CRITICAL THINKING SKILLS AND STUDENTS’ LEARNING OUTCOMES IN LEARNING BIOLOGY OF MUSHROOM CONCEPT AT SMA NEGERI 4 BARABAI

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Abstract: Teachers as learning agents must be able to present the learning process contextually by involving the active participation of students. Some students learn best when they have the opportunity to interact with real objects through inquiry activities that will help students deepen their understanding of a concept. Inquiry learning is one that can be adapted to students’ abilities, can build cognitive structures, and can motivate students to think critically. This research is classified as descriptive research. The subjects of the research were students of class X SMA Negeri 4 Barabai as many as 78 students in the 2015/2016 academic year on the mushroom group material. The research data were in the form of observations on students’ critical thinking skills which were analyzed descriptively using categorical methods, namely very good (≥ 3), good (2-2.99), not good (1-1.99). While cognitive learning outcomes were obtained through tests and success was determined based on KKM = 67 with classical completeness 85%. The results showed that students’ critical thinking skills were at least good, namely formulating hypotheses, designing experiments, conducting experiments, and making conclusions, while formulating problems, and analyzing data still needed improvement. Meanwhile, students’ cognitive learning outcomes have not yet achieved minimal completeness.

Keywords: critical thinking skills, learning outcomes, inquiry

* Abstract in Indonesia at the end of the journal page.
PRELIMINARY

Teachers as learning agents must be able to present the learning process contextually by involving the active participation of students. Some students learn well when they have the opportunity to interact with real objects through inquiry activities that will help students deepen their understanding of a concept (Nur, 2000; Kariani, 2015; Afidayani et al., 2018). According to constructivism theory, learning is an active process of the subject learning to reconstruct meaning, whether it be texts, dialogue activities, physical experiences, and others. Learning is the process of assimilating and connecting the experiences he has learned with the understanding he already has, so that his understanding develops (Sardiman, 2007).

Constructivist rules provide direction for teachers to use student-centered learning models (Zaini, 2014; Rahayu et al., 2018). Observing conditions like this, it is time for teachers to leave the rules of teaching (to teach) to be teaching (to learn), both concepts (content standards) and processes (working scientifically) (Ridwan, 2010). The teacher also acts as a facilitator in improving critical thinking skills through student-centered learning. Nur (2013) stated that critical thinking teaches various strategies and skills that can improve our ability to engage in critical evaluations.

The inquiry learning model is one model that can encourage students to be active in learning. Kunandar (2010), states that inquiry learning is a learning activity in which students are encouraged to learn through their own active involvement with concepts and principles, and teachers encourage students to have experiences and conduct experiments that allow students to discover principles for themselves.

Inquiry learning is one that can be adapted to students’ abilities, can build cognitive structures, and can motivate students to think critically. Hamalik (2004) explains that the inquiry approach is a student-centered strategy. The inquiry approach includes the process of asking questions and finding answers to scientific questions posed. The most effective way to develop critical thinking skills is to include them as part of every lesson. Teaching critical thinking is an ongoing process. This cannot be limited to classroom sessions, but must be incorporated through a variety of questions, lessons, and activities that focus on higher-level thinking skills (Reddington, 2012).

Higher order thinking skills include critical, logical, reflection, metacognitive, and creative thinking (Fahmi, 2018). Active learning involving students usually includes this skill component. Critical thinking skill is one that is expected to be mastered by students in the learning process. Arends (2012) states that effective critical thinking requires skills that will help determine the accuracy of information and will assist in recognizing illogical and/or erroneous arguments. According to Facione (1998) there are several skills that can be categorized as part of critical thinking skills. These skills are expertise in interpretation, analysis, inference, evaluation, explanation, and self-assessment. If the student has mastered one of these skills, then he has led to the ability to think critically even though he still does not fulfill all the skills mentioned (Putri et al., 2021).

The scientific ability of Indonesian students is low, let alone its implementation in the form of scientific literacy, is even lower and has not shown an increasing trend (Wasis, 2015). The important thing that needs to be done is to design learning that is able to stimulate the increase in scientific literacy. One way that can be done is to provide the widest opportunity to do scientific work, pour scientific work (thinking skills) and be accompanied by bills or evaluations (minds-on).

