

Improving Critical Thinking Ability and Learning Outcomes through Problem Based Learning Model for Mathematics Subjects in Fourth Grade

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1. Abstract

This research aims to improve the critical thinking skills and learning outcomes of students in Mathematics subjects of KPK and FPB fourth grade. The research conducted was collaborative classroom action research using the Problem Based Learning model. The research was carried out in two cycles with four stages, namely planning, implementation, observation, and reflection. Data collection techniques used to determine critical thinking skills are tests in the form of essay questions and observations, while to determine learning outcomes using the same test given at the pre-cycle and at the end of each cycle. The data analysis technique uses qualitative description analysis. The research subjects were fourth grade students totaling 27 students. The results showed that the application of the Problem Based Learning model can improve the critical thinking skills and learning outcomes of students in Mathematics subjects of KPK and FPB material in class IV. The research data on critical thinking skills showed an increase from pre-cycle activities which were originally in the low category, increasing to the moderate category in cycle I and high in cycle II. The learning outcomes of KPK and FPB materials for students also increased. Learners get scores above KKM 75, in the pre-cycle 37% to 67% in cycle I and 88% in cycle II.

Keywords: *problem based learning, critical thinking ability, learning outcomes*

2. Introduction

Education is one of the important components to realize the progress of a nation. Education will mold individuals into quality human resources. 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, and the State (Law of the Republic of Indonesia No. 20 of 2003 concerning the National Education System article 1). Education goes hand in hand with technological developments which demand the development of human resources in order to master various things including critical thinking or problem solving skills. The ability to think critically can be fostered, one of which is integrated in Mathematics. Through Mathematics subjects, especially on problems in the form of story problems, students are expected to have critical thinking skills, analytical, logical, systematic and have the ability to work together. Critical thinking ability are thought to have a close relationship with mathematics, because critical thinking skills provide more precise direction to students in thinking, working, and help more accurately determine the relationship between something and others (Egok, S. A., 2016).

Judging from the evaluation results in pre-cycle activities in class IV, the learning outcomes of Mathematics subject matter factors and multiples have not yet reached class learning completeness, especially on story-shaped questions. Of the 27 students minus 1 student who did not leave the class, there were 10 students who scored above the KKM, namely 75. These results are certainly less than 50% of the total number of students. Learners are less able to understand statements in story problems so that they cannot determine the appropriate way to solve the problem. Students tend to lack the ability to

think critically to solve mathematical problems in determining which concepts to use to solve the story problem.

The factors that make students have difficulty learning mathematics are the attitudes and interests of students who are low and less liked by students, where students do not like math lessons which make students not pay attention to the teacher during math lessons so that students feel discouraged during math lessons. Then the assumption of some students that math lessons are very boring lessons (Buyung et al, 2022). Conditions like this cause students to not be accustomed to thinking critically in solving math problems, especially story problems. In addition, learning activities are also still teacher-centered. Students who are not actively involved in the learning process are one of the factors for the low critical thinking skills of students. This is certainly contrary to the statement that mathematics is a means that can develop logical, systematic, critical, objective, rational and principled thinking patterns. Where this is very much needed by individuals in everyday life and in studying various sciences.

The Problem Based Learning (PBL) learning model is one of the learning models that is considered capable of improving students' critical thinking skills. According to Sianturi, A., et al (2018) that the mathematical critical thinking skills of students who follow learning with the Problem Based Learning (PBL) model are higher than those of students who follow conventional learning. This is because in it students are given problems or problems as a stimulus that becomes the focus and must be solved in learning activities which in turn will have an impact on improving critical thinking skills and student learning outcomes both individually and classically / in groups. This is as stated by Assegaf & Uep (2016) that Problem Based Learning is an approach to structuring curriculum that involves students with problems from practice that provide a

stimulus for learning. In addition, Tan in Ismamuza (2010) also conveyed that Problem Based Learning is a learning model that focuses on problem solving activities. Problem Based Learning as a learning model seeks to present a variety of problematic situations that are authentic and meaningful to students, which can be functioned in conducting investigations. The Problem Based Learning process is done collaboratively, where students learn in facilitated small groups, just as they work individually (Muniroh, 2015). In this activity students investigate on their own, find problems, then solve the problem under the guidance of a facilitator (teacher) (Ditjendikdasmen, 2016).

