The Elementary Students' Critical Thingking Ability Through Brainstorming Technique of Problem-Based Learning

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Abstract. The student-centered learning approach is in line with the development of information technology. In this case students must be provided by various things for establishing critical thinking skills. Those critical thinking abilities were built with the use of Problem-Based Learning (PBL) with Brainstorming techniques. The purpose of this study was to develop the students' critical thinking skills in Natural Science learning through PBL models with Brainstorming techniques. This study used a qualitative method with a grounded theory approach. The validity of the data included: credibility; transferability; dependability, and confirmability. The data analysis techniques used was the Miles and Huberman Model which included: data collection, data reduction, data display, and verification. The respondents were fifth grade students at SDN 01 Mandiraja Pemalang. The data collections techniques used were observation, questionnaires, interviews, and documentation. The results showed that Brainstorming techniques of PBL learning model made the students had critical thinking skills.

Keywords: Critical Thinking, Problem Based Learning, Brainstorming

1. Introduction

Looking at the complexity of 21st century competencies that must be owned by the students, there was a learning paradigm that changed from teaching to learning paradigm. The vision of 21st century learning includes the learning activities to think rationally and logically, to solve the problems, learn independently and live in mutual cooperation in groups. The teacher plays a role in presenting a problem, asking questions and facilitating an investigation. The students are faced by problems that encourage them to think critically in solving these problems. Critical thinking skills that are directed through elementary school learning are included in the high-level thinking category (HOTS). [1] The thinking skills lessons must be a part of the curriculum for students to solve problems individually, cooperatively and creatively. Teachers on the other hand must be fluent in the techniques needed to teach higher thinking.

The Science or Natural Science at the elementary school level plays an important role in education. [2] Natural Science learning can contextually construct the character of students, including the ability to express opinions, discipline, curious, and care for the environment. One aspect of thinking skills that is emphasized in science learning in order to face technological change and society today is the ability to think critically and solve problems. [3] Science

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learning on 21st century leaning in Indonesia uses problem-based learning integrated with critical, communicative, collaborative, and creative thinking growth (4C skills).

A research conducted by Pertiwi [4] found that students were still lack of understanding in several indicators of critical thinking, one of which was to provide reasons or opinions. Even though, Susilo stated that [5] the students activities in problem solving activities were group discussions and integrating students' opinions through the submission of ideas that were in line with or contrast to their idea. Students' critical thinking skills are not easily awakened when the teacher in learning does not use certain learning methods or techniques. [6] Problem solving is one of the main goals in science teaching, but there are still many students who find it difficult. The effectiveness of learning based on problems can be applied with certain technique, which is the brainstorming technique. This technique is the activity to gather or brainstorm ideas on an issue that is the topic of learning material. [7] The application of the Brainstorming method can influence problem solving.

The purpose of this study was to build the students' critical thinking skills in Natural Science learning through PBL learning model with Brainstorming technique. The general objectives were to build a knowledge base, develop problem solving skills, teach effective collaboration and provide the skills needed to be successful lifelong learners [8]. Through this research, it was expected that it could be able to help learning activities improvement in schools and make students able to develop critical thinking skills in the problem solving learning related to students' daily life.

2. Method

This study used a qualitative method. The respondents were the fifth grade students at SDN 01 Mandiraja Pemalang. The validity the data included: credibility; transferability; dependability, and confirmability. The data analysis techniques used were the Miles and Huberman Model which included: data collection, data reduction, data display, and verification.

In summary, the research activities concerned the following steps, 1) collecting the students and teachers' data through the analysis activities of students' critical thinking skills using Brainstorming techniques of PBL models in the class, 2) sorting out the important data components according to those that has been determined by the researchers, 3) verifying the data by the indicator of critical thinking ability determined by the researcher. The data collections techniques used were observation, questionnaire, interview, and documentation techniques. The data analysis used was descriptive qualitative.