The results of Sukamti’s research (2004) that the discovery-inquiry method allows students to be actively involved in using their mental processes to find some concepts and principles of the material being studied. Based on research from Murtiani (2008) reports that the use of an inquiry approach can improve student learning outcomes and activities.

High school students are able to reason logically and quantitatively. They are able to move freely from one point of view to another. They are able to be quite objective in assessing events, they are also able to focus on several properties of an object or event simultaneously and understand the relationship between the dimensions.

METHOD

This research is classified as descriptive research. The research subjects were students of class X SMA Negeri 4 Barabai as many as 78 students in the 2015/2016 academic year. The subject matter studied is about mushrooms. The data collected on critical thinking skills include formulating problems, formulating hypotheses, designing experiments, conducting experiments, analyzing data, and making conclusions. Indicators of critical thinking skills based on the syntax of the inquiry model. The instrument used in this study was an observation sheet on students’ critical thinking skills which were analyzed descriptively using

categorical methods, namely very good (≥ 3), good (2-2.99), not good (1-1.99) (Nur, 2013). While cognitive learning outcomes are obtained through tests and success is determined based on KKM = 67 with classical completeness 85%.

RESULTS AND DISCUSSION
Students' critical thinking skills obtained from mushroom practicum activities are presented in Table 1 below.

<table>
<thead>
<tr>
<th>Inquiry Syntax</th>
<th>Class</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X.1</td>
<td>X.2</td>
<td>X.3</td>
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<tr>
<td></td>
<td>Score</td>
<td>Score</td>
<td>Score</td>
<td></td>
</tr>
<tr>
<td>Formulating the Problem</td>
<td>1.81</td>
<td>1.78</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>Formulating Hypotheses</td>
<td>1.58</td>
<td>2.07</td>
<td>2.04</td>
<td></td>
</tr>
<tr>
<td>Designing Experiments</td>
<td>2.81</td>
<td>2.89</td>
<td>2.80</td>
<td></td>
</tr>
<tr>
<td>Doing Experiments</td>
<td>2.38</td>
<td>2.41</td>
<td>2.00</td>
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<tr>
<td>Analyzing Data</td>
<td>1.62</td>
<td>1.59</td>
<td>1.84</td>
<td></td>
</tr>
<tr>
<td>Making Conclusions</td>
<td>2.88</td>
<td>2.04</td>
<td>2.80</td>
<td></td>
</tr>
</tbody>
</table>

Kategori: baik sekali (≥ 3), baik (2-2.99), dan kurang (1-1.99) (Nur, 2013)

The students' critical thinking skills in Figure 1 show a good average, while the skills to formulate problems and analyze research results are still lacking. The cognitive learning outcomes of the three parallel classes are presented in Table 2.

<table>
<thead>
<tr>
<th>No</th>
<th>X.1</th>
<th>T/TT</th>
<th>X.2</th>
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<th>X.3</th>
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<td>4.</td>
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<td>6.</td>
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<td>7.</td>
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<td>8.</td>
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<td>9.</td>
<td>57</td>
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<td>T</td>
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<td>16.</td>
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</tbody>
</table>
Students' critical thinking skills are classified as good, including; a) formulating problems, b) designing experiments, c) conducting experiments, and d) drawing conclusions. However, there are several indicators of critical thinking skills classified as lacking that need improvement, namely; a) formulate the problem, and b) analyze the data.

Students' critical thinking skills are classified as good, including; a) formulating problems, b) designing experiments, c) conducting experiments, and d) making conclusions, this is in line with several previous studies (Norhasanah, 2016; Kurniawan et al., 2015; Zulfah et al., 2015; Harmawati et al., 2016). This study reports formulating hypotheses, designing experiments and conducting experiments that are classified as good (Norhasanah, 2016).