Some existing studies also explain that with the application of Problem Based Learning critical thinking skills can develop, because the critical thinking skills observed are the ability to identify, analyze, solve problems, and draw conclusions (Fakhriyah, 2014). In addition, Marsinah, et al (2019) also said that critical thinking skills can be improved through PBL because the learning approach is on authentic problems, and students are not only asked to understand the problem but also must be able to work together to solve the problem. So that it can stimulate the abilities and skills of students, especially the ability to think critically. From this explanation, this research is intended to apply the Problem Based Learning model in accordance with its syntax to improve students' critical thinking skills and learning outcomes. The purpose of this study was to determine the improvement of critical thinking skills and learning outcomes of students using the Problem Based Learning model.

Based on the identification of problems in the classroom and the description, researchers are interested in conducting research that focuses on efforts to improve critical thinking skills and learning outcomes in mathematics subjects through the Problem Based Learning model aimed at fourth grade students.

3. Methods

3.1. Participants and context

The subjects in this research were fourth grade students with a total of 27 students consisting of 10 female students and 17 male students. The object chosen in the study is the improvement of critical thinking skills and learning outcomes. The subject matter that is the focus of the research is the Mathematics subject matter of KPK and FPB fourth grade. This research uses the type of classroom action research (PTK). According to Subyantoro (2019) classroom action research is a form of reflective systematic study conducted by teachers to improve learning conditions. This research was conducted in a collaborative manner in collaboration with the cooperating teacher and supervising lecturer. In this study, researchers used the Kemmis and McTaggart model. The Kemmis and McTaggart model has four steps in research activities, namely planning (plan), action (act), observation (observe), and reflection (reflect) (Sukardi, 2014). The research design was carried out in the form of cycles, one cycle included four steps of research activities with an allocation of 3 meetings. However, if the first cycle has not met the predetermined achievement criteria, then the researcher continues the second cycle with the same steps until it meets the predetermined achievement criteria.

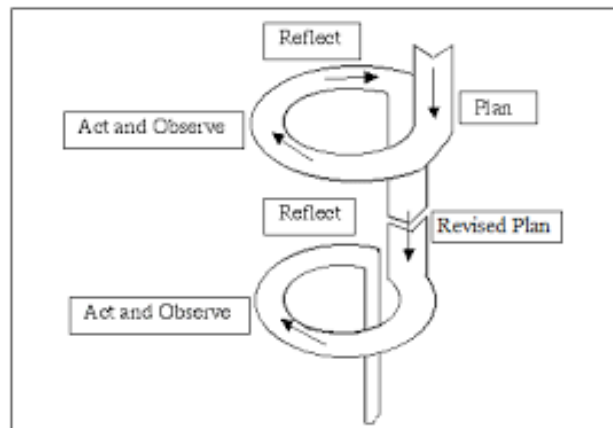


Figure 1: Classroom Action Research Procedure Kemmis and McTaggart Model

According to Arikunto (2015) the four steps involved in classroom action research are 1) planning, in this step the researcher first identifies the problems found in classroom learning and then prepares learning tools tailored to overcome these problems; 2) implementation, in this step the researcher carries out learning activities directly using the learning tools that have been prepared; 3) observation, in this stage the researcher observes the activities of students and teachers during the learning process; 4) reflection, in this step the researcher reflects and evaluates together with friends, student teachers, and supervisors on learning activities in cycle one. From the results of reflection and evaluation, an action plan is then made to determine cycle two if the achievement criteria have not been met.

3.2. Material

The data collection techniques used in this study were written tests, observation, and documentation. The instrument used for written tests is in the form of essay

questions to measure critical thinking skills as well as student learning outcomes. This test question was developed based on indicators of critical thinking skills on KPK and FPB material. According to Facione in Maslakhatunni'mah, D., et al (2019) indicators of critical thinking skills include explanation, interpretation, analysis, inference, evaluation, and self-regulation. In this study, researchers took four of these indicators, namely inference, analysis, evaluation and inference. The observation instrument is an observation sheet to measure students' critical thinking skills during the learning process, and documentation.

