

Application of the Problem Based Learning Model in Mathematics Learning to Improve Critical Thinking Skills for Grade III SD X

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1. Abstract

Mathematics is a field of science that has abstract objects and can improve thinking skills and provide assistance in solving everyday problems. The Problem Based Learning model is a learning model that presents problems for students to solve both individually and in groups by understanding the concepts of existing problems in order to stimulate students' critical thinking to solve problems in a way that they understand. This study aims to improve students' critical thinking skills through the application of the Problem Based Learning model at X Elementary School. This type of research is collaborative classroom action research which consists of two cycles. The participants in this study were grade III SD X semester 2 of the 2022/2023 academic year, with a total of 16 students. The data collection technique used consists of test and non-test techniques which involve observation and documentation. The results of this study indicate that the application of learning models can improve students' critical thinking skills in learning mathematics. The average students' ability to think critically increased from pre-cycle by 53.4%, cycle I by 63%, and cycle II by 79.7%. This shows that students' critical thinking skills increased

from cycle I to cycle II by 16.7%. So it can be concluded that the problem-based learning model can improve critical thinking skills in learning mathematics for third grade students at X Elementary School. The results of this study indicate that the application of learning models can improve students' critical thinking skills in learning mathematics. The average students' ability to think critically increased from pre-cycle by 53.4%, cycle I by 63%, and cycle II by 79.7%. This shows that students' critical thinking skills increased from cycle I to cycle II by 16.7%. So it can be concluded that the problem-based learning model can improve critical thinking skills in learning mathematics for third grade students at X Elementary School. The results of this study indicate that the application of learning models can improve students' critical thinking skills in learning mathematics. The average students' ability to think critically increased from pre-cycle by 53.4%, cycle I by 63%, and cycle II by 79.7%. This shows that students' critical thinking skills increased from cycle I to cycle II by 16.7%. So it can be concluded that the problem-based learning model can improve critical thinking skills in learning mathematics for third grade students at X Elementary School. This shows that students' critical thinking skills increased from cycle I to cycle II by 16.7%. So it can be concluded that the problem-based learning model can improve critical thinking skills in learning mathematics for third grade students at X Elementary School. This shows that students' critical thinking skills increased from cycle I to cycle II by 16.7%. So it can be concluded that the problem-based learning model can improve critical thinking skills in learning mathematics for third grade students at X Elementary School.

Keywords: *Mathematics, Critical Thinking Skills, Problem Based Learning Models*

2. Introduction

Learning takes place as a process that influences each other between teachers and students in teaching and learning activities. Learning is said to be able to improve critical thinking skills if students are actively involved, both physically, mentally and socially in the learning process. Based on the above, the teacher's efforts in developing students' critical thinking skills are very important, because students' critical thinking skills determine the success of the learning carried out.

Critical thinking ability is the ability to think clearly and rationally about what must be done or what must be believed to solve an existing problem. According to Fristadi and Bharata (2015) Critical thinking is the process of analyzing or evaluating information on a problem based on logical thinking to make decisions. Critical thinking skills can encourage students to come up with new ideas or thoughts about world problems. Students will be trained on how to select various opinions, so they can distinguish which opinions are relevant and which are irrelevant, which are true and which are not.

Mathematics is a symbolic language which is a science based on logical, creative, innovative thinking, and consistently has abstract objective objects, namely facts, concepts, operations, and principles (Vitasari, 2013: 3). In the process of learning mathematics, one of the abilities that needs to be developed to achieve 21st century skills is the ability to think critically in solving or solving problems. Critical thinking skills need to be developed for each student so that students can solve all the problems that exist in the real world. 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, LV, & Kristin, F., 2016: 222). According to Rachmantika and Wardono (2019) the ability to think critically and solve problems leads

to the ability to think critically, laterally and systemically, especially in the context of problem solving. In line with the opinion of Azizah (2018: 62) critical thinking skills are "cognitive processes of students in systematically and specifically analyzing the problems they face, distinguishing these problems carefully and thoroughly, and identifying and analyzing information to plan problem-solving strategies".

The problems presented in learning mathematics can be in the form of non-routine questions which include story questions, depictions of a phenomenon or event, illustrated pictures or puzzles. Problems that contain mathematical concepts are called mathematical problems (Lidinillah, 2008:2). According to Gunantara, et al (2014: 3) The difficulties faced by students are due to the lack of variations in learning models applied in mathematics subjects, especially in solving story problems, learning also tends to be teacher-centered.

