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Analysis of Critical Thinking Skills on Implementation of Problem-Based Learning on Endemic Flora and Fauna in Senior High School in Bengkulu

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ABSTRACT

This study aims to analyze the critical thinking skills of students Grade 10 in Senior High School through Problem-Based Learning on biodiversity material of endemic flora and fauna in Bengkulu Province. This study used a survey method with the data collection used a questioner essay questions via a google form to measure critical thinking skills. The sample consists of 48 senior high school students, grades 10 IPA in Bengkulu. The data analysis technique using descriptive data analysis with a quantitative approach. The results showed that: (1) the critical thinking skills of students grade 10 in senior high school in Bengkulu classified into three categories 77.09% low critical thinking skills, 18.75% fair critical thinking skills, and 4.17% good critical thinking skills; (2) the lowest critical sub-skills of thinking are on elementary clarification, the bases for a decision, inference, and supposition and integration than other critical thinking sub-skills.

Keywords: Critical thinking skills, Problem-based learning, Biodiversity, Endemic flora and fauna.

1. INTRODUCTION

Bengkulu is a province in Indonesia that has a lot of biodiversities. There are some flora and fauna which are endemic in the Province of Bengkulu. Based on the environmental status report of the Bengkulu area (SLHD) in 2014, Corpse flower, Rafflesia flower, Pitcher plants, Sumatran palms, Orchids, and various other botanical are some examples of flora endemic in Bengkulu. Furthermore, several types of fauna that are endemic in Bengkulu are Sun Bears (*Helarctos malayanus*), Mungkus fish (*Sicyopterus cynocephalus*), Mikih fish (*Cetraeus* sp.) and so on [1]–[3].

Endemic flora and fauna as local potentials in Bengkulu Province are fascinating objects for learning resources that have not been widely used in school learning. The use of endemic flora and fauna as a learning resource, especially in Biology learning, provides students with direct experience to develop competencies to have a deep understanding of the natural surroundings scientifically. Local potential-based learning can be implemented effectively in learning activities [4]. The endemic fauna can be used as a learning resource through Augmented Reality (AR) -based technology to help students get to know Indonesia's endemic fauna [5]. Other research [6], states that local plants' potential can be used as a source of learning biology, one of which can be applied to biodiversity material.

Knowledge of biodiversity is needed in learning, especially in knowing local flora and fauna. The level of the most important flora elements in biodiversity is in the protection of species [7]. In addition, students' basic understanding of biodiversity (fauna) is the basis for understanding the process of natural selection and evolution, and the impact of climate change on species conservation [8]. However, if biodiversity is disturbed, it will disrupt the energy flow chain; therefore, preservation is necessary to protect biodiversity as a natural resource.

The above cases can be used as a source of problems to be solved by students through problem-based learning. Problem-based learning is learning-oriented to authentic questions [9]. Problems that are taken in problem-based learning are a description of an event or phenomenon that occurs in a real-life [10]. Student involvement with problems through problem-based learning can improve student learning outcomes [11]. The orientation of the problem in problem-based learning is on authentic problems, so that students need critical thinking skills to solve problems [12]. Critical thinking skills are important factors that determine student learning success [13]. Besides, critical thinking is critical to improving individual professional competence [14]. In the last few decades, the ability to think critically as a crucial stage in every learning that is why research on critical thinking skills is interesting [15]. Student's skills to think critically and with insight will perform better academically in a school environment and face academic rigors in higher education [16]. The skills to think critically is one of the skills that is needed in this 21st century.

One of the critical thinking skills applications is during the learning process [17]. The application of critical thinking skills, according to Ennis [18], is divided into five categories, namely elementary clarification, the bases for decision, inference, clarification, and supposition and integration. These five aspects are a reference in measuring the critical thinking skills of students during the learning process. Several previous studies have stated that, on average, high school students' necessary thinking skills are low [19]–[21]. The factors that influence critical thinking skills include physical condition, motivation, anxiety, intellectual development, and interactions [22]. However, previous research stated that the critical thinking skills of students were high with learning models [23]. Therefore, this study will discuss the analysis of critical thinking skills of students grade 10 in senior high school through the problem-based learning material on biodiversity based on endemic flora and fauna in Bengkulu province. This research is intended to provide insight into the theory and practice of learning in schools.

2. METHODS

This research is descriptive with the survey method. This method is used to describe the critical thinking skills of students in Senior High School in grade 10 IPA in Bengkulu by implementing Problem-Based Learning on biodiversity material.

The population in this study were all students of Senior High School in grade 10 IPA Bengkulu Province. The sampling technique used purposive sampling technique because the sample was selected with the characteristics of students who have received learning with the Problem-Based Learning on biodiversity material. The research sample was 48 high school students in grade 10 IPA Bengkulu Province, Indonesia.

The data collection instrument used paper and pencil tests. This test used an essay question that consists of 5 questions with material issues of biodiversity in endemic flora and fauna in Bengkulu Province. The test is given after students get the learning material to measure their critical thinking skills. The categories of critical thinking skills, according to Ennis [18] in Table 1.