3.3. Data Collection and analysis

This research uses two types of data analysis, namely quantitative and qualitative data analysis. This research refers to the interactive analysis model by Miles and Huberman (in Sugiyono, 2015: 338), which consists of four stages, namely data collection, data reduction, data presentation, and conclusion drawing. The following are the criteria for critical thinking ability presented in tabular form.

Table 1. Critical Thinking Ability Criteria

No	Presentase (%)	Kategori
1	81-100	Very High
2	61-80	High
3	41-60	Enough
4	21-40	Low
5	0-20	Very Low

(Source: Riduwan, 2013)

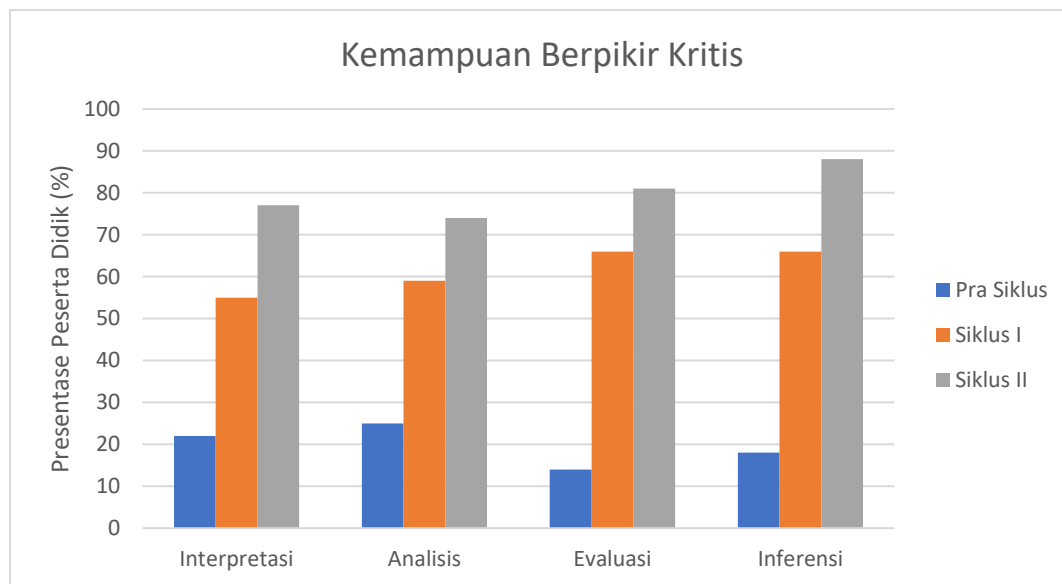
The success criteria for critical thinking skills in research is if there is a significant increase from pre-action activities, cycle I, and cycle II. Meanwhile, the learning outcomes of students are said to increase if more than 75% of the total number of students get scores above the KKM, namely 75.

4. Results and Discussion

Researchers will present the results of research from the application of the Problem Based Learning learning model to improve students' critical thinking skills and learning outcomes in Mathematics subjects of KPK and FPB material in class IV. The research data that will be described are the results of essay question tests and observation results. Essay questions are given from pre-cycle, end of cycle I, and end of cycle II which are used to measure critical thinking skills and learning outcomes. Based on the results of the essay question test from pre-cycle to cycle I has increased and from cycle I to cycle II has also increased.

Table 2. Data on Critical Thinking Ability Results

Critical Thinking Ability Indicator	Pre Cycle (%)	Cycle I (%)	Cycle II (%)	Description
Interpretation	22	55	77	Increased
Analisis	25	59	74	Increased
Evaluation	14	66	81	Increased
Inference	18	66	88	Increased



Graph 1. Data on Critical Thinking Ability Results

From the tabular data and graphs of students' critical thinking skills, the interpretation indicator has increased from 22% in the pre-cycle stage, to 55% in cycle I and increased to 77% in cycle II. Furthermore, the evaluation indicator also increased from 25% in the pre-cycle stage, to 59% in cycle I, and 74% in cycle II. The evaluation indicator increased from 14% in the pre-cycle to 66% in cycle I, and 81% in cycle II. Finally, the inference indicator also increased from 18% in the pre-cycle to 66% in cycle I, and 88% in cycle II. Based on the explanation above, all indicators experienced a significant increase. In pre-cycle activities in the low category, in cycle I it became a sufficient category, and finally in cycle II it increased to a high category. Thus, the critical thinking ability of students on the KPK and FPB material through the application of the Problem Based Learning learning model has increased. This can be seen in working on essay questions in the form of story problems, students have used a coherent and

