Improvement of Elementary School Critical Thinking Skills Through the POE Learning Model (Predict-Observe-Explain) on Natural Resource Material

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Abstract. This study aims to determine the improvement of critical thinking skills before and after applying the POE learning model (predict-observe-explain). This type of research is a Pre-Experiment type design of One Pretest-Posttest Design Group, which is an experiment conducted on one group only, without any comparison. This research was conducted in SDN 188 Pekanbaru in class IVA, which totaled 38 students. Based on the results of the study, it was found that the average score of the learning outcomes before the treatment (pretest) was 57.89 while the average score of the learning outcomes after the treatment (posttest) was 80.63 and the gain index value was 0.55 which was the medium category. This shows that the POE learning model can improve the critical thinking skills of elementary students in natural resource material.

Keywords: POE learning model, Natural resource material

1. Introduction
Science has distinctive characteristics from other knowledge. Most knowledge about nature is obtained empirically, namely direct observation of events in nature. Therefore, science learning is not only limited to the delivery of material but also requires learning activities that involve students directly through experimental or observational activities that utilize the surrounding environment that sharpens students' critical thinking skills [1]. One reason for the importance of critical thinking in the dimension of science education is that it promotes science as an inquiry. In connection with this goal many points focus on critical thinking, such as “identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations”, “analysis of firsthand events and phenomena as well as the critical analysis of secondary sources; testing reliability of knowledge they have generated”, and “the critical abilities of analyzing an argument by reviewing current scientific understanding, weighing the evidence, and examining the logic so as to decide which explanation and models are best”. The National Science Foundation educating Americans for the 21st century also makes references related to the development of critical thinking skills in learning science [2]. The government also emphasized that it is important for every education sector to prepare students who are able to think critically [3].
Recognizing the importance of learning science for students, it is necessary to involve students and teachers in efforts to achieve a good learning process, this will be seen from students' critical thinking skills. Critical thinking skills are thoughts that include curiosity, analytical skills and the ability to evaluate problems. It is very important to make children who keep abreast of change, have critical and creative thinking, find solutions to any problems that arise and guarantee humanity [4]. Critical thinking can be seen in the way a person considers and participates in the world through judgment based on evidence and argumentation to decide on decision making [5]. The development of critical thinking skills is generally referred to as the main goal of science learning. Critical thinking can be a way to develop science that is already in the minds of students. Through critical thinking can improve student thinking related to natural knowledge [6].

One of the basic material found in science lessons in four grade elementary school is Natural Resources. Natural resource material discusses and learns about what natural resources are around the student environment, the types of natural resources, the technology of utilizing natural resources and various other things. Through subject matter related to daily life, students will be able to apply this knowledge directly. The learning process with learning material is able to develop 21st-century skills such as critical thinking, creativity, communication, problem-solving and collaboration skills (Handayani, Sopandi, Syaodih, Suhandi, Maftuh, Hermita, Somantri and Samsudin, 2019). Critical learning emphasizes the activities of analyzing, interpreting, and evaluating things or problems rationally and logically. Intrinsic motivation of students is needed in the implementation of this learning activity [7]. Student motivation to participate in the learning process can be improved through prediction activities. In addition, the key to exploring students' understanding and reasoning in POE strategies is to reconcile the conflict between prediction and observation [8].

This agrees with what was stated [9] that critical thinking ability is an important ability for students to have so students can solve problems faced in a world that is constantly changing. Understanding and knowledge at the cognitive level according to Bloom's taxonomy is included in critical thinking skills [10]. Critical thinking skills are one of the skills that need to be prepared for children. Critical thinking exercises should ideally be introduced to children from an early age. At the age of 6-12, it is time to teach critical thinking that very important and is most useful. Teaching critical thinking to students at that age really helps them in understanding and applying the subject matter [6]. Bloom's taxonomy is the basis for understanding critical thinking skills (Sosniak & Anderson, 1994), in terms of critical thinking dimensions, such as analyzing, evaluating and assessing [11]. In fact, students' critical thinking skills have not yet been fully developed in elementary schools. The development of critical thinking skills has not yet been seen in the design, implementation, and assessment of learning in primary schools. The implementation of learning in schools is still teacher-centered so that student activities are still not optimal [12].

The learning process that lacks motivation for students will affect student learning outcomes. Based on the observations, it was found that the learning outcomes of science were still low in four grades. The low learning outcomes of science in four classes are caused by several things such as (1) teachers who are still using conventional teaching methods (2) the learning process still tends to memorize theory and students experience less what they are learning, (3) general science learning. There are concepts that require observation, students have not been given the freedom to make direct observations, (4) during ongoing learning students are less active in answering questions about the material being studied, seen when the teacher questions students more silently, and (5) students still many imitated answers [13].

In an effort to facilitate students so that critical thinking skills develop, namely must depart from learning that makes students active, Such as focusing on conclusions or questions, considering each condition, finding and giving reasons, providing information well, looking for other options, and withholding judgment when the evidence and reasons are not sufficient. Critical thinking skills include things like the ability to analyze arguments, assess the source's credibility, identify the focus of the problem, and answer and ask questions of clarification and/or challenges [14]. This was stated by
Ibrahim to bring to the direction of learning that can develop critical thinking skills must depart from learning that makes students active [15].

Teachers should be able to create interesting learning by choosing learning models that can involve student activity and teach students to learn independently in terms of solving problems of a problem and provide flexibility to make direct observations so that the material can be remembered longer and sharpen students' critical thinking so that learning outcomes students can increase. One of the efforts to improve students’ conceptual understanding of science is viewed from the aspect of the process, so a learning model is needed towards a better direction, namely learning that includes a process of positive interaction between teachers and students. The teacher should choose a learning model that is in accordance with the subject matter and characteristics of students in order to be able to make students actively participate in learning [16].

