

## **EFFECTIVENESS OF THE PROBLEM BASED LEARNING MODEL ON CRITICAL THINKING ABILITY ABOUT SCIENCE SUBJECT FOR FIFTH GRADE ELEMENTARY SCHOOL STUDENTS**

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**Abstract:** *This study aims to determine the effectiveness of the problem based learning model on the science critical thinking skills of fifth grade elementary school students. This type of research is literature study research. The data used in this study were obtained from the DOAJ, Sinta, and Google Scholar websites. The researcher uses 30 articles that have been reduced according to the following criteria: (1) Articles published in the last five years, (2) reputable national or international articles, (3) Research in the form of experiments and classroom action research using Problem Based Learning, (4) The research population is elementary school students, and (5) The content of science, mathematics, or thematic subjects. Based on the results of the article analysis, it can be concluded that the problem based learning model can be applied in science and mathematics learning, the problem based learning model can improve various abilities and learning outcomes, and the problem based learning model is effectively applied in science learning for fifth grade to improve critical thinking skills. This research can be used as a benchmark for using the problem based learning model*

**Keywords :** *Problem-Based Learning, Critical Thinking, Science, Elementary School*

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## INTRODUCTION

Education faces new challenges in the era of globalization. Rapid advances in technology, science, and communication systems demand to produce quality human resources. Human quality can be seen from the ability possessed to compete in the era of globalization. Students in the era of globalization also need an ability that is commonly called 21st century skills. 21st-century abilities emphasize 4C abilities which include: 1) Communication, 2) Collaboration, 3) Critical thinking and problem solving, and 4) Creative and innovative (Putri et al., 2020, p. 605). One of the 4C abilities that students must have in learning the 2013 curriculum is the ability to think critically (Critical thinking).

The 2013 curriculum has a focus on knowledge, attitudes and skills that need to be developed (Chanifah et al., 2019, p. 164). So that the 2013 curriculum learning process uses a scientific approach at all levels of education (Sari, 2019, p. 1397). The scientific approach applies the 5M learning process, namely observing, asking, trying, reasoning, and communicating. The applied scientific approach can make critical thinking skills develop. In line with the statement (Azizah et al., 2018), the purpose of implementing the 2013 curriculum is to develop higher-order thinking skills, one of which is critical thinking skills.

Critical thinking skills are higher-order thinking skills to solve problems (Asriningtyas et al., 2018), think at a complex level for the purpose of scientific knowledge (Hidayat et al., 2019), the ability to support student understanding (Pamungkas et al., 2019), learn to interact with information actively to bring pros and cons, evaluate to determine the truth, change information, and generate new ideas (Florea & Hurjui, 2015), and problem solving skills by thinking seriously, actively, and thoroughly (Liberna, 2015). 2012). The purpose of critical thinking is to have the ability to understand something in

depth, be able to see situations, solve problems, and make decisions (Putri et al., 2020, p. 606).

The ability to think critically is very important to be applied in science education because science includes the processes required by scientific activities and investigations such as; observation, classification, measurement, use of numbers, data collection, formulating hypotheses, controlling variables, experimenting, interpreting, and generalizing (Alsarayreh, 2021, p. 90). Through science learning, critical thinking skills can be developed and are very useful for improving self-quality. Science is closely related to problem-based learning, so students are expected to understand, observe, analyze, and solve problems (Oktaviani & Tari, 2018, p. 11). Science learning does not only aim to gain knowledge, but also needs to develop critical thinking skills (Anindyta & Suwarjo, 2014, p. 210). This is because science is a discovery process that is closely related to nature, so that it does not only master knowledge in the form of facts, concepts, or principles (Wardani, 2020, pp. 108–109). Based on the explanation above, it can be concluded that critical thinking in science learning is the mindset of students that must be developed to solve problems and make decisions. The purpose of learning science is so that students can study themselves, the natural environment, and the social environment and apply them in real life (Yanti, 2017, p. 91). How to develop critical thinking skills in science learning can be done by asking questions, giving criticism, and arguing (Santos, 2017).