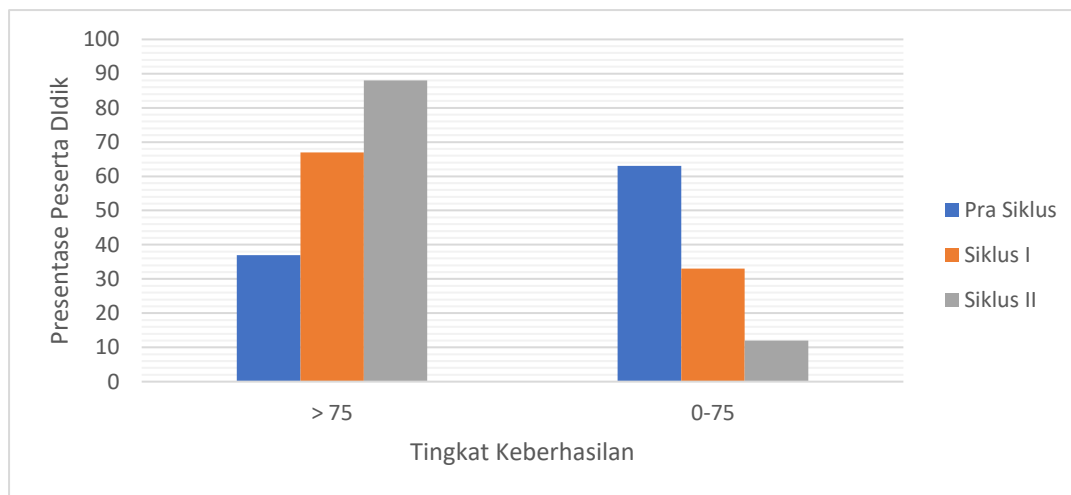
complete way of working by writing what is known in the problem, what is asked, how to work, and conclusions.

Data on students' cognitive learning outcomes are taken from pre-cycle, cycle I, and cycle II activities. In pre-cycle activities, students are not given the stimulus of learning media or other activities. The teacher only uses the lecture method in explaining the material. Furthermore, students work on evaluation questions that are used to determine the initial ability level of students. In cycle I and cycle II, students have been given a stimulus using the Problem Based Learning learning model combined with concrete media, learning videos, and student activities. From these activities, data on the cognitive learning outcomes of students on KPK and FPB material are obtained as follows.

Table 3. Data on Student Learning Outcomes

Success Rate	Pre Cycle (%)	Cycle I (%)	Cycle II (%)
>75 (passed KKM)	37	67	88
0-75 (have not passed KKM)	63	33	12

Based on the table data above, it shows that there is an increase in the number of students who score above KKM 75. In pre-cycle activities there were 37% of students who scored above KKM. In cycle I it increased to 67% of students who scored above KKM and increased again to 88% in cycle II. This shows that there is an increase in student learning outcomes seen in the fulfillment of the success indicators of learning outcomes, namely more than 75% of the total number of students in class IV obtained scores above the KKM, namely 75. Below when displayed in graph form.



Graph 2. Data on student learning outcomes

5. Conclusion

Based on the results of classroom action research that has been carried out for two cycles with each cycle consisting of two meetings for learning and one meeting for evaluation activities, it can be concluded that the application of the Problem Based Learning learning model can improve the critical thinking skills and learning outcomes of students in Mathematics subject matter KPK and FPB. The research data on critical thinking skills showed an increase in all indicators of critical thinking skills studied, namely interpretation, analysis, evaluation, and inference from pre-cycle activities which were originally in the low category, increasing to the moderate category in cycle I and high in cycle II. The learning outcomes of KPK and FPB material for students also increased to 67% in cycle I and 88% in cycle II getting scores above KKM 75.

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