3. Results and Discussion

The results of this study contained a description of the data on critical thinking skills, as well as the teachers' efforts in constructing students' critical thinking skills through the Brainstorming techniques of PBL model. This study used the learning design shown in table 1

Tabel 1 The Learning Design of Brainstorming technique in PBL model

PBL Syntax	*Brainstorming* Phases
Stage 1 Problems Orientations	1. The teacher explains the rules of brainstorming and determines the topic that will be studied
Stage 2 : Organizing the Students to Learn	2. The teacher choose one of the students who will be created as a note-taker to write down the ideas conveyed
Stage 3 : Guiding the individual or group investigations	3. The teacher encourage the students to bring up the ideas or opinion without any critique
Stage 4 : Developing and presenting the work results	4. The teacher gives breaks and asks the note-taker to present the ideas that have been made
Stage 5 : Analyzing and evaluating the problem solving process	5. The teacher guides the class to analyze and evaluate the collected ideas by choosing the relevant ideas and expend the irrelevant ones.

According to the Table 3.1, all learning activities used the PBL model along with the implementation of the Brainstorming technique. Students conveyed all ideas to the problems presented by the teacher in learning process. [9] The problem based learning (PBL) model was used to teach the students to think critically which contained the new idea and opinions. The main advantage of this model lied on the phase of directing the students to the actual issue which could enhance the critical thinking skills so that the learning process was more fun. The students problem solving's model could be trained in terms of generating new ideas or opinions that make critical thinking power and increase students' courage in giving opinion so that the learning process was more satisfying.

Based on the results of learning observations in the fifth grade students in Elementary School, it was found that the Brainstorming techniques of Problem-Based Learning model implemented in the learning process were very good. The overall score was 4.5 with a score range of $4.2 < x \leq 5.0$ in the Very Good category. The implementation of learning was in accordance with the Syllabus and Lesson Plan (RPP) in the circulatory system material which was contained in the themes of 4, sub-themes of 1, first semester of fifth grade, and taken in 1, 3 and 5 learning in which there were Science subjects at each meeting. Learning material provided by the teacher was carried out by the presentation of a problem in order to stimulate, to strengthen the mastery of the material and improving students' thinking skills. By the issue offered by the teacher about the occurrence of diseases in human blood circulation, the students offered the idea or the opinion which were useful as a way of problem solving. Those ideas were collected by the student who was asked to be a note taker in his group. Through the presentation of a problem, students were enthusiastic in learning and working together to solve problems. Students' thinking ability could increase because of thinking activities that required the students finding alternative solutions to problems. [10] Critical thinking tended to be an effort to give an assessment of something that was characterized by the ability to find reasons and alternatives in problems solving based on real situations and later could change someone's views based on evidence. In solving the problems, the teacher helped students to find references and knowledge as many as they were related to the issues that were being problems in learning. The students brainstorm the ideas based on preceding knowledge. [11] Brainstorming was one of the ways to approach the students-centered learning, because it was the open sharing activity, which was usually used in a small group to motivate the students' participation.

The teacher would introduce the students how to act according to the steps or scientific process in solving problems through direct practice, guide individual and group investigations,

develop and present the work, and evaluate the problem solving processes. Learning practice directly in the field plays an important role in linking with the daily lives of the students so that they can understand the lesson directly. Skills that can be obtained from practical activities include skills in observation, measurement, classification, data recording, and conducting scientific experiments [12]. The students carried out the pulse measurement activities on each wrist, to determine the normal heart condition and human blood pressure. So that students could conclude whether or not there were the humans' components and circulatory system disorders. Students who have understood the scientific steps indirectly influence the way of thinking in facing a problem so that they are able to complete the task accurately and precisely.

Based on interviews done to fifth grade students, it shows that they were motivated and confident in expressing opinions and felt more free and relaxed in expressing her ideas during group discussions. The material for the topic of discussion was the circulation of human blood and the disease it causes. It became easier to understand by the students. Based on the experiments carried out by the teacher, students could examine the discussion and were able to provide arguments towards logical problems. The way of thinking of the students developed and brought out the ability to ask and answer questions as well as concludes from the results of the investigation. [13] During the PBL stages, monitoring and skills assessment must be intensified and follow the existing assessment scheme.

Based on the results of the analysis of students' critical thinking skills, indicators of critical thinking skills were respectively found, starting from the most visible ones. The followings are descriptions of the research results based on indicators of critical thinking skills according to Ennis [14]:

1. *Defining an action*

Through the PBL learning with Brainstorming techniques, students' ability to solve problems was getting better. Students could answer the problems through giving ideas along with reasons. The results of observations and interviews showed that the students looked very active and had high participation in problem solving learning. The results of the interview indicated that, students were able to plan and select criteria for the possible answers that might be a solution to the problem. Students' understanding of the concept of blood circulation tends to increase, because in the learning process, the students brainstorm all ideas and opinions based on the learning process carried out by the PBL model.

