The Implementation of Inquiry by Using Local Potential to Improve Critical Thinking Skills in Bima

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Abstract. The Inquiry model supports physics learning in schools, especially in high school because it used the scientific method. The purpose of this study was to analyze the improvement of students' critical thinking skills by implementing inquiry using Bima's local potential. The Research method was a quasi-experimental with one-group-pretest-posttest control group design. The instruments used learning plan, student worksheets, and evaluation questions. All instruments had been validated by experts and practitioners. Students were invited to conduct physics investigations by understanding the local potential around. Some of Bima's local potentials that became the topic of this research were making of salt from sea water, the traditional of Bima sarong (Tembe Nggoli), and the Timbu cooking process. Through learning raised from everyday life, it was expected to be able to improve students' critical thinking skills. The results showed an increase in students' critical thinking skills through inquiry learning using Bima's local potential. The improvement of students' critical thinking skills was mostly in the low category, namely 52% (high category), 40% (medium category), and 8% (low category).

1. Introduction

The inquiry model supports learning of physics in schools, especially in high school because it used the scientific method. This was supported by the statement of Mulyaningsih & Saraswati who explained that the purpose of physics is studied in the secondary schools so students are able to use scientific methods to solve problems and master the concepts of physics and their interrelations in daily life [1]. Learning physics using scientific methods require students to have sufficient skills.

Learning using inquiry was a learning approach that involved the students in finding and used various information resources to improve their understanding. Through this learning students were exposed to scientific activities such as skills in observing, measuring, classifying, drawing, concluding, and communicating findings [2]. Some recent research results proved that inquiry was suitable for improving students 'existing skills including students' generic science skills [3], critical thinking skills [4], students' cognitive physics skills [5], and students' creative thinking skills [6].

Inquiry learning needed activities to explore local potentials that were close to students and relate directly to themes in physics lessons in schools so that they provided a clear and relevant picture between learning material, educators, and students [7]. Regional potential (local) was the potential for specific resources owned by an area. Local potential should be utilized to support the decentralization of Education. Local potential including natural, human, technological and cultural resources could be developed to build the national independence. In addition, Arowolo explained that culture was not
only a potential that was directly related to art and culture, but it was all about the way of life of the local community that was related to beliefs, productivity, employment, staple foods, creativity, values, and norms [8].

Local potentials that owned by each region were different and have their own characteristics, as well as local potentials that were owned by Bima Regency, West Nusa Tenggara (NTB). Some of the local potentials of the Bima region included iron sand, brackish water cultivation (milkfish ponds, shrimp), traditional Timbu food, various types of traditional cloth (Tembe), traditional games, wild horse milk, honey, bricks, o i ta’a, salt ponds, cashew nuts, candlenut. Besides that, there were tourism areas including Tambora tourism area, pink Sape beach, Wera snake beach, Sambori and Wawo cultural tourism. There are many potentials of Bima Region that could be utilized as a medium for learning physics including the process of cooking traditional food (Timbu), the characteristics of the fabric (Tembe) and Nggoli, the process of making salt for the temperature and heat material.

Local potential-based inquiry was focused on being able to train the students' high-level thinking skills, one of them was critical thinking skills. The ability to think critically was reflective and reasoned thinking that was focused on making decisions to solve problems [9]. Students' critical thinking skills were often not well developed in teaching and learning process. This was due to the fact that learning in schools generally did not lead the students actively in solving the problems to gain knowledge. Subsequently, by utilizing local potential, the learning process must be contextual therefore the students were able to understand and solve the problems that occurred, as a result they could train students' critical thinking skills.

There were five indicators of critical thinking according to Ennis which derived from critical activities, namely: (1) formulating the main points of the problem; (2) reveal the facts; (3) choose a logical argument; (4) detecting biases with different perspectives; (5) draw conclusions [10]. This study aims to implement the guided inquiry model with the help of local potential to improve students' critical thinking skills.

