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The Use of Inquiry-Based Handouts on Science Learning for Student Critical Thinking Ability

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ABSTRACT

The problem that is often found in the field is that poorly trained students thinking critically because learning is still teacher-centered. The purpose of this study was to determine the effect of using inquiry-based handouts on students critical thinking abilities. The design of this study was experimental design with pretest and posttest group control design methods. It was by looking at the students ability to answer the pretest and posttest question sheets that contain critical thinking indicators such as analyzing, synthesizing, connecting, concluding, evaluating, and creating. The results of this study show that the students critical thinking skills for the group given the handout showed that they met good criteria, that is the average score above 75. Meanwhile, students critical thinking skills in the class or group of students who were not given handouts were still not more than 50. From the results of the study it can be concluded that the handouts used can help students in training critical thinking skills.

1. Introduction

Science learning is used as a transfer of knowledge and skills, and is also used to instill and develop scientific attitudes and values such as honesty, discipline, precision, objectivity, creativity and effective and efficient ways of thinking. These abilities cannot develop on their own without intensive guidance and direction from the teacher through innovative and accommodating science learning. According to Zulirfan, et al (2018) learning science must be more contextual, meaning that scientific activities should be more directed to observe the symptoms of science that are around students. Therefore, science (IPA) should

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be studied in ways that enable the development of students critical thinking skills in solving real problems. Abdullah et al. (2019) stated that there are 3 top skills needed in the 21st century, namely skills of critical thinking, problem solving, and creative thinking. All of these skills can be classified into Higher Level Thinking Skills

According to Febriana (2012) critical thinking is an active, continuous and careful consideration of a belief or form of knowledge that is taken for granted by including reasons that support rational conclusions and conclusions. Every person has the potential to think critically that can be developed optimally in achieving a better life. Thus, critical thinking can be concluded as a process of thinking that aims to make rational decisions directed at deciding whether to believe or do something.

Hendra (2013) suggested several stages of critical thinking, namely first, Analyzing Skills. Analyzing skills is a skill to decipher a structure into component components in order to find out the organization of the structure. In these skills the main goal is to understand a global concept by breaking down or detailing that globality into smaller and more detailed parts. The analysis question requires that the reader identify the logical steps used in the thinking process to arrive at the conclusion point.

The second, the synthesis skills. The synthesizing skill is the skill of joining parts into a new form or arrangement. The synthesis question requires the reader to unite all the information obtained from the reading material, so that it can create new ideas that are not explicitly stated in the reading. This synthesis question gives an opportunity to think freely controlled.

The third, Knowing and Problem Solving Skills. These skills are applicative skills concepts to several new meanings. These skills require the reader to understand the reading critically so that after the reading is finished the students are able to capture some of the main reading thoughts so they are able to pattern a concept. The fourth, concluding skills. Concluding skills are activities of the human mind based on understanding / knowledge (the truth they have). The fifth, Evaluating or Assessing Skills. These skills require careful thinking in determining something value with various criteria. Assessing skills requires the reader to provide an assessment of the values measured using certain standards. From some experts' opinions on critical thinking skills, it can be concluded that critical thinking is a mental process for analyzing or evaluating information. This information can be obtained from the results of observations, experiences, common sense or communication.

Critical thinking goal is to test an opinion or idea, including doing consideration or thinking based on the opinions proposed. These considerations are usually supported by criteria that can be accounted for. The critical thinking indicator according to Ennis (2011) consists of: providing simple explanations, building basic skills, drawing conclusions, giving further explanations, and arranging strategies and tactics

Based on the observations made, it was found that students' critical thinking skills were still low, such as analyzing, synthesizing, evaluating and concluding. The use of handouts in addition to fostering positive responses from students, can also improve critical thinking skills. The purpose of this study is to see how the influence of handouts on students' critical thinking abilities. The benefits of this study include being able to develop students' critical thinking skills in the learning process.

2. Methodology

Data collection in the study was carried out in class VII of 25 SMP Negeri Pekanbaru Academic Year 2018/2019. The population in this study were as many as 9 classes with an average number of 40 students in each grade in the odd semester 2018-2019.

The design used in this study was experimental design with pretest and posttest control group design. The sample was determined by conducting a homogeneity test and normality test. The sample in this study was one control class (class VII. 9) which amounted to 43 students and one experimental class (class VII. 6) which amounted to 40 students.

In the experimental and control classes, each basic competency in the subject matter was studied, the teacher gave a posttest on the subject matter of classification of living things and substances and their characteristics to determine students critical thinking skills.