Researchers made observations during learning activities to be precise in class III SD X. The results of these observations indicate that students are less able to develop their critical thinking skills. The inability of students to develop their critical thinking skills is shown by students tending to be silent during learning, only smart students are active in asking questions, besides that when students are given a problem and students are required to solve the problem, students feel confused in determining what action to take to solve the problem. Setting strategies and tactics to determine the actions that these students must take is an indicator of aspects of critical thinking,

The problems above show that students' critical thinking skills are still low. One of the supporting factors for the success of the teaching and learning process is selecting the right learning model. According to Anugraheni (2018: 15), regarding the Meta Analysis of Problem Based Learning Models, it states that the Problem Based Learning model can improve

students' critical thinking. According to Ariani and Wulandari (2016) the problem-based learning model is a learning model that uses problems to be investigated as the first step in gathering and developing new knowledge for students through a group work process that requires real solutions so as to make students actively participate in learning activities. Research conducted by Helmon (2018: 50) concerning the Effect of the Problem Based Learning Model on Students' Critical Thinking Ability, states that the PBL model has a positive and significant effect on the critical thinking skills of fourth grade students at SDN Serayu. In research conducted by Asriningtyas and Kristin (2018) raised that the application of problem-based learning models can improve critical thinking skills and mathematics learning outcomes for 4th grade elementary school students. Research conducted by Sukmawati (2020) also states that Problem Based Learning is very influential in improving students' critical thinking skills in elementary school mathematics with the lowest percentage of 1.16% to the highest of 40.35% with an average of 20.70%. stated that the PBL model had a positive and significant effect on the critical thinking skills of grade IV students at SDN Serayu. In research conducted by Asriningtyas and Kristin (2018) raised that the application of problem-based learning models can improve critical thinking skills and mathematics learning outcomes for 4th grade elementary school students. Research conducted by Sukmawati (2020) also states that Problem Based Learning is very influential in improving students' critical thinking skills in elementary school mathematics with the lowest percentage of 1.16% to the highest of 40.35% with an average of 20.70%. stated that the PBL model had a positive and significant effect on the critical thinking skills of grade IV students at SDN Serayu. In research conducted by Asriningtyas and Kristin (2018) raised that the application of problem-based learning models can improve critical thinking skills and mathematics

learning outcomes for 4th grade elementary school students. Research conducted by Sukmawati (2020) also states that Problem Based Learning is very influential in improving students' critical thinking skills in elementary school mathematics with the lowest percentage of 1.16% to the highest of 40.35% with an average of 20.70%. In research conducted by Asriningtyas and Kristin (2018) raised that the application of problem-based learning models can improve critical thinking skills and mathematics learning outcomes for 4th grade elementary school students. Research conducted by Sukmawati (2020) also states that Problem Based Learning is very influential in improving students' critical thinking skills in elementary school mathematics with the lowest percentage of 1.16% to the highest of 40.35% with an average of 20.70%. In research conducted by Asriningtyas and Kristin (2018) raised that the application of problem-based learning models can improve critical thinking skills and mathematics learning outcomes for 4th grade elementary school students. Research conducted by Sukmawati (2020) also states that Problem Based Learning is very influential in improving students' critical thinking skills in elementary school mathematics with the lowest percentage of 1.16% to the highest of 40.35% with an average of 20.70%.

The Problem Based Learning learning model can be a solution to overcome the low critical thinking skills of third graders of X Elementary School in mathematics. The Problem Based Learning learning model is a learning model that begins with problems to collect and integrate new knowledge (Fathurrohman, 2015: 24). The application of the Problem Based Learning model in the learning process can assist students in solving problems, self-study, teamwork, and acquiring broad knowledge. The purpose of this study was to determine the application of the problem-based learning model to learning mathematics in improving critical thinking skills for class III SD X. The application of this model uses a type of classroom

research which is often called Classroom Action Research (CAR). In the Classroom Action Research (PTK) that will be carried out there are 2 cycles. Cycle I consisted of planning I, implementation of action I, observation I and reflection I. Then in cycle II there were several processes, namely planning II, implementation of action II, observation II and reflection II.

3. Method

3.1. Participants and context

The subjects of this study were 16 students in grade III SD X Yogyakarta with the aim of knowing the true extent of increasing students' critical thinking skills in learning mathematics with the application of the Problem Based Learning model.

The object of research in this study is to improve the critical thinking skills of Grade III students at Tamansiswa Elementary School by using the PBL (Problem Based Learning) learning model. Classroom Action Research is carried out collaboratively with class teachers and tutors by making observations together. The focus of this research is to improve students' critical thinking skills in learning mathematics by applying the Problem Based Learning model.

3.2. Material

The instruments used in this study were observation sheets, tests, and documentation. The observation sheet serves to collect data on students' critical thinking skills and to find out the increase in students' critical thinking skills. The test functions to measure the level of development that has been achieved by students after taking the learning process. Documentation serves as evidence and accurate data about a statement. Documentation in this study was in the form of photos and videos during the learning

activities.