2. Methods

This research was a Quasi Experiment study with a One-Group-Pretest-Postest-design research. the design involving 25 students of Woha class of XI IPA 2 High School students. The Samples were selected by purposive sampling. The study design was in Table 1 below.

Table 1. One-Group-Pretest-Posttest Research Design

| O₁  | X   | O₂    |
|-----|-----|-------|

Information :
O₁ : Pretest
X : Treatmen
O₂ : Postest

The design of this study consisted of three stages, those were : (1) Pretest, an initial test conducted to measure the level of students' critical thinking skills, (2) Provision of treatment, application of Inquiry learning using local potential, (3) Posttest, the final test to measure students' critical thinking skills after being given treatment. There were two variables in this research, namely Inquiry Learning using local potential which was applied in the form of Temperature and Heat learning LKS and critical thinking skills. After the pretest and posttest data of critical thinking skills were obtained, the data were analyzed using the N-gain formula and interpreted according to the categories listed in Table 2.

\[
N - gain = \frac{Posttest\ Score - Pretest\ Scores}{Ideal\ Score - Pretest\ Scores}
\]

Table 2. Interpretation of Normalized Gain Score

| Scores<g> | Criteria |
|-----------|----------|

2
Data on the results of critical thinking skills tests were described and made decisions based on the criteria of Table 2.

3. Results and Discussion

Students’ work on the problem in figure 1 can be seen in the following table:

| <g> ≥ 0.7 | High         |
|----------|--------------|
| 0.7 > <g> ≥ 0.3 | Medium     |
| <g> < 0.3 | Low         |

This study used inquiry learning that was integrated with the local potential of the Bima’s area. Inquiry was learning using scientific methods. To make learning more meaningful, inquiry was integrated with the local potential of the Bima’s area. Learning design by utilizing this local potential could give a picture to students that learning Physics was very close to the environment, and could provide direct experience thereby increasing students' thinking skills.

This research was conducted on the temperature and heat material in the Class of XI High School. The local potential used in this research was the Timbu cooking process, thermal conductivity in Tembe Nggoli, and changes in the form of substances that occurred in the process of making salt.

At the beginning of learning, students were invited to observe the events around by distributing worksheets. Presentation of local potential around invited students to associate daily life with the
material temperature and heat. The Example in the presentation of the second local potential, at the beginning of learning students got the following description: "Tembe Nggoli had features that were warmer than other fabrics or sarong, smooth and soft, not easy to tangle and colors were more durable. Because of the nature warm of Tembi Nggoli, Tembu Nggoli was often used when the weather was cold. How was the heat absorption in copper Nggoli? How was the comparison between copper and another sarong? " In this lesson, the teacher brought several different colors of Tembe Nggoli and another sarong of the same color as Tembe Nggoli. Through this activity, students conducted the investigation into the material's thermal conductivity and color differences in absorbing heat. In that way, the students did the temperature measurements in every few minutes to measure the temperature intensification.

Another example was in presenting the third local potential, students were presented with a description that "salt farmers must wait for hot sun or dry season in order to be able to turn sea water into salt. Why did this happen? Whether with the increasingly heat of the sun would change the sea water more quickly into the salt? After getting a stimulus at the beginning of learning, students were asked to formulate problems in physical variables, determine hypotheses from the formulation of the problem, arrange experiments, analyze data, and draw conclusions.

By giving contextual stimulus questions, students found it easier to link the concepts of changing matter and heat. The greater the heat given, the less time was needed to change the form of matter. This also showed students that the heat provided was not always to change the temperature but also to change the form of matter. After getting the pretest and posttest data, the increase in students' critical thinking skills was measured in two ways, namely seeing the improvement of each indicator and the improvement classically. This was to know which indicators were high, medium, low, and to compare the improvement in classical critical thinking skills. Table 3 showed the increase in students' critical thinking skills for each indicator.

