Effect of problem based learning on critical thinking ability on science

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Abstract: This study aims to determine the tendency of critical thinking on the content of science class V students of elementary school of Rejowinangun, Yogyakarta, which is taught by the model of learning problem-based learning and direct instruction learning model, knowing the difference of critical thinking ability. This research includes the kind of quasi-experimental research. The sample of this research is V student of elementary school of Rejowinangun, Yogyakarta number 52 students. Data collection techniques use documentation techniques and test techniques. The technique of data analysis using descriptive analysis and t-test which preceded by test requirement analysis covering test of distribution normality and homogeneity test of variance. The result there is a very significant ability to think critically between the taught with the model of learning problem-based learning and direct instruction learning model. The average score of critical thinking ability taught with problem-based learning is higher than that taught by direct instruction; it means there is the influence of learning problem-based learning model on the ability of critical thinking on science.

1. Introduction

The Government Regulation No. 19 of 2005 on national education standards states that basic education aims to lay the foundation of intelligence knowledge, personality, noble character and skills to live independently and follow the next education. To achieve these goals, teachers are required to optimize learning so that students have a balance between cognitive, affective and psychomotor aspects [1, 2]. One of the cognitive aspects that can be seen is the ability of students to think that can be measured by students’ critical thinking skills.

Around us, there are many objects, events, games, social behavior of the society that can be used as a context of learning mathematics. However, sometimes people do not realize that the activities they do use mathematical concepts. We can observe the builders during ceramic installation. Before installing, it is necessary to ascertain whether any corner in the room to be installed ceramic is right-angled. The builder measures 6 cm on the side, and 8 cm on the other. Then he stretched the rope, if the length of the rope 10 cm, then the elbow. In this situation, the builder uses the concept of Pythagoras, and perhaps he does not realize it.

Critical thinking is an activity through thinking about an idea or idea related to a given concept or a given problem [3]. Critical thinking is the ability to say things with confidence, my idea is good because based on logical reasoning, or your idea is good because it is supported by strong evidence. So critical thinking is an activity through the way of thinking about ideas or ideas related to the concept or problem that is exposed and able to say something with confidence because based on logical reasons.
The characteristic of critical thinking is through an active process, having strong and cautious beliefs, using rational reasons and implications and solving problems in a wise and considerate way [4]. The characteristics of critical thinking include expressing the obvious problem by asking questions and making judgments, having strong and cautious beliefs, using logical reasoning and proof, making conclusions by solving problems wisely.

Elementary schooling should develop critical thinking skills so that students can meet the challenges of the 21st century where information flow is very fast and dynamic [5]. Development of students' critical thinking skills in elementary school is adjusted to the cognitive aspect. As generally stated that elementary students are in a phase of concrete operational development so that in learning students the elementary school has not been able to think formally or abstract [6, 7]. Therefore, the critical thinking skills of elementary school students are measured based on five indicators of critical thinking skills that provide simple explanations, build basic skills, summarize, provide further explanations, and organize strategies and tactics [8].

When students are accustomed to using critical thinking to deal with real problems in everyday life then students will get used to forming their own mindset. If directed to the realm of learning in the classroom, then students' critical thinking skills will be very useful. One way that can be used to support this is to use a problem-based learning model. This learning model contains a learning approach to the authentic problem so that students can develop their own knowledge and develop higher skills.

The selection of the type of problem given is expected to stimulate the students to ask questions from the various perspectives in the society's life, students are required to have good skills and attitudes, have a lot of knowledge, can interact with all, understand new things and develop the ability to think well such as ability in analyzing, evaluating, and creating something so as to distinguish between positive and negative. The development of critical thinking ability is taught in the content of science in integrated thematic learning. The content of science materials in classroom learning can be said to be very important because the applications of the Science content learned are very close to everyday life. Based on observations made at Elementary School Rejowinangun of Yogyakarta it is found that most of the students' ability in analyzing, evaluating, and creating is not taught intensively, only to the knowledge, understanding, and application. The teacher has given problem-solving problem, but student response is still low. Therefore it is necessary to apply a problem-based learning model so that students' critical thinking ability will be better.

Problem Based Learning is a learning model that trains and develops the ability to resolve problems that are oriented to the authentic problems of the student's actual life to stimulate high-order thinking skills [9]. Meanwhile, according to [10], states that Problem Based Learning is a model of learning that involves students with real problems in accordance with student attention. Thus, what is meant by problem-Based Learning is a learning model that trains and develops the ability to solve problems involving students with real problems to stimulate high-order thinking.

The problem-based learning model has steps [11] orientates students to problems, explores early knowledge, organizes students to learn, creates individual or group investigations, produces and presents work, analyzes and evaluates problem-solving processes, and assessment and reflection of learning.

The low critical thinking ability of grade V students of Elementary School of Rejowinangun in Yogyakarta can be observed from the students' ability during the middle test of Semester. Categories of problems that can improve the ability to think critically is a matter of High Order Thinking Skills. Based on the value obtained by students in problem-solving, it is found that the average value of students is still below the minimal mastery criteria, therefore it is necessary to model the right learning to maximize the development of students' thinking level. The appropriate learning model is model problem-based learning.