The assessment of critical thinking skills is seen from the ability of students to answer the pretest and posttest question sheets that contain critical thinking indicators such as analyzing, synthesizing, connecting, concluding, evaluating, and creating. Descriptions of critical thinking KD 3.2 classification of living things can be seen in Table 1.

Table 1. Description of Critical Thinking Questions KD 3.2 Classification of Living Beings

| No | Indicator | Sub Indicator | question number | Key | Total Question |
|-----------------|--------------|---------------------|-----------------|-----|----------------|
| 1 | Analyze | 1. Distinguishing | 1 | A | 6 |
| | | | 7 | B | |
| | | 2. Organizing | 13 | C | |
| | | | 14 | C | |
| 3. Contributing | 15 | D | | | |
| | 22 | D | | | |
| 2 | Synthesizing | 1. Arrange facts | 2 | B | 6 |
| | | | 10 | C | |
| | | 2. Arrange concepts | 17 | A | |
| | | | 20 | A | |
| | | 3. Arrange theory | 23 | D | |
| 28 | D | | | | |

| | | | | | |
|---|----------|-------------------------------------|----|---|---|
| 3 | Connect | 1. Connect the facts | 3 | B | 6 |
| | | | 9 | A | |
| | | 2. Connect the facts to the concept | 16 | C | |
| | | | 19 | C | |
| | | 3. Linking facts | 24 | D | |
| | | | 36 | D | |
| 4 | Conclude | 1. Solve the problem with the key | 4 | A | 6 |
| | | | 8 | A | |
| | | 2. Understand / summarize | 21 | C | |
| | | | 26 | C | |
| | | 3. Categorize | 30 | D | |
| | | | 32 | D | |
| 5 | Evaluate | 1. Assess | 5 | A | 6 |
| | | | 11 | B | |
| | | 2. Criticism | 12 | C | |
| | | | 25 | C | |
| | | 3. Directing | 27 | D | |
| | | | 29 | D | |
| 6 | Create | 1. Deuteronomy | 6 | B | 6 |
| | | | 18 | A | |
| | | 2. Modified results | 31 | A | |
| | | | 33 | A | |
| | | 3. Original | 34 | D | |
| | | | 35 | A | |

Description of critical thinking questions KD 3.3 substances and their characteristics can be seen in Table 2.

Table 2. Description of Critical Thinking Questions 3.3 Substances and Characteristics

| No | Indikator | Sub Indikator | No Soal | Kunci | Jumlah/ Soal |
|----|--------------|----------------------------------|---------|-------|--------------|
| 1 | Analyze | Distinguishing | 1 | B | 6 |
| | | | 12 | B | |
| | | | 17 | C | |
| | | | 18 | C | |
| 2 | Synthesizing | Organizing | 19 | D | 6 |
| | | | 25 | D | |
| | | | 2 | A | |
| | | | 28 | B | |
| 3 | Connect | Contributing | 8 | C | 6 |
| | | | 29 | C | |
| | | | 30 | D | |
| | | | 31 | D | |
| 3 | Connect | Connect the facts | 3 | B | 6 |
| | | | 7 | B | |
| | | | 26 | D | |
| | | | 27 | B | |
| 4 | Conclude | Connect the facts to the concept | 32 | C | 6 |
| | | | 33 | C | |
| | | | 4 | A | |
| | | | 11 | A | |
| 4 | Conclude | Linking facts | 14 | C | 6 |
| | | | 21 | C | |
| | | | 23 | D | |
| | | | 24 | D | |
| 4 | Conclude | Solve the problem with the key | 4 | A | 6 |
| | | | 11 | A | |
| | | | 14 | C | |
| | | | 21 | C | |
| 4 | Conclude | Understand / summarize | 23 | D | 6 |
| | | | 24 | D | |
| | | | 23 | D | |
| | | | 24 | D | |

| | | | | | |
|---|----------|------------------|----|---|---|
| 5 | Evaluate | Assess | 5 | B | 6 |
| | | | 9 | B | |
| | | Criticism | 13 | C | |
| | | | 15 | C | |
| | | Directing | 16 | D | |
| 6 | Create | Deuteronomy | 6 | B | 6 |
| | | | 10 | B | |
| | | Modified results | 22 | A | |
| | | | 34 | C | |
| | | Original | 35 | D | |
| | | | 36 | D | |

To find out the value of Capabilities Students critical thinking, it is analyzed using criteria as in Table 3 (Sugiyono, 2010).

