phases consist of planning, implementation, observation, and reflection. The planning phase involves planning the research activities to improve critical thinking skills and student learning outcomes through the application of the PBL learning model. Planning activities include preparation schedules, PBL learning model tools, hands-on equipment and materials, learning media, student worksheets (LKPD), and research instruments.
The critical thinking skills developed in this study, especially in mathematics, are students' ability to give simple explanations, build basic skills, make inferences, give further explanations, and organize strategies by taking multiple-choice tests to assess learning outcomes and critical thinking skills tests in the form of essays that are completed individually or in groups.

Indicator	KKM	Students	Pracycle		Cycle 1		Cycle 2	
			Student complete	Criteria	Student complete	Criteria	Student complete	Criteria
Give a simple explanation	70	25	15	65,25	18	73	20	80,50
Build basic skills	70	25	10	50	14	66	22	72,25
Conclude	70	25	11	62	16	69	21	74
Make further explanations	70	25	12	63	15	70,25	22	75
Setting Strategy and tactics	70	25	10	52,50	14	62	19	74,50
Average Value				**58,55**		**68,05**		**75,2**
Classical Mastery Percentage				**46%**		**62%**		**83%**

Table. 3. Observation Results of Students' Critical Thinking Ability

ISSN: 3025-020X

Prior to the application of the problem-based learning model, data were collected on pre-cycles. The minimum completeness criterion (MCM) for mathematics for the Golo State Elementary School class is 70, and the results can be seen in the table. In the pre-cycle, the average was only 58.55, indicating that of the learning outcomes for Grade V students, the ability to think critically was only 46% of classical completeness, and the overall average was below the KKM in mathematics. The data in cycle I was collected after the introduction of the problem-based learning model and showed an average of 68.05, indicating that the ability to think critically is 62% of classical completeness among the students in grade VI, the overall average is below the PPM in mathematics. In contrast, in the II cycle, it can be seen that students' critical thinking ability increases significantly, with an average score of 75.2 and a percentage of classical completeness of 83%.

Discussion

From the research data, it can be concluded that the problem-based learning model can improve critical thinking skills in fifth grade mathematics classrooms. In addition to improving critical thinking skills, the use of the problem-based learning model can also improve the implementation of teacher and student activities.

Based on the results of observations in Cycle I, several deficiencies were identified, including: Students still paid little attention to the teacher's explanations and did not have the courage to attempt to work on the sample questions given by the teacher; in addition, some students did not seriously work on LKPD with a group system. Based on the deficiencies in Cycle I, learning improvements were made in Cycle II. These improvements include: Motivating students with contextual questions according to the material in Cycle II and rewards for groups or individual students to work on sample questions provided by the teacher.

Anugraheni (2018) describes the learning model of problem- based learning, a learning model that engages students in learning activities and focuses on real-world problems in school, home, or community settings as the basis for acquiring knowledge and concepts through critical thinking and problem-solving skills. In addition, problem-based learning is a learning approach that presents contextual problems and develops

ISSN: 3025-020X

understanding of issues. Students learn how to construct problem frames, organize and investigate problems, collect and analyze data, assemble facts, construct arguments to solve problems, work individually or collaboratively to solve problems (Nuraini, & Kristin, 2017).

The learning process in this study can be seen in Cycles I and II, which were conducted according to the steps of the learning model of problem-based learning. The steps of the Problem Based Learning model used are orienting students to problems, organizing students for learning, guiding individual or group experiences, developing and presenting work, and analyzing and evaluating problem solving processes (Rusman, 2017).

This finding is inextricably linked to the majority of students who worked systematically on the test questions. Students demonstrated an increase in working on the test questions by writing down what is known and asked in the questions (clarification), allowing students to better understand the questions. Using the problem- based learning (PBL) learning model increases students' critical thinking skills when solving test questions. PBL learning that emphasizes problems can develop students' thinking skills in analyzing questions and finding appropriate answer solutions, making them more systematic and making it easier for students to solve problems. PBL learning increases students' interaction in solving problems in groups so that students can find concepts in solving problems.

Slamet (2017) states that critical thinking skills are an important reference point in thinking and working, which helps to look more closely at a relationship between everything that is analyzed. In addition, mathematics is a subject that requires the ability to think critically to solve problems, especially in the form of stories, so learning is required to improve critical thinking skills. Mathematics is a scientific discipline that can improve the ability to think and reason and contribute to solving everyday problems and in the world of work, so it is very important to learn mathematics (Rahmadani, & Anugraheni, 2017). So, it can be said that critical thinking skills have increased significantly in students of Golo Elementary School in each cycle.

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5. Conclusion

Based on the results of classroom action research conducted at Golo Elementary School, the use of problem-based learning models can improve students' critical thinking skills. In Prasiklus, it shows that 46% of students achieved classical completeness and the average was 58.55 before applying the PBL learning model. In Cycle I, classical completeness was 62% and the average was 68.05 after the problem-based learning model was applied. Then in cycle II, it increased significantly to 83% classical completeness with an average of 75.2. The problem-based learning model as a whole can improve students' critical thinking skills, which has an impact on increasing students' learning outcomes in the learning process. Recommendations for further research on motivation, learning media that are interesting to students need to be increased to increase students' interest in participating in learning, so that the problem-based learning model can be carried out properly.

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