Table 1. Category of critical thinking skills

Category of sub-skills	Indicator
Elementary Clarification	Make a basic clarification of one or more arguments
The bases for a decision	Judge the credibility of an information
Inference	Make conclusions based on the data obtained
Advanced clarification	Identify the assumptions of the arguments
Supposition and integration	Provide alternative solutions to a problem

Data collection techniques using a questionnaire with online survey tools via a google form. Data analysis techniques using quantitative descriptive. Data from the test results were analyzed by calculating the percentage. The test results are formulated with a formula.

$$P = \frac{\text{Score gained}}{\text{Maximum Score}} \times 100$$

The criteria for the average score are presented in Table 2 below.

Table 2. The criteria of average score on critical thinking skills

Average score	Criteria
100% ≥ P > 75%	Good
75% ≥ P > 60%	Fair
60% ≥ P ≥ 0	Low

Adapted from Seventika [24]

3. RESULTS AND DISCUSSION

The results of the research on critical thinking skills are presented in Table 3.

Table 3. Description of the level of critical thinking skills

Critical Thinking Skill	Persentase
Low	77.08%
Fair	18.75%
Good	4.17%

Table 4. Description of critical thinking skills by category

Category of Sub-skills	Percentage of Student Answers	Criteria	Percentage of The Best Student Answers
Elementary Clarification	40.63%	Low	12.50%
The bases for a decision	46.35%	Low	10.41%
Inference	42.71%	Low	12.50%
Advanced clarification	64.06%	Fair	27.08%
Supposition and integration	57.81%	Low	18.75%

Four categories to measure critical thinking skills, according to Ennis [18], are elementary clarification, the bases for a decision, inference, advanced clarification, supposition and integration. Research data on each category in critical thinking skills can be seen in Table 4.

Based on the results of the analysis of each category of critical thinking skills, it was found that one of the five categories was classified as fair, namely, advanced clarification. Meanwhile, the other four categories are classified as low, namely, elementary clarification, the bases for a decision, inference, and supposition and integration. Thus, student's critical thinking skills are classified at two levels, namely low and fair.

Each category of critical thinking skills has different data results; this shows that each type has another degree. Elementary clarification category, where students formulate problems and answer questions. The problem given to this category is to develop a statement stating that the number of protected flora and fauna increased from 2009-2014, which is presented in the table and is associated with a decrease in flora and fauna diversity in Bengkulu Province. Most of the students' answers did not answer according to the question, only 12.50% of students answered the best answer. One of the best answers from participants in this category was "In conclusion,

The results showed that the critical thinking skills of students in Senior High School in Bengkulu province at the low criteria reached 77.08% than the fair and good criteria. The percentage of students who have low critical thinking skills is more than half of the total percentage. The good-criteria of critical thinking skills is at only 4.17%. Meanwhile, the fair-criteria was only 18.75%. Thus, on average, students have low critical thinking skills. According to Daniati [25], low critical thinking skills can be influenced by different test questions with daily practice questions and students are less trained and not used to answering questions with phenomena.

the protected flora and fauna from 2009 to 2014 has increased, starting from mammals, which were only 12 in 2009; in 2014 there were 17. Then there were only 2 reptiles in 2009, then 8 in 2014, then plants, which initially 3 then in 2014 there are 12. In addition, from the table, there is a decrease in the diversity of flora and fauna. So, from 2009 to 2014 there was a decrease in the diversity of flora and fauna, namely reptiles and plants, which decreased/were lower than mammals". The percentage of critical thinking skills is 40.63%, with low criteria for critical thinking skills. It appears that some students have not been able to determine information based on the problems presented.

In the category the bases for a decision, students provide evidence and reasons for the credibility of information by providing argument support. The question given in this category is to analyze the impact of damage to the coral reef ecosystem on biodiversity on Pulau Dua. Most of the students answered according to the questions, but only 10.41% of students answered the best. One of the students' best answers was, "Damage to the coral reef ecosystem has a very negative impact/has a major impact on biodiversity on Pulau Dua because it can affect the threat of the overall marine ecosystem on Pulau Dua. Also, Pulau Dua is known for its high diversity of coral reef ecosystems, but now it is not again, even damage to coral reef ecosystems refers to competition that

causes certain species to be dominant". The percentage of critical thinking skills in this category is 46.35%, with low criteria of critical thinking skills; thus, it can be seen that students have not been able to provide evidence and reasons for the credibility of information to support their arguments.

In the inference category, students conclude correctly and logically based on the data obtained. The questions summarize the data from the graph and link the causes of the extinction of biodiversity with its impacts. Most of the students' answers did not answer according to the question; only 12.50% answered the best answer. One of the best answers from students was, "The conclusion is that the decline in flora and fauna in Bengkulu province based on the table from 2009 to 2014 was caused by factors that occurred, including the decline in biodiversity at the global level, namely the presentation of habitat for flora and fauna, conversion of function and fragmentation of overexploitation invasive species, pollution, and climate change finding the consequences at this time are so difficult to find protected flora and fauna in Bengkulu province, except in forestry areas where protected flora and fauna are still found.". The percentage of critical thinking skills in this category is 42.71%, with low criteria of critical thinking skills.

In the advanced clarification category, the criteria of fair critical thinking skills (64.