Science learning that is applied in elementary schools still finds problems in the process. This statement is supported by research conducted by Walfajri & Harjono (2019), they observed Mangunsari 02 Salatiga Elementary School and obtained information that students' critical thinking skills in science learning were still low. This is in line with the research by

Puspitasari et al (2020) which suggests that students are less able to analyze the surrounding problems in science learning because students' critical thinking skills are still lacking. Ulandari et al (2020) explained that students' critical thinking skills were low because students only answered short quotes from books and memorized the subject matter. Winoto & Prasetyo (2020) argue that the low critical thinking ability of students is also due to the application of learning models that are less innovative and not student-centred. The use of conventional learning models makes students passive and their critical thinking skills are also low (Winoto & Prasetyo, 2020, p. 229).

Several studies have been conducted in an effort to improve critical thinking skills. Among them are The Power of the two model (Putri et al., 2020), the Think Pair and Share model (Rahmadina, 2021), the Discovery Learning model (FW Dari & Ahmad, 2020), and the Contextual Teaching and Learning model (Yasinta et al., 2020). Other research uses the Problem Based Learning model to improve elementary school student learning outcomes (OW Dari & Taufik, 2020; Zuriati & Astimar, 2020; Budi et al., 2021; Irwan & Mansurdin, 2020; Febrita & Harni, 2020). Furthermore, research using the Problem Based Learning learning model can also improve problem solving skills in mathematics, namely research conducted by (Silvi et al., 2020).

This literature study will discuss the improvement of critical thinking in elementary school students that focuses on the Problem Based Learning model. Problem Based Learning is a learning model that uses real problems so that students can cultivate a scientific attitude (Winoto & Prasetyo, 2020, p. 230). Problem Based Learning requires teachers to design learning that is tailored to the student's perspective, namely based on what is known, used, and organized in everyday life so that students can solve problems in real life (Suryanti & Nurhuda,

2021, p. 668). Sufairoh (2016) explains the steps in the Problem Based Learning model include activities; student orientation to problems, organizing learning activities, conducting experiments to obtain data, developing and presenting work, analysis and evaluation of problem solving processes. The advantage of using the Problem Based Learning model is that students can understand the content of learning, develop new knowledge, increase student activity, connect knowledge with problems in the real world, encourage students to think critically, and attract students' interest to continue learning (Lestaringasih, 2017).

The Problem Based Learning learning model is suitable for use in problem-based science learning (Walfajri & Harjono, 2019, p. 17). The Problem Based Learning model can make students play an active and critical role through problem solving (Nurkhasanah et al., 2019, p. 35). The development of critical thinking using the Problem Based Learning model can make students involved in discussions and questions that focus on certain issues, so that students actively build their own information (Alsarayreh, 2021, p. 91). This model has the characteristic that the focus of learning is the presentation of problems (Haryanti, 2017). In line with this statement, Devi & Bayu (2020) revealed that the purpose of learning science in elementary schools is to train critical thinking skills in dealing with a problem.

Based on the exposure of experts, it can be seen that the problem based learning model is suitable to be applied in science learning. Therefore, the researcher will conduct a literature study that aims to determine whether the Problem Based Learning (PBL) learning model is effectively used to improve the critical thinking skills of fifth grade elementary school students on science content.

## **METHOD**

The method used in this study is a literature study. Literature study research is

an activity of collecting library data, reading and taking notes, then processing research data objectively, systematically, analytically, and critically (Putri et al., 2020, p. 606). The data used in the literature study research is secondary data. Secondary data collected and analyzed in the form of research results of journal articles that are relevant to the Problem Based Learning learning model.

The website used to collect journal articles was used as the source of this research, namely; DOAJ, Sinta, and Google Scholar. A systematic search using keywords to make it easier to find journal articles that are relevant to the research. Search journal articles using keywords relevant to Problem Based Learning, critical thinking, science, and elementary school. The article search strategy is shown in the table below:

**Table 1. Article Research Strategy**

No	Keywords
1	"Problem Based Learning" AND "Critical Thinking"
2	"Problem Based Learning" AND "Critical Thinking"
3	"Problem Based Learning" AND "Problem Solving" OR "HOTS"
4	"Problem Based Learning" AND "Critical Thinking"
5	"Problem Based Learning" AND "Critical Thinking" AND "Science" AND "Elementary School"

The keywords problem solving and HOTS (higher order thinking) are used in the research because they are relevant to critical thinking. According to (Cahyono, 2016) the characteristics of critical thinking are being able to solve a problem, while problem solving also aims to find solutions to solve a problem. Both are related to solving problems to get the right solution, this makes critical thinking and problem solving have relevance.