Table 3 Intervals and Categories of Students' Critical Thinking Ability

| Interval % | Category |
|------------|-----------|
| 85– 100 | Very good |
| 75– 84 | Well |
| 65 – 74 | Enough |
| < 64 | Less |

3. Results and Discussion

Students Critical Thinking Ability in KD 3.2 (Classification of Sentient Beings Class Experiments and Control Classes)

The absorption of students critical thinking skills in KD 3.2 material in the experimental class and the control class before and after being given treatment can be seen in Figure 1.

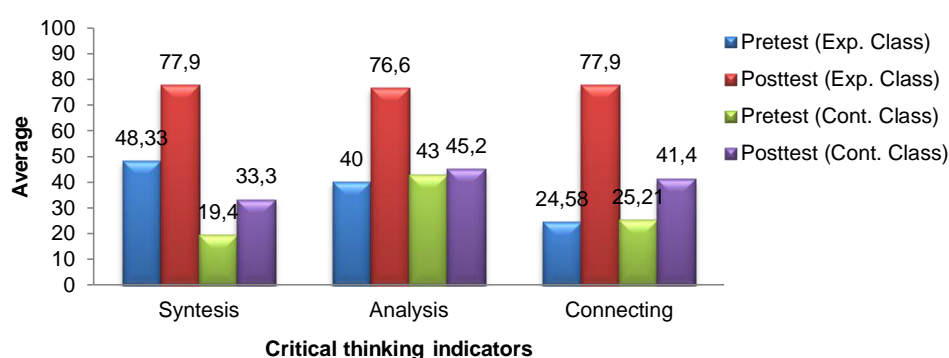
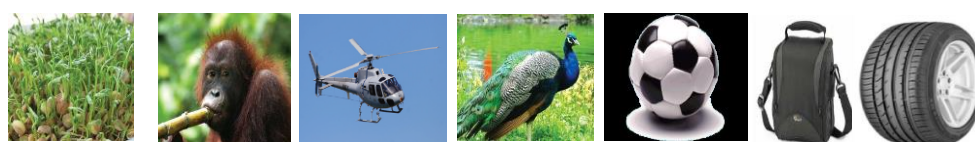


Figure 1. Students' critical thinking skills in analyzing indicators, Synthesize and connect KD 3.2 Classification of Creatures Life

In figure 1, it can be seen the absorption of students critical thinking skills in the experimental group and the control group before and after being given treatment

(pretest and posttest) on the indicators analyzing, synthesizing and correlating. From the 3 indicators, the indicator with the highest score is the synthesizing indicator with a value of 77.5. The ability to synthesize is the ability that students do in connecting results from several analyzes to forming new ideas. In accordance with the presentation of the problems contained in the handout where students are required to discuss the characteristics of objects in the picture or objects that are around it (Figure 2)



Plant Monkey Helicopter Peacock Ball Bag Tire
 Figure 2. Objects in the environment around (Source: Dok.Kemdikbud)

Then the stage of synthesizing where students observe the characteristics possessed by objects and give a check mark (✓) the characteristics of the objects that are appropriate. This can refer to a person's ability to associate and unite the various elements and elements of knowledge that exist so that a more comprehensive new pattern is formed. According to Arief (2007), the ability to synthesize is the ability to combine parts into a new formation or arrangement. Questions with this synthesizing ability provide opportunities for students to think critically, freely and in a controlled manner.

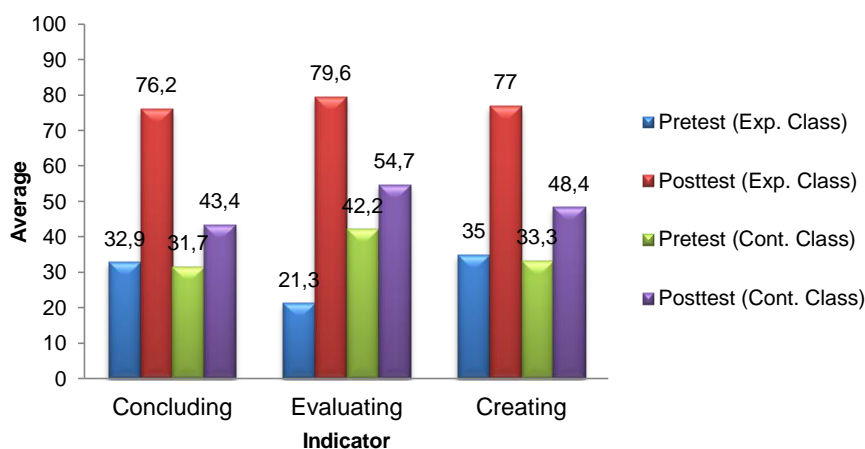


Figure 2. The ability of students to think critically on concluding indicators, Evaluating and Creating KD 3.2 Classification of Living Beings