Joyce Suggesting the purpose of the learning model can be used as a guide in planning the implementation of learning in the classroom, but also as a guide in determining the source of learning and others [17]. The learning model is a pattern that has been carefully planned and is a guideline for the implementation of learning starting from the opening, core and closing activities and assessment of learning arranged in such a way as to achieve the learning objectives (both main objectives and companion goals / nurturing effects) [13].

One of the learning models applied so that students can be actively involved and gain direct learning experience in science learning activities is the POE model. The POE model (predicting-observing-explaining) is one of the learning models that is used to help students develop their knowledge through the senses. Learning activities are making predictions, making observations and making explanations [18]. Measuring student understanding using POE procedures through 3 stages [19]. The first stage is Predict (P), at this stage students need to predict the consequences and need to explain these predictions. The second stage is observed (O), at this stage students mark what they have noticed. The third stage is Explain (E), at this stage students need to reconfirm the discrepancy between predictions and observations [20].

The stages in the POE learning model can stimulate the activity of students [21]. This is reinforced by research conducted [7] that Critical thinking skills can be improved through the application of the POE learning model (Predict-Observe-Explain). POE learning model to determine students' understanding of science and identify student achievement levels based on student learning outcomes [22].

According to Ennis, Critical Thinking Skill is the ability to consider, think reflectively, and focus on decision making. Critical thinking is a metacognitive process that requires each individual to be able to describe the thought process [23]. Critical thinking skills are in line with scientific investigation methods, namely identifying questions, formulating hypotheses, collecting relevant data, testing hypotheses and evaluating them logically, and drawing conclusions. Therefore, skills in scientific investigation methods are compatible with critical thinking skills [24].

Thus students will be able to think critically in learning if the teacher is able to develop a learning process that requires active student involvement in it so that students' thinking skills will develop with problems and challenges they face. Critical thinking simply states the ability to analyze and evaluate information.

The POE Predict-Observe-Explain model) can improve students' critical thinking skills. This is because the stages of POE learning guide students to find and explore findings on observational activities (Observe) and also the initial knowledge that students already have (based on the results of predictions) into one new knowledge [7].

Based on the problems described above, this study aims to determine: differences in the improvement of students' critical thinking by applying the POE learning model (Predict-Observe-Explain) in fourth-grade students of SDN 188 Pekanbaru.
2. Methodology

2.1. Research Methods
The method used in this study is a pre-experimental method with one group pre-test post-test design. According to Sugiono that the pre-experimental research results are dependent variables not solely influenced by independent variables. This can happen because there is no control variable and the sample is not randomly selected [25]. In this design, before the treatment must be given pre-test (initial test) and at the end of the learning given post-test (final test). This design is used in accordance with the objectives to be achieved, namely to know the improvement of students' science learning outcomes after the implementation of the POE learning model (Predict-Observe-Explain).

2.2. Data analysis technique
The research instrument in this study was a test of critical thinking skills from objective multiple choice questions. The increase students' critical thinking skills is calculated using the average gain value (g). The difference in the increase in pretest and posttest was calculated using the t-test, then the normality test was calculated by Kolmogorov-Smirnov [26].

3. Results and Discussion
Based on multiple choice objective test questions, the results of the pretest and posttest of students' critical thinking skills can be seen in the following figure 1:

![Figure 1. The result of students’ critical thinking skills](image)

The average critical thinking pretest score was 44.21 while the average posttest critical thinking score was 74.21. The average normality of the gain value of students' critical thinking skills in the experimental class is 53%, the medium category. The results of the statistical test of students' critical thinking skills in the experimental class can be seen in table 1 below:
Table 1. Category of Critical Thinking Skills

| Test  | Score | Normalitas (α=0,05) | t-test (α=0,05) | Decision |
|-------|-------|----------------------|-----------------|----------|
|       |       | α<sub>max</sub> | D<sub>table</sub> | Category | T<sub>count</sub> | t<sub>table</sub> |
| Pretest | 44.21 | 0.1765   | 0.2206 | Normal | 4.059 | 2.028 | Significant |
| Posttest | 74.21 | 0.2148   | 0.2206 | Normal |       |        |

Based on the table above it can be seen that there are significant differences in critical thinking skills between pretest and posttest. The difference in the increase in the critical thinking skills of students in natural science subjects with significant is due to the different treatments given at the beginning of the test and the end of the test. In the initial test in the form of a pretest, treatment has not been given which results in low student learning outcomes. After that, the treatment was given by using the POE learning model (predict-observe-explain) and then tested again with the final test in the form of a post that shows the level of student learning increases. With the application of the POE learning model (predict-observe-explain), it can further encourage students to think critically and be more active in conducting experiments to find their own answers with direct observations made by students.

Based on observations made by the observer during the learning process teacher activities and student activities showed significant growth in a better direction. The percentage increase in teacher and student activities can be seen in diagram 2 below:

It can be seen in the diagram above that the activities of teachers and students experience a significant increase. Student activities at the first meeting (75%, sufficient category), second meeting (83.3%, good category), and third meeting (89.6%, very good category) getting better at each meeting.
While the teaching activities at the first meeting (77.08%, good), the second meeting (85.42%, good), and the third meeting (91.7%, very good category) also showed the progress that improved at each meeting. The application of the POE learning model (predict-observe-explain) provides an increase in students’ critical thinking skills.

4. Conclusion
Based on the results and discussion that has been done, the conclusions are as follows: (1) the critical thinking ability of elementary school students in natural resources material increases after learning applies the POE learning model (predict-observe-explain), (2) the POE learning model (predict-observe-explain) can be one of the mainstay learning models for improving students’ critical thinking skills.

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