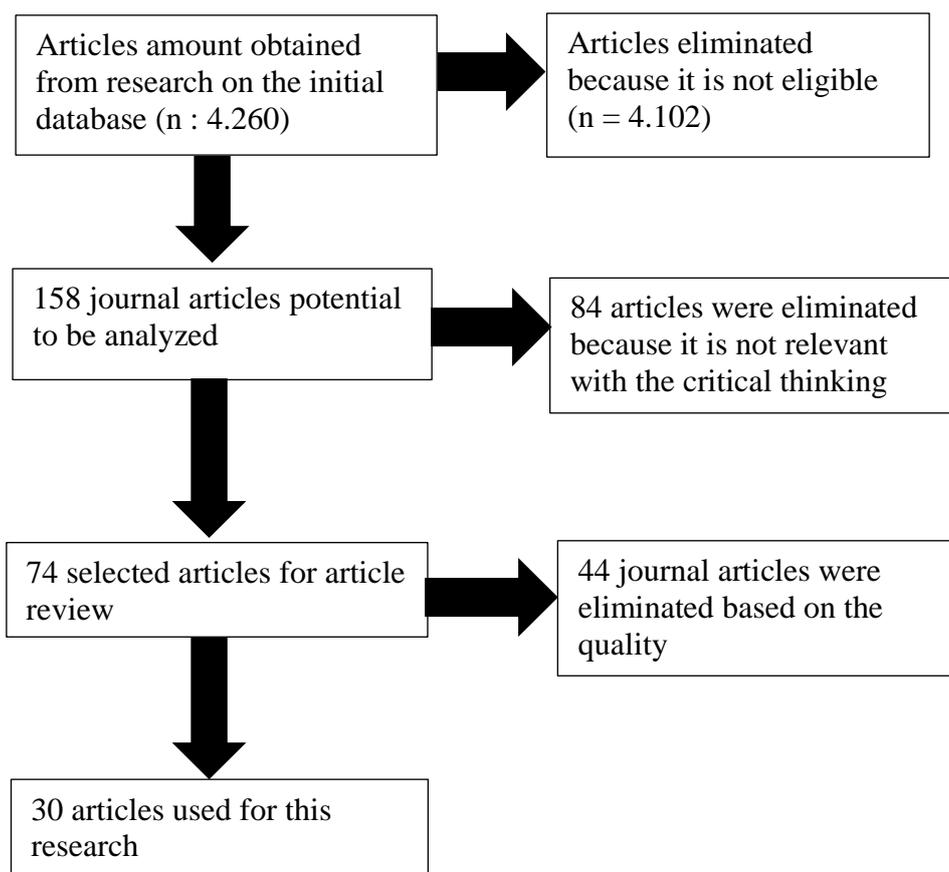
(Dinni, 2018) States that HOTS includes problem solving, argumentation, decision making, creative thinking, and critical thinking skills. The purpose of higher order thinking is related to improving critical thinking skills. So, critical thinking skills and HOTS also have relevance to each other. Improving higher order thinking skills is the same as improving critical thinking skills.

Articles that will be involved in research are articles that come from research that has the following criteria:

- a. Articles published in the last five years
- b. Articles of national or international repute
- c. Research in the form of experiments and classroom action research using Problem Based Learning
- d. The research population is elementary school students
- e. Contents of science, math, or thematic lessons

Silvi et al., (2020) explain the steps in this literature study research, including: data collection, data reduction, data display, discussion, and conclusion. After searching and collecting articles, data reduction was carried out to select the appropriate articles to be used as reviews in this study.

## RESULTS AND DISCUSSION



Picture 1. Articles Reduction Chart

Description of the data from the articles used in this study. Based on the application of Problem Based Learning in the content of lessons in elementary schools, it can be presented as follows:

Table 2. Articles Distribution Based on Subjects

Data Groups	Quantity	Percentage
Science	18	60%
Mathematics	12	40%
Total	30	100%

According to the 30 articles used in this study, 60% of research articles on science content and 40% of research articles on mathematics were obtained.

The following is the distribution of articles based on data groups, namely critical thinking, HOTS, and problem solving.

Table 3. Articles Distribution Based on Data Groups

Data Groups	Quantity	Percentage	
Critical Thinking (AND)	-	11	36,67%
	Problem Solving	1	3,33%
	Concept Mastery	3	10%
	Learning Outcome	9	30%
	Science Literation	1	3,33%
HOTS	2	6,67%	
Problem Solving	3	10%	
Total	30	100%	

According to the Table 3, it is known that most articles come from critical thinking articles as much as 83.33%, followed by problem solving articles 10%, and HOTS as much as 6.67%.