Figure 2 shows the absorption of students critical thinking skills in the experimental group and KD control group 3.2 classification of living things before and after being given treatment (pretest posttest) on the indicator concludes, evaluates and creates. From the three indicators, the highest indicator is the evaluating with value of 79.6 in the posttest of the experimental class. At this evaluation stage students are required to be able to summarize and evaluate all learning that has been studied based on the facts that exist. In general, students have been able to evaluate a learning that has been undertaken. According to

Lorin and David (2010) evaluation is an assessment of data that has been collected. In line with this, Asmawi and Noehi (2010) state that evaluation can be expressed as a decision-making process using information obtained through learning outcomes. Evaluation can also be seen as a process of planning, obtaining, and providing information that is very necessary to make alternative decisions.

Students Critical Thinking Ability in KD 3.3 Substances and Characteristics of Experimental Classes and Control Classes

The absorption of students critical thinking skills in the KD 3.3 material in the experimental class and the control class before and after being given treatment can be seen in Figure 3.

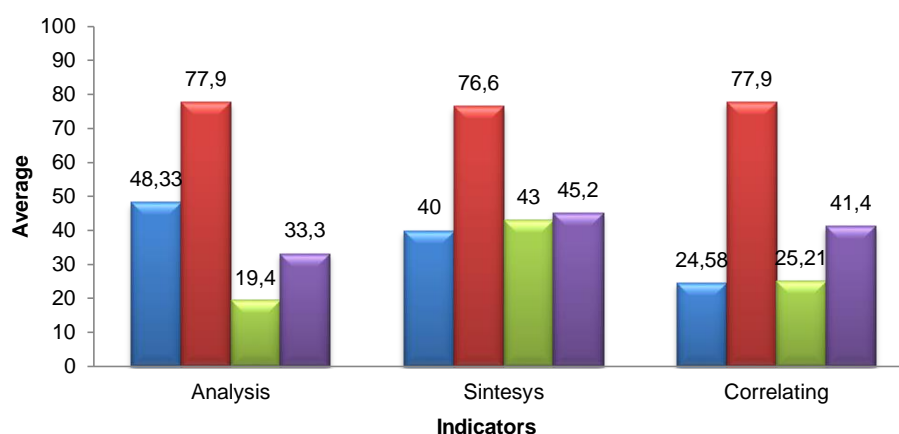


Figure 3. Students' critical thinking skills in analyzing indicators, Synthesize and Connect the 3.3 Substances KD and Characteristics

Figure 3 shows the absorption capacity of students' critical thinking skills in the experimental group and the control group KD 3.3 Substance and its characteristics before and after being given treatment (pretest posttest) on the indicators analyzing, synthesizing and correlating. Of the 3 indicators, the connecting indicator and analyzing indicator are the highest indicators with a value of 77.9 in the posttest of the experimental class. Linking is a process that occurs when a student is able to emphasize a point of view, aberration, values, or the purpose of a form of communication. Linking includes expansion beyond the category of understanding the material provided in order to predict the intent or point of view contained in the learning material presented (Lorin, et al, 2010).

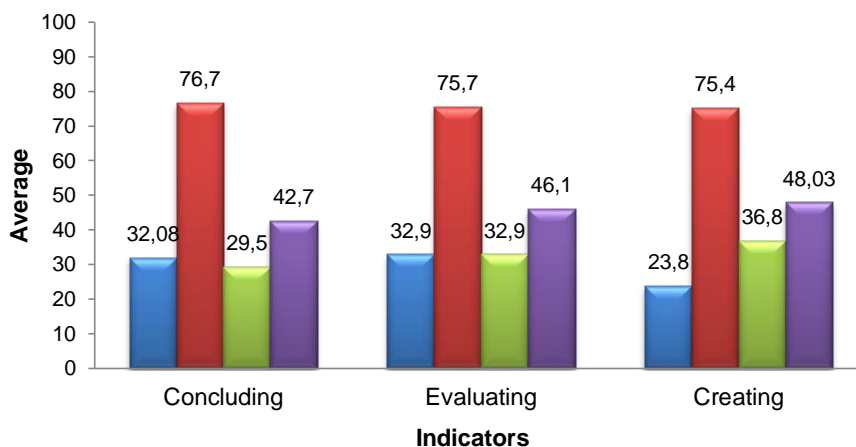


Figure 4. Student's Critical Thinking Ability to Conclude Indicators, Evaluating and Creating KD 3.3 Substances and Characteristics