2. *Focusing on questions*

Many students offered the questions from the problems presented by the teacher, starting from asking why there were diseases in the human circulatory system. Students were required to respond by identifying and giving questions through opportunities given by the teacher to students to ask questions about the problem. Students were able to formulate basic questions and answer the questions well. The students asking ability which was because of the material given by the teacher began with giving a problem, not on material that was memorized.

3. *Analyzing arguments*

Based on the facts of the problem given by the teacher, there were ideas or opinions that had certain arguments. Based on the argument, students could analyze them and provide the answers by including reasons according to the knowledge they have. Opinions were given by students during small group discussions. Students presented the results of their discussions to other friends. Other students responded and the teacher asked one of them to gather students' ideas or opinions without any exception. It was to prove whether the student's assumptions are correct and could be accountable for.

4. *Providing further explanations*

The students' ability in analyzing the results of the investigation was they could describe the answers to questions that were previously made. The activity was carried out while doing experiment about the problems of human circulatory system. Students could provide a simple explanation by the ideas that they conveyed in the discussions to solve problems in learning. The results of students' interviews indicated that they could provide further explanation because they experienced themselves the process of investigation carried out with the group.

5. *Considering the suitability of the source*

Through scientific activities, students not only got a lot of resources but they were able to identify the credibility of the sources obtained whether they were relevant and trusted or not. Students always asked librarians and class teachers about sources such as the books they had. Students could distinguish which sources were trusted and which were not appropriate. The aspects of thought developed along with so much information growth, so students would be more accurate and difficult to use certain sources without a clear basis.

6. *Considering observation reports*

Based on the process of understanding the problem, the students were able to evaluate between the concepts they had about the circulatory system with the observation reports whether it was appropriate or not. The evaluation carried out by the students, which was in the observations results report about the cause of heart disease, stroke, and hypertensions. The students' critical thinking ability had been already awakened and improved so that the students could respond the problems faced according to what they have learned.

7. *Drawing conclusions from the results of investigation*

Students' ability to draw conclusions had developed a lot starting from identifying problems, asking questions about the sources, and taking conclusions confidently. The learning process through PBL with brainstorming techniques had helped students to think how to respond to everything very carefully.

8. *Determining the outcome of consideration based on consequences*

Students were able to design and explain the results of consideration based on consequences. Through problems about diseases which caused the human circulatory system disorders, students were able to explain between the concepts they had with problem solving solutions so that humans can live healthy.

9. *Identifying assumptions;*

Students were able to categorize assumptions from the results of personal and other arguments. This ability was possessed by students to be able to provide comparisons of various assumptions through brainstorming activities between their friends in a group.

10. *Defining terms.*

Students were able to give arguments about a concept found. Those concepts were that the human circulatory system has to be kept healthy. Without any expends, the students gave their opinions based on the knowledge obtained by the observations results and many relevant sources.

The ability of teachers to manage learning based on models, strategies, methods and techniques must be interactive, challenging, interesting, motivating, and fun that can encourage students' interests and abilities so that the attitude, skills and knowledge aspects of students can be mastered independently, critically and sustainably. The use of the PBL model of brainstorming techniques also has disadvantages. [15] PBL has problems including limited time and requires an adaptation process for implementing PBL in the classroom. The researchers used brainstorming technique to minimize time limitations and adaptation to students. Learning

is not only memorizing knowledge, but also applying recall or retrieval knowledge in solving real world problems [16].

The learning process which used brainstorming technique to the fifth grade students was a new step in handling the students' critical thinking skills problems. The implementation of PBL model were not sufficient to improve them, it was needed a technique which was able to dig the students' knowledge and skills through problem-based learning. Its implementation with brainstorming technique was very suitable to be applied in elementary school learning process. Viewed from how important it is for students to master and have critical thinking skills is something that is very fundamental for the development of science and education community or stakeholders. This research was expected that it could provide a contribution for the teacher in implementing problem-based learning to develop the students' critical thinking skill and for the educational world especially in Indonesia.

4. Conclusions

In developing and implementing critical thinking skills, teachers can apply problem-oriented learning and develop students' ability to express ideas based on concepts that have been learned to solve problems experienced by students in daily life. It is concluded that learning by using PBL model with brainstorming technique can develop critical thinking skills of elementary students in learning Science.

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