Critical thinking skills in formulating hypotheses are on average good in class X.2 and X.3, while this skill is still lacking in class X.1. Students' skills in formulating hypotheses from a problem being studied, as a temporary answer, the hypothesis needs to be tested for truth (Sanjaya, 2012). The ability or potential of an individual to think has basically already been possessed since the individual was born. The potential for thinking starts from the ability of each individual to guess or guess (hypothesize) from a problem. When the individual can prove his guess, then he will arrive at a position that can encourage him to think further. The potential to develop the ability to guess in each individual must continue to be trained.

One way that teachers can do is to develop the ability to guess (hypothesize) in each child is by asking various questions that can encourage students to be able to formulate temporary answers or can formulate various estimates of possible answers to a problem being studied. Estimation as a hypothesis is not just an estimate, but must have a solid foundation of thinking, so that the hypothesis raised is rational and logical. The ability to think logically itself will be greatly influenced by the depth of insight possessed and the breadth of experience. Any individual who lacks insight will find it difficult to develop rational and logical hypotheses. Critical thinking skills in designing experiments are quite good. Designing a biology learning experiment through inquiry activities where students are given the opportunity by the teacher to determine the steps that are in accordance with the hypothesis carried out, in this case students sequence the steps or work procedures in making observations that will be carried out.

According to Dimyati and Mudjiono (2006) in order for a research to be carried out properly and produce something useful and meaningful, a research design is needed. The skills to formulate work procedures or design observations need to be given to students, so that through inquiry learning children are trained to design and conduct investigations through experiments. It is intended that by training students to formulate a research design to be able to carry out research well and can produce something useful.

Experimental investigation is an ability that includes the ability to identify certain object phenomena, and to identify the similarities and differences of certain objects with their senses carefully. According to Dimyati and Mudjiono (2006) through observation, students learn about the real world which can demand curiosity, questioning, thinking, interpreting our environment, and researching further. The ability to observe is the most basic skill in the process and acquire knowledge and is the most important thing for developing other process skills.

Inquiry learning is carried out on real objects, students will experience directly the process of inquiry in the research they are doing. Through experience, knowledge in students will grow and develop, this will be realized if students are trained and continue to be trained through inquiry activities. Students' understanding will be stronger and attached to themselves if they are always tested with new and challenging experiences to be investigated by students.
Students' critical thinking skills in formulating conclusions are classified as good. This trains students to be more skilled and better at carrying out research, not an easy problem to solve, because it is a high-level process skill. So far, the results of the learning process have not been given much attention, so that teachers do not really know how the students' abilities in learning process skills are, especially in making conclusions properly and correctly according to the observations they get.

According to Dimyati and Mudjiono (2006) concluding can be interpreted as a skill to decide the state of an object or event based on known facts, concepts, and principles. Conclusions are made based on the results of observations and the results of observational analysis. So, guided inquiry learning is learning that will direct students to get a conclusion from a series of activities carried out so that students seem to find the knowledge themselves.

Some indicators of critical thinking skills in this study are classified as those that still need improvement, namely; a) formulate the problem, and b) analyze the data. This is in line with research that has been reported (Norhasanah, 2016). He reported that an indicator of critical thinking skills that also needs improvement is analyzing data. Indicators of critical thinking skills in this study still need improvement, and are contrary to previous research (Norhasanah, 2016; Kurniawan et al., 2015; Zulfah et al., 2015; Harmawati et al., 2016).

Students' critical thinking skills in formulating problems still need improvement. This is because students are not used to formulating problems in experimental activities. The problem or question that they formulate appears logically from the results of observations, is a description of observations, is well made, leads to further observations, is an interpretation of the results of observations, puzzles. The problem presented is a problem that challenges students to think about solving the puzzle. It is said that the puzzle in the formulation of the problem to be studied is because the problem has an answer and students are encouraged to look for the right answer. The process of seeking answers is very important in the inquiry strategy, students will gain invaluable experience as an effort to develop mentally through the thinking process. The puzzles that become a problem in inquiry are puzzles that contain clear concepts that must be sought and found.