Figure 4. shows the absorption of students' critical thinking skills in the experimental group and the control group KD 3.3 substance and its characteristics before and after being given treatment (pretest posttest) on the indicator concludes, evaluates and connects. From these 3 indicators, the concluding indicator is the indicator with the highest score with a value of 76.7. Critical critical thinking skills of students in the indicator concluded that this was classified as a very good category. In the indicators concluded, students were required to be able to summarize and summarize all learning that had been learned based on the facts. Handoko (2010) states that through conclusions made students will be better able to improve their critical thinking skills.

The overall results of the assessment of students' critical thinking skills for the group given Handout shows that they have met good criteria. Meanwhile, students' critical thinking skills in the class or group of students who are not given handouts are still not so good. This shows that the handouts used can help students in practice critical thinking. Critical thinking is a very important and necessary ability in the learning process because it can help students handle mental, spiritual questions, and can be used to evaluate all information that has been obtained from any source. Critical thinking is the ability to understand assumptions, make a fact or guess that is supported by the existence of evidence and then designed a conclusion based on the evidence that has been collected (Andrews, 2015).

According to Karakoc (2016), critical thinking skills in the education process is one of the important things. Critical thinking can increase creativity and understanding. Research conducted by Styron (2014) suggests that critical thinking is a process of intellectual discipline that actively and skillfully conceptualizes, implements, analyzes, synthesizes, and evaluates information collected from, or produced through observation, experience, reflection, reasoning, or communication. This is in accordance with Mutawski (2014),

students who are accustomed to using critical thinking skills will often ask questions and actively participate in the learning process. So that the teaching and learning process tends to increase.

According to Mutawski (2014), critical thinking skills learned in classrooms are important and have an impact on the future of students. This will train students to think deeply and critically process the problems that exist in the surrounding environment. The results of this critical thinking ability can be seen from a person's ability to make effective decisions, think well and know the impact on daily life.

In the study of Kumar et al. (2015) in Oman, it was argued that critical thinking skills enable a person to be successful in his field, as well as for students. This critical thinking ability is very important for students, because this will create a character that is useful for their future future. In his research on engineering students at Nizwa, it was found that this critical thinking ability produced very significant results. So, he suggested that educational institutions should focus on developing students' critical thinking skills. When students do a visual grouping of an argument, record the premise, and conclusions and consider the objections or impacts, students will be able to build their own arguments.

Elisabet, et al (2018), concluded that critical thinking ability is the thinking ability possessed by someone who is supported by a proper argument. Therefore, the teacher has the responsibility to improve students' critical thinking skills in thematic learning. The teacher must identify some basic abilities in learning and teach students with the right system to apply in real situations. With critical thinking, students have the ability to solve problems that exist in social life and everyday life.

In a study conducted in Thailand by Changwong, et al (2018), it was suggested that students who mastered the ability to think critically would have better academic values (learning outcomes) in their school environment, and would be better prepared and more able to improve results. learn at the next stage of education. The teacher must also convince students to practice critical thinking skills.

Critical thinking habits will make someone a problem solver, so critical thinking is not a goal but a process. Teachers are expected to have the ability to choose, determine, and use learning methods that are able to create situations and conditions that bring students to actively participate in the learning process so that they can hone their critical thinking skills (Sarjono, 2017). According to Erwiza, et al (2019) critical thinking directly affects learning achievement by 27.3%. In general, critical thinking can affect learning achievement.

Martin, et al (2015), a learning atmosphere that uses reviews (reviews) will shape the conditions or atmosphere to be better, can improve understanding of the information provided during learning. In this study, students were grouped into small groups aimed at improving students' critical thinking skills. This is in

accordance with Styron (2014), who said that the exchange of ideas in group discussions is an action that is able to form critical thinking skills. Conversations in discussion groups between students can stimulate students' thinking for critical thinking.

4. Conclusion

Students critical thinking skills for groups given Handouts show that they have met good criteria. Meanwhile, students critical thinking skills in classes or groups of students who are not given handouts are still lacking.

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