3.3. Data Collection and analysis

Data collection techniques used are observation, tests and documentation. Observations or observations run concurrently with the implementation. Observations were made using observation sheets for students' critical thinking skills that had been prepared which included: being able to analyze arguments, being able to ask questions, being able to answer questions, being able to solve problems, being able to make conclusions, and being able to evaluate or assess the whole. Then, the test questions that have been made are given to students and then completed individually. The test is carried out at the beginning of each cycle (pre-test) and at the end of the cycle (post-test). Documentation in the form of photos and videos during the learning activities takes place.

In Collaborative Classroom Action Research, there are several cycles. In planning the research that the researcher will do, there are 2 cycles, namely cycle I and cycle II. In cycle I, from the problems obtained, action planning I, action I implementation, I observation and reflection I are carried out. Then, in cycle II there are several processes of new problems resulting from reflection I, namely action planning II, implementation of action II, observation II and reflection II. In this study, researchers used an action research model from the Kemmis & Mc Taggart model, namely planning, action, observation/data collection, reflection. The data analysis technique used is a quantitative descriptive analysis technique.

The following is the formula for calculating the observational analysis of the learning process using the PBL model.

$$P = \frac{F}{N} \times 100\%$$

Information:

P = Percentage to search

F = Total score obtained

N = Sum of all scores (maximum score)

Meanwhile, to calculate the results of student performance tests using the following formula.

$$KI = \frac{T}{Tt} \times 100\%$$

Information:

KI = Individual Mastery

T = Total score obtained by students

Tt = Total score (Somadoyo, 2013: 71)

While the formula to see classical student learning completeness is:

$$KS = \frac{ST}{N} \times 100\%$$

Information:

KS = classical mastery

ST = Number of students who complete

N = Number of students in class (Arikunto, 2007: 284-285)

Each student is said to have passed his study (individual completeness) if the proportion of students' correct answers is $\geq 70\%$ and a class is said to have completed his studies (classical completeness) if in that class there are $\geq 75\%$ of students who have completed their studies. The KKM value applied is ≥ 70 .

3.4. Ethical Considerations

In this study involving humans as research subjects. Therefore, the basic principles of this research include respect for others and responsibility. Respect for other people means that we must respect all research involving humans as research subjects. In this case, we respect and value students as research subjects. Responsibility refers to behavior that conforms to widely accepted moral principles. Ethical responsibility is interpreted more broadly as an effort to produce research that can have positive implications for society.

3.5. Limitations to the Study

Limitations of action owned by researchers related to time, effort, and costs. The limitations of this research are the limited time because it is carried out near the end of the school year so that there are many school activities that must be carried out, limited research staff, and minimum costs because it only comes from private funds to conduct research.

4. Results and Discussion

Collaborative Classroom Action Research (PTKK) consists of pre-cycle, cycle I, and cycle II. The following is the observation data of students' critical thinking skills:

Table 1. Observation Data of Students' Critical Thinking Ability

No	Indicator	Percentage		
		Pre cycle	Cycle I	Cycle II
1.	Able to analyze arguments	60.9 %	73.4 %	79.7%
2.	Able to ask	54.7 %	54.7 %	76.6%
3.	Able to answer questions	46.8 %	76.6%	82.8%
4.	Able to solve problems	56.3 %	60.9%	81.3%
5.	Able to make conclusions	50 %	57.8%	79.7%
6.	Able to evaluate or assess	51.6 %	54.7%	78.2%
	Average	53.4 %	63%	79.7%
	Criteria	Not enough	Enough	Good

Based on the student activity data table above, it is known that in the first indicator, namely being able to analyze arguments, the percentage data obtained in the pre-cycle was 60.9%, the first cycle was 73.4% and the second cycle was 79.7%. So that there was an increase from pre-cycle to cycle I of 12.5% from cycle I to cycle II of 6.3%. In the second indicator, namely being able to ask questions, the percentage data obtained in the pre-cycle was 54.7%, cycle I was 54.7% and cycle II was 76.6%. So that there was an increase from pre-cycle to cycle I of 0% from cycle I to cycle II of 21.9%. Furthermore, on the third indicator, namely being able to answer questions, the percentage data obtained in the pre-cycle was 46.8%, the first cycle was 76.6% and the second cycle was 82.8%. So that there was an increase from pre-cycle to cycle I of 29, 8% from cycle I to cycle II of 6.2%. The fourth indicator, namely being able to solve problems, obtained percentage data in the pre-cycle of 56.3%, cycle I of 60.9% and cycle II of 81.3%. So that there was an increase from pre-cycle to cycle I of 4.6% from cycle I

to cycle II of 20.4%. On the fifth indicator, namely being able to make conclusions, the percentage data obtained in the pre-cycle was 50%, the first cycle was 57.8% and the second cycle was 79.7%. So that there was an increase from pre-cycle to cycle I of 7.8% from cycle I to cycle II of 21.9%. As for the sixth indicator, namely being able to evaluate or assess, the percentage data obtained in the pre-cycle was 51.6%, the first cycle was 54.7% and the second cycle was 78.2%. So that there is an increase from pre-cycle to cycle I by 3.1% from cycle I to cycle II of 23.5%. Data on improving students' critical thinking skills in the pre-cycle, cycle I and cycle II can be seen in the following diagram.

