Problem based learning: a way to improve critical thinking ability of elementary school students on science learning

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Abstract. The background of this research is to find information on learning models that can improve the thinking skills of elementary school students in science learning. The purpose of this study was to determine the effectiveness of the problem-based learning model to enhance the critical thinking skills of elementary school students in science learning. This study was a true experimental design with a type of post-test group. The results showed that the problem-based learning model could improve the critical thinking skills of elementary school students in science learning. This study implies that elementary school teachers can use a problem-based learning model in enhancing students' critical thinking skills in science learning in elementary schools.

1. Introduction
The learning process at school is still dominated by traditional learning methods so that elementary school learning is still one-way (teacher centred) which results in weak student thinking skills [1]. The one-way learning model will cause information that is not useful to students and becomes useless [2]. Teachers often require students to learn but do not explain how to learn well and solve problems in the learning process [3], included in the process of learning science in elementary school.

Science learning is learning that is integrated with other learning in elementary schools. Science learning in elementary schools is learning that contains natural phenomena, identifying and formulating natural phenomena based on observations, and finding solutions to problems [4]. Science learning in elementary schools has the goal that students can have the ability to learn, be responsible and can implement their knowledge in social life [5]. Science learning can also improve the critical thinking skills of elementary school students [6]. This fact is in line with the objective of science learning that science used in making decisions on sociocultural issues in democratic societies so that it requires strong critical abilities [7]. Therefore science learning must be carried out properly.

Critical thinking ability is a high level of skill to solve problems and make decisions [8]. Critical thinking ability is an intellectual ability that can make concepts, apply concepts, analyse ideas, synthesise concepts and evaluate information collected from observation, experience, reflection, reasoning, or communication [9] [10]. Dell’olio states that the ability to think critically is the ability of students to analyse, focus, observe, hypothesis, assume, conclude review, and reflection [11]. Critical thinking is an ability that must be possessed in the 21st century because this ability requires individuals

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to be able to use their thinking skills in everyday life [12]. Therefore this ability must be developed since elementary school age.

Analysis of science learning that is still one-way and the importance of developing the thinking skills of elementary school students requires the effort to improve the quality of science learning to enhance the critical thinking skills of elementary school students. One attempt to overcome this problem is to use a learning model. The suitable learning model used based on these problems is a problem-based learning model.

Problem-based learning is a process that can create existing relationships between students and students, using problems related to students' real lives, ill-structured and open-ended [13]. In PBL students are given the opportunity to solve problems together and make the learning experience the basis for learning [14]. Problem-based learning is learning that focuses on learning from students' direct experience or learning from real problems faced by students [15]. Problem-based learning can improve students' skills, improve student communication, cooperate, increase motivation, and increase the convenience of collaborating in solving problems [16]. Based on the opinion above, the need for proof that states problem-based learning can improve the critical thinking skills of elementary school students in science learning.

2. Method

The study was a True experimental design that uses simple random sampling. This study consists of two variables, namely the independent variable and the dependent variable. The independent variable in this study is the problem-based learning model, and the dependent variable is the thinking ability of the elementary school students. The study design uses the PPost test group. Data collection methods include documentation methods (name and semester grades) and test methods to measure critical thinking skills of elementary school students.

3. Formatting the title, authors and affiliations

Analysis of critical thinking in elementary school students in the experimental class and control class can see in table 1 below:

| Component          | Post Test |
|--------------------|-----------|
| Control            | Experimen |
| Number of Students | 35        |
| Average            | 73,5      |
| % Mastery Learning | 65,71     |
| Complete Learning  | 12        |
|                    | 35        |
|                    | 82,5      |
|                    | 94,28     |
|                    | 2         |

Based on the t-test obtained t count equal to 3.983 with t table equal to 1.690. This result states that $t_{count} > t_{table}$. The point is the existence of differences in critical thinking skills of elementary school students who use problem-based learning between the control class and the experimental class. The results of critical thinking skills of elementary school students experienced a significant increase between classes in traditional learning (the method used by the teacher is the lecture method) with the class learning using problem-based learning.

The increase that occurred in the experimental class was due to changes in the learning model that could train students' critical thinking skills. Thomas stated that the problem-based learning model requires students to be active in the learning process [17]. This fact is supported by the stages of problem-based learning that requires active students in the learning process. Arends states that there are five steps of problem-based learning namely problem orientation, learning organisation, individual and group investigation, development and presentation of the results of problem-solving, analysis and evaluation of problem-solving processes [18]. While in the control class using the conventional method (lecture method). In the lecture method, students only listen to the teacher's explanation so that students become passive [19]. This result in students being only able to remember the information provided by the
teacher. The student active is essential in the learning process [20]. But in learning using the lecture method of student activity is low because the learning process carried out is still a student centre. This result in the critical thinking skills of students not being trained so that students' critical thinking skills are low. Therefore the critical thinking ability of students in the control class is lower than the experimental class. This fact is by the statement that learning that uses problems in the real world students will be able to train the ability of critical thinking skills and knowledge to solve the issues and can obtain necessary information in the learning process [21].

This statement support by research conducted by Sihaloho which states that problem-based learning can train students' thinking skills such as critical thinking skills, problem-solving, and creative thinking skills [22]. Problem-based learning that requires students to be able to find solutions to problems from problems that occur in the real world automatically both individually and in groups [23]. The problem-based learning model is the flow of constructivism that can develop the critical thinking skills of students who can analyse problems in the real world [24]. Also, problem-based learning can train critical thinking skills that are embedded in a long time [25].

The problem-based learning model has the characteristics of problems that used as the basis for learning. The student uses the issue for finding information and solving problems in groups. In this process, students collaborate with other students in solving problems. Problem Based Learning allows students to exchange information and solve problems so that students' critical thinking skills automatically increase. This case is contrary to the conventional method (lecture method), students do not give a problem, students are only asked to listen to what is conveyed by the teacher so that students record what is sent by the teacher. This result in the critical thinking skills of untrained/low students.

Every elementary school student can think critically. This ability better train from elementary school age through a learning process such as the science learning process. This study proves that the science learning process that uses a problem-based learning model can improve the critical thinking skills of elementary school students.

4. Conclusion
The results of the calculation of the t-test show that t is equal to 3.983 with t table of 1.690 with this result stating that \( t_{\text{count}} > t_{\text{table}} \). This study shows that the problem-based learning model can improve the critical thinking skills of elementary school students. This model can be an effort to enhance the thinking skills of elementary school students in science learning.

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