| No. | Indicators of Critical Thinking Skills | Improvement Categories |
|-----|--------------------------------------|------------------------|
| 1   | Identifying Assumptions              | High                   |
| 2   | Assessing Source Credibility         | Low                    |
| 3   | Analyze Arguments                    | Low                    |
| 4   | Make a Conclusion                    | Low                    |
| 5   | Conduct Further Clarification        | High                   |
| 6   | Make decisions                       | High                   |

Based on Table 3 it appeared that from the sixth indicators measured, there were three indicators that were classified as increasing from pretest to high posttest, and there were also three that were classified as low. Indicators categorized as having a high increase were identifying assumptions, making further clarifications, and making decisions. On the other hand, indicators that were classified as low increase were analyzing source credibility, analyzing arguments, and making conclusions. Based on the results of data analysis, an increase in students' critical thinking skills was classified into three categories. The results of the analysis of increasing students' critical thinking skills were presented in Table 4.

| No. | Improvement Categories | Percentage (%) |
|-----|------------------------|----------------|
| 1   | High                   | 8              |
| 2   | Medium                 | 40             |
| 3   | low                    | 52             |

Based on Table 4, it could be seen that all students experience an increase in critical thinking skills. This increase was classified into three categories, namely 52% low, 40% moderate, and 8% high.
Increased students' critical thinking skills mostly in the low category. While the number of students experiencing an increase in critical thinking skills was smaller in the high category.

Most students in the low category were possible because the students were not accustomed to thinking at a high level. Critical thinking skills were not skills that developed with physical development. Thinking skills could be developed in students through learning in school. In addition, physics learning in schools also often displays experimental activities with cook books. According to Halim et al. (2015) critical thinking skills could not be built with practices that present procedures such as cook books. To be able to build critical thinking skills, students must be willing to think deeply. Students must be able to construct the initial facts conveyed by the teacher to build new concepts. Students must associate local potential with the concepts they will learn. Explanation of local potential leads students to design a set of experimental sequences that will be used to conduct investigations.

According to Arends high level thinking involved self-regulation of thought processes. We could not measure the higher-order thinking in an individual if others determine each of his behavior. This happened in the implementation of research [11]. Students were not familiar yet with the Inquiry process especially by using worksheets so that they needed the adaptation by the need for special directions from the teacher. This means that students could not be released by themselves to study independently. This was combined with the worksheet used in this study was open worksheet. Therefore, it took longer learning time so that the improvement of critical thinking skills could be optimal.

But contrarily, classically, the students’ critical thinking skills buildup. This happened because physics learning was associated with local potential and Inquiry models. Inquiry learning was learning using scientific methods. Inquiry learning was learning that seeks and requires students to find the answers of the problems [12]. Inquiry learning made the teacher as a facilitator [13]. By using inquiry which integrated with local potential, learning physics became contextual. As a result, students found it easier to understand and students’ thinking processes more deeply. This is supported by Gunawan & Kusdiastuti’s research which stated that inquiry-based learning strongly supports the development of critical thinking, which is one of students’ thinking abilities [14]. In addition, involving students in the inquiry process made students felt challenged. In inquiry learning, students would be asked to observe the phenomena related to the local potential. Gunawan et al., Stated that students who observed a phenomenon directly or indirectly were able to develop critical thinking skills better [15]. Students then formulated problems, wrote the hypotheses, and designed the experiments to test them, then conducted the experiments and formulated the experimental results. This was in line with Hidayah et al. which stated that aspects of critical thinking skills included proposing hypothetical solutions, or applying solutions directly to issues, dilemmas, or problems and perhaps testing hypotheses [16]. In addition, the process of inquiry by groups also made students sharpened in critical thinking and conceptual understanding [17]. As stated by Muhfahroyin that learning in groups builds together successful activities, so that brain storming and sharing appear that activate critical thinking skills [18].

4. Conclusion

Based on the results of data analysis that has been done, it could be concluded that all students experience an increase in critical thinking skills and a dominant increase in the low category. Increased critical thinking skills in the three categories are as follows: 52% the low category, 40% the medium category, and 8% the high category.

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