**Table 4. Data Recapitulation of Involved Articles in Research**

Article Review		Journal Articles	
Number of Articles		30 Articles	
Types of Research	Experiment Research	13 Articles	<b>Total : 30 Articles</b>
	Classroom Action Research	17 Articles	
Instrument Type	Essay	19 Articles	<b>Total : 30 Articles</b>
	Multiple Choice	3 Articles	
	Combination	8 Articles	
Result PBL on	Berpikir Kritis	11 Articles	<b>Total : 30 Articles</b>
	Critical Thinking and Learning Outcome	9 Articles	
	Critical Thinking and Problem Solving	1 Article	
	HOTS	2 Articles	
	Problem Solving	3 Articles	
	Critical Thinking and Scientific Literacy	1 Article	
	Critical Thinking and Concept Understanding	3 Articles	

### 1. The Effect of Problem Based Learning on Various Skills on Science Subject in Elementary School

The Problem Based Learning model is an innovative learning model that makes students learn actively (Kurniasari et al., 2020). Meanwhile, according to (Solihah & Mashinta, 2019) the model uses the principle of constructivism. Using the Problem Based Learning model in elementary science learning can make students improve their various skills. Some skills that students can improve in learning using Problem Based Learning, namely critical thinking, problem solving, higher order thinking, understanding concepts, and scientific literacy. This statement is supported by (Aiman et al., 2019) that Problem Based Learning can help students develop intellectual skills, think critically, solve problems, and participate in groups.

The results of research conducted by (Kumullah et al., 2018) state that the Problem Based Learning model makes students think, reason, and construct concepts according to the stages of the model. Students can write down information to solve problems, understand concepts, and think critically through practical activities. (Ejin, 2017) added that the preparation of learning implementation plans (RPP) using Problem Based

Learning, training critical thinking skills and understanding concepts in science learning. According to (Rahman et al., 2020) learning using the Problem Based Learning model makes it easier for students to complete the task. Students can also work together in groups, so that solutions to problems can be solved together with various points of view. This can help students improve skills and mastery of concepts in science learning.

Furthermore, regarding problem solving skills, (Wardani, 2020) explained that the Problem Based Learning model could improve problem solving abilities. Relevant research by (Oktaviani & Tari, 2018) using problem-based learning in discussion activities, finding solutions, and reflection can improve problem solving abilities. (Solihah & Mashinta, 2019) stated that to solve a problem students must combine their prior knowledge and knowledge, because finding a solution requires the ability to identify problems correctly.

The next skill that can be trained by students is higher order thinking (HOTS). Higher order thinking needs to be trained in learning because it is very useful for students in facing the challenges of 21st-century education (Kurniasari et al., 2020, p. 170). Higher order thinking is also closely related to critical thinking skills. According

to (Azizah et al., 2018) one of the higher order thinking skills is critical thinking skills. The results of the study (Kurniasari et al., 2020) used the Problem Based Learning model to train HOTS in problem analysis, collecting data, and solving problems. His research also explained the need for repeated learning to practice HOTS skills. (Puspitasari et al., 2020) also discusses increasing higher order thinking. Carrying out learning with the PBL model starts from the stage of orientation to problems, working on assignments in groups, conducting experiments, solving problems, and finally a question and answer session.

The last skill that can be trained using the Problem Based Learning model in this discussion is scientific literacy. Scientific literacy is the ability to make decisions related to nature using scientific knowledge (Aiman et al., 2019). Scientific literacy also has a positive relationship with critical thinking skills. Problem Based Learning model based on scientific literacy can improve critical thinking skills. This statement is supported by research results (Wijayanti et al., 2020), that the PBL model based on scientific literacy increases the ability to think critically about problems and find solutions. (Aiman et al., 2019) also added, the higher students' critical thinking skills, the better their scientific literacy skills.

The Problem Based Learning model applied in science learning allows students to improve many skills. Using a problem and requiring students to find solutions to practice higher-order thinking skills, critical thinking, problem solving, mastery of concepts, and scientific literacy. Each of these skills is interrelated, students must master concepts from various scientific literacy to build knowledge information, after that high-order thinking skills and critical thinking are needed to connect problems with knowledge information, finally students can find solutions for problem solving.