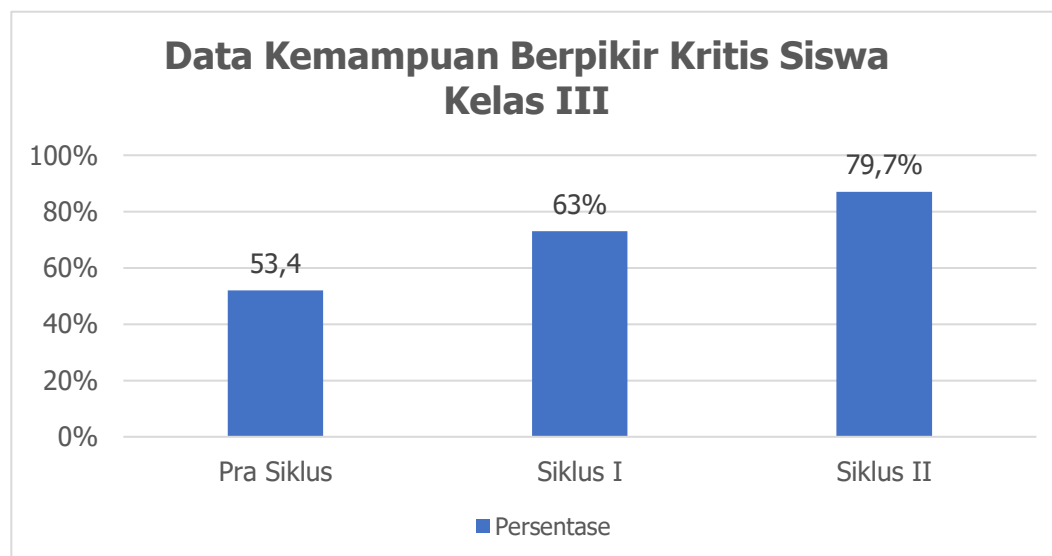


Figure 1.

Based on the data on students' critical thinking skills in the picture above, it can be seen that the average critical thinking ability of class III students in the pre-cycle was 53.4%, cycle I was 63% and cycle II was 79.7%. This shows an increase in the critical thinking

skills of class III students with an increase in percentage data in the pre-cycle to cycle I of 9.6% and cycle I to cycle II of 16.7%.

The research data shows that there is an increase in the critical thinking skills of class III students from the pre-cycle, cycle I to cycle II. This can be seen from the achievement of indicators of critical thinking skills for third grade students. Most of the students have been able to fulfill all the indicators of critical thinking skills that have been determined. In this study, critical thinking skills were measured through six indicators, namely: 1) Able to analyze arguments, 2) Able to ask questions, 3) Able to answer questions, 4) Able to solve problems, 5) Able to make conclusions, 6) Able to evaluate or assess.

Based on observational data in cycle I, it shows that the average percentage of students' critical thinking skills is 63%, this shows that critical thinking skills have started to improve or are sufficient, but not optimal because of the six indicators there is still one that is very lacking. The learning process carried out in cycle II went well and the enthusiastic students were enthusiastic in learning because there were efforts to improve the reflection results of cycle I. The average increase in student learning activeness obtained in cycle II was 79.7%. The average increase in learning activity in cycle I and cycle II increased by 16.7%. In this second cycle, each indicator in students' critical thinking skills has increased in each student, although there are some students who still have not experienced changes after learning in cycle II. The activeness of student learning through the application of the Problem Based Learning model assisted by LKPD has reached the expected criteria, namely good.

5. Conclusion

Based on the results of research and discussion, the conclusions of this study are as follows:

The application of the Problem Based Learning learning model can improve critical thinking skills in learning mathematics for class III SD X. This is evidenced by the ability to think critically which has increased from the average critical thinking ability of class III students in the pre-cycle of 53.4%, cycle I of 63% and cycle II of 79.7%. This shows an increase in the critical thinking skills of class III students with an increase in percentage data in the pre-cycle to cycle I of 9.6% and cycle I to cycle II of 16.7%.

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