Based on the description, the purpose of this research is to know the difference of critical thinking on the content of science grade V students in primary school of Rejowinangun I Yogyakarta which is taught by the model of learning problem-based learning and direct instruction learning model.
2. Method
This research was conducted at primary school of Rejowinangun I Yogyakarta for 4 months. This research includes the kind of quasi-experimental research. Quasi-experiments have a control group, but cannot fully function to control or manipulate the outside variables that affect the implementation of the experiment [12].

The research population is 52 students of grade V in primary school of Rejowinangun I Yogyakarta. All members of the population became the sample of the study. The research variables consist of the independent variable that is learning model and dependent variable that is critical thinking ability. The research data was collected by documentation technique to collect data on students' early ability and test techniques to collect critical thinking ability data.

Research instrument in the form of critical thinking ability test on science content with Basic Competence analyzes the relationship between ecosystem component and food webs in the environment. The critical thinking skills test consists of 10 items in the form of a description. Of the ten items are 9 valid items and 1 item fall is a matter of number 10. The reliability coefficient is 0.804 and the instrument is very reliable.

The research design used in this research is Matching Pretest-Posttest Control Group Design [13] as in table 1.

| Group      | Pretest | Treatment | Posttest |
|------------|---------|-----------|----------|
| Eksperiment | $O_1$   | $X$       | $O_2$    |
| Control    | $O_1$   | -         | $O_2$    |

Note:
- $O_1$: The initial ability
- $O_2$: Critical thinking skills
- $X$: Problem-based learning
- -: Direct instruction

3. Result And Discussion
3.1 result
The Result of calculation of normality test by using SPSS aid obtained that $p = 0.102$ for a group of Problem Based Learning and $p = 0.243$ for DI learning. Because obtained $p > 0.05$ hence can be concluded that data is a normal distribution. Whereas the result of the homogeneity test of the variance of between Problem Based Learning and DI using SPSS aid obtained that $p = 0.497$. Since $p > 0.05$ can be concluded that the data has the same variance.

Hypothesis test results using t-test obtained that $p = 0.000$ with t count of 3.993. Based on these results it can be concluded that there is a difference in the ability of critical thinking among students who use problem based learning or direct instruction. By looking at the mean of problem based learning and direct instruction groups it is found that problem based learning is bigger than direct instruction because the mean of problem based learning is 22.731 whereas direct instruction is equal to 19.500.

3.2 Discussion
From the result of the research, it is found that the tendency of critical thinking ability on the content of science, which is taught by the problem-based learning model, is very high; it shows that the problem-based learning model gives the students the opportunity to develop critical thinking ability. This learning model can create meaningful learning. Learning takes place more directed at developing the ability of critical thinking. This lesson focuses on problem-solving and students tend to be more active. Solely
students, not teacher-troubleshooting results, can find troubleshooting. Problem-based learning model can also create a conducive and meaningful learning.

In students who are taught by direct instruction model, the tendency of critical thinking on science is high. The direct instructional learning model is a learning model where teachers dominate more in the learning process so that students tend to be passive. Direct instruction learning activities look monotonous because the teacher only explains the material and rarely gives the students the opportunity to solve problems independently, this will result in students' critical thinking ability cannot be developed properly.

In comparative research results obtained that there is a very significant difference in the ability of critical thinking on the content of science grade V students of Elementary School Rejowinangun I Yogyakarta between the students who taught with the problem-based learning model and direct instruction-learning model.

By looking at the average score of critical thinking ability on the content of science that is taught with a model of learning-based learning is higher than that taught using direct instruction learning model, thus it can be said that the problem-based learning model influences the ability to think critically on the content of Science.

Students who are experimented with their problem-based learning model are more active to train and develop the ability to resolve the problems given by the teacher. Thus, students are expected to develop critical thinking ability on the content of Science to solve the problem. Through this learning can encourage students to have the initiative to learn independently and not depends on the way of solving problems provided by teachers.

Students who are taught using direct instructional instruction models tend to be passive because learning is more teacher-centered. The learning process using this model looks monotonous because the teacher only explains the material, while the students only listen and record the material. Problem-solving in everyday life is only done from the knowledge of the teacher, the student is not given the opportunity to solve the problem with his own opinion. This causes students' critical thinking skills to be low because students are not taught intensively to solve problems.

Based on the description can be concluded that the use of learning model problem-based learning to give effect to the ability of critical thinking on the load Science. In the learning process, the problem-based learning model is better than using direct instruction model, therefore the problem-based learning model needs to be applied in the learning process so that students' critical thinking ability can develop optimally.

4. Conclusion
The results of the research concluded that there is Problem Based Learning is bigger than direct instruction, because the obtained calculation results p = 0.000, average problem based learning 22.731 and average direct instruction 19.500.

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