Students' critical thinking skills in analyzing the results of observations still need improvement. This is because students are not familiar with these learning activities, so they are not trained in the skills of analyzing the results of observations. Allegedly because the daily learning process by the teacher has not yet led to the skills of analyzing the results of observations, so that when students are faced with an assessment of analyzing the results of observations students have difficulty. Students' skills in analyzing the results of observations are the ability to learn to solve problems. According to Kunanandar (2009) students learn to solve problems independently and have critical thinking skills because they must always analyze and handle information.

Inquiry learning can train and measure students' abilities in analyzing the results of the investigations they find. This will make students as prospective scientists who are reliable in carrying out investigations well. If students are still not skilled in analyzing results, then teachers need to train and continue to train students' abilities in thinking skills to interpret each learning process. One approach in learning that can train students' ability to analyze data is through inquiry learning. Students can learn to solve problems independently and cultivate thinking skills, because they have to analyze and manipulate the information they find themselves. This finding is also supported by other research reports. Primadani (2015) suggests that students who are not familiar with inquiry, one of the alternatives that can be used is structured inquiry. Structured inquiry includes the following stages: (1) formulating problems, (2) formulating hypotheses, (3) collecting evidence, (4) testing hypotheses, and (5) drawing conclusions.

The inquiry learning model is intended to help students scientifically, skillfully collect facts, develop concepts, and develop generalizations independently. Learning with a discovery approach will help students use mental processes in depth, make classifications, make assumptions, measure, explain and draw conclusions. Learning with the inquiry model has a more complex mental process. For example, designing experiments, analyzing data, generating conclusions and so on.

Students' cognitive learning outcomes have not reached minimum completeness, this is contrary to previous research reports (Listawati et al., 2015; Andi et al., 2016; Kurniawan et al., 2015). They found that cognitive learning outcomes were quite good. The learning outcomes they found were
supported by learning motivation as reported by previous research (Novitasari et al., 2015; Taufiq, 2015; Nurfauziah et al., 2015).

The most effective way to develop critical thinking skills is to include them as part of every lesson. Teaching critical thinking is an ongoing process. This cannot be limited to classroom sessions, but must be incorporated through a variety of questions, lessons, and activities that focus on higher-level thinking skills (Reddington, 2012).

One of the lessons that train critical thinking skills is inquiry learning. However, inquiry learning is not as easy as imagined, in its application there are various difficulties. According to Sanjaya (2012) inquiry learning emphasizes the thinking process that relies on the learning process and learning outcomes. So far, many teachers who are accustomed to learning patterns as a process of conveying information that emphasizes learning outcomes, many object to changing their teaching patterns. Inquiry learning is difficult to control the activities and success of students, it is difficult to plan learning because it collides with student habits in learning, and it takes a long time so that it is often difficult for teachers to adjust it to the allotted time.

Learning with this inquiry approach students will be faced with a problem that must be observed, studied, and observed, which in turn can improve understanding of concepts in learning activities. Logically, if students increase their participation in learning activities, it will automatically increase understanding of the concept of learning material, and in the end will be able to improve learning achievement.

The inquiry approach has advantages over other learning approaches, one of the advantages is that it provides space for students to learn according to their learning styles, and can serve the needs of students who have above average abilities. Inquiry learning is considered to be in accordance with the development of modern learning psychology which considers learning to be a process of changing behavior due to experience.

Learning outcomes are obtained by learning experiences through scientific activities. Learning outcomes have not been said to be good because critical thinking skills still need to be trained. Critical thinking skills are one of the competencies that must be possessed by students. Critical thinking skills need to be trained so that students are more accustomed to doing it. This study finds the parameters of formulating problems, formulating hypotheses and analyzing data still need improvement. Critical thinking skills need to be trained on an ongoing basis, with the hope that students can master it in the learning process. To be effective, critical thinking requires skills that will help determine the accuracy of information and will assist in recognizing illogical and/or erroneous arguments (Arends, 2012).

CONCLUSION

The critical thinking skills of students are at least good, namely formulating hypotheses, designing experiments, conducting experiments, and making conclusions, while formulating problems, and analyzing data still need improvement. Students’ cognitive learning outcomes have not yet achieved minimal completeness.

REFERENCES


Kata kunci: keterampilan berpikir kritis, hasil belajar, inkuiri