## **2. The Effect of Problem Based Learning on Critical Thinking Skills on Science Subject in Elementary School**

Natural Sciences or commonly called Natural Sciences are the main subjects in the 2013 curriculum. According to (Aiman et al., 2019) Science has an important role because science can be a provision for students in the global era. Science learning in elementary schools must be able to train students to have a scientific attitude, be competent, active, and think critically in solving problems (Devi & Bayu, 2020). Science emphasizes direct experience and practical activities in learning because it can improve critical thinking skills (Dianawati et al., 2017).

In relation to the application of Problem Based Learning to critical thinking, research by (Ulandari et al., 2020) explains that there is an increase in critical thinking with the Problem Based Learning model. It can be seen from the activeness of students when paying attention to lessons, asking the teacher, answering questions, expressing opinions, collaborating with groups, working on questions, and using resources during learning. This research is in line with (Maqbullah et al., 2018) learning science using the Problem Based Learning model is carried out by finding information related to problems, conducting experiments, analyzing problems, presenting, and providing responses. Based on the activities carried out, it showed a satisfactory improvement in critical thinking skills.

Furthermore, research by (Walfajri & Harjono, 2019) Problem Based Learning improves critical thinking skills and learning outcomes for science content. Students are required to be active and creative to seek information, so that students' critical thinking skills will emerge. (Islam et al., 2018) also said that the Problem Based Learning model can improve critical thinking skills and 4th-grade science learning outcomes. Research by (Dianawati et al., 2017) also uses the Problem Based Learning model to improve critical thinking

skills. The results of his research also add to the success factor of science critical thinking because the PBL model focuses on problems in students' daily lives, uses visual media to understand the material, teacher involvement, and appreciation as student reinforcement in the learning process.

The Problem Based Learning model is indeed effectively applied in improving critical thinking skills. The results of the study (Khomaidah & Koeswanti, 2020) also stated that Problem Based Learning was more effective than Guided Inquiry Learning in terms of students' critical thinking skills. (Vera & Wardani, 2018) added that the use of video in learning can make students see directly the examples described, so that students' critical thinking skills increase. Further relevant research by (Devi & Bayu, 2020) proves that science learning using Problem Based Learning assisted by visual media makes students have better critical thinking skills. When learning activities take place, students become excited, have high curiosity, and try to find solutions to problems given by the teacher. In contrast to the results of research (Kumullah et al., 2018) LKS can help students' critical thinking skills in science learning because there are practical activities. This practical activity makes students make observations and find their own solutions to problems.

Based on the description above, the Problem Based Learning model can improve critical thinking skills in science learning. This model is applied in science practicum activities so that students can find solutions to problems. How to know students' critical thinking skills increase can be seen from their attitude when learning takes place. Students who are active during learning can be a benchmark that students practice their critical thinking skills. The application of this PBL model can also improve science learning outcomes related to critical thinking skills. The use of visual media or worksheets in science learning can also be a tool so that students' critical

thinking skills are more developed, because students can easily understand the material. Another important factor that makes learning run smoothly is the involvement of teachers. Teachers as facilitators and motivators of students so that students become more enthusiastic in learning science.

### **3. The Effect of Problem Based Learning on Critical Thinking Ability on Mathematics in Elementary School**

Mathematics in elementary schools requires students to be able to recognize, understand, and be skilled in developing abstract knowledge and reasoning (Misla & Mawardi, 2020). (Ayudya & Rahayu, 2020) explained that learning mathematics in elementary schools includes natural numbers, integers, simple fractions, geometry, simple measurements, and simple statistics. This mathematics learning can be achieved if students use, train, and develop skills for themselves. This statement is supported by (Hagi et al., 2019), that to achieve basic mathematical abilities requires skills to think logically, analytically, systematically, critically, creatively, and the ability to work together.

(Lisbiyaningrum et al., 2019) in her research using *Problem Based Learning* to improve critical thinking skills, the findings explain the PBL model makes learning activities controlled, students become active, confident, fun, and improve critical thinking skills. Relevant research proposed by (Nurkhasanah et al., 2019) *Problem Based Learning* model can improve and achieve four stages of critical thinking skills, namely clarification, assessment, inference, and strategy.

Furthermore, research by (Afifah et al., 2019; Misla & Mawardi, 2020) shows the *Problem Based Learning* model is more effective in improving critical thinking skills than the *Problem Solving* model in learning mathematics. Meanwhile (Triningsih & Mawardi, 2020) proves the *Problem Based Learning* model is more effective than the *Project Based Learning* model, in terms

of critical thinking skills in mathematics learning.

Models of *Problem Based Learning*, *Problem Solving*, and *Project Based Learning* according to the explanation above have similarities in improving critical thinking skills. But among the three models, *Problem Based Learning* is more effective in developing mathematical critical thinking skills when compared to *Problem Solving* and *Project Based Learning* models. Students recognize mathematics as a subject that has difficult material. With the implementation of the PBL model, mathematics lessons become fun learning. Based on the results of the research above, the success of this PBL model can be seen from students who become active and confident during the learning process.

#### **4. The Effect of Problem Based Learning on Critical Thinking Ability and Learning Outcomes of Mathematics in Elementary School**

Learning outcomes are the success of students' efforts to obtain information, knowledge, and experience (Asriningtyas et al., 2018). Learning outcomes and critical thinking skills are related to each other. This statement is supported by (Pamungkas et al., 2019) in learning mathematics, and increasing critical thinking skills affects the mastery of learning outcomes. The use of the *Problem Based Learning* model can realize the goals of critical thinking and mathematics learning outcomes. (Ayuningsih et al., 2019) added the advantages of PBL in mathematics to improve critical thinking skills and learning outcomes.

The advantages of *Problem Based Learning* in improving critical thinking and learning outcomes are in line with classroom action research by (Pramono & Suhandi, 2020), the results of the study show an increase in critical thinking skills followed by an increase in mathematics learning outcomes using the PBL model. (Hasannah et al., 2021) also explained that *Problem*

*Based Learning* can increase activity, critical thinking, and student learning outcomes. Although *Problem Based Learning* takes a long time to implement, the learning process can be successful because the teacher optimizes learning time. Meanwhile, according to (Ayuningsih et al., 2019) in addition to improving learning outcomes and critical thinking, the *Problem Based Learning* model also makes students actively determine problems, explain hypotheses, search for data, and draw conclusions.

Furthermore, research conducted by (Hagi et al., 2019) applied the syntax of the PBL model to improve critical thinking skills, train analytical skills, high student curiosity, and be able to solve mathematical problems. The improvement of critical thinking also has an impact on the learning outcomes of mathematical fractions material, so that it can be applied in students' daily lives. In line with (Asriningtyas et al., 2018) also assumes that the *Problem Based Learning* model can improve critical thinking skills and learning outcomes, especially in solving math story problems. Further relevant research was put forward by (Chanifah et al., 2019) an increase in critical thinking skills and learning outcomes in data material mathematics using the *Problem Based Learning* model.

Using the *Problem Based Learning* model in learning mathematics in addition to training critical thinking skills can also improve learning outcomes. The relationship between critical thinking and learning outcomes makes both of them have a positive relationship. The more critical thinking skills increase, the learning outcomes will also increase. The application of the PBL model is effective for various materials on mathematical content, such as simple fractions, math story problems, data material, and so on. The role of the teacher as a facilitator is also very necessary in learning this PBL model. The positive impact makes students become active in

solving problems or problems given by the teacher.

## CONCLUSION

Based on the results of the analysis of the articles in this study, it can be concluded that the *Problem Based Learning* (PBL) model is effectively applied in learning in the fifth grade of elementary school. However, it is not only effectively used in class V learning, *problem based learning* can also be used in class III and IV learning. This *Problem Based Learning* model is suitable to be applied to lower classes as well. If the teacher applies this model repeatedly so that students get used to it.

The use of the PBL model can improve students' critical thinking skills in science and mathematics content. During learning using the PBL model students become more active, confident, and have high curiosity in the learning process, so that students can find solutions to problems given by the teacher. This PBL model also makes learning more fun. It can be seen from the attitude of students who are enthusiastic and motivated to learn even though science and mathematics are difficult subjects.

Increased students' critical thinking skills have a positive relationship with learning outcomes. If critical thinking skills increase, student learning outcomes also increase. In addition to improving critical thinking skills, this PBL model can also improve students' various abilities. Other abilities possessed by students such as problem solving, higher order thinking, mastery of concepts, and scientific literacy. The PBL model which has many advantages can be applied by teachers in the learning process. Through this model teachers and students can achieve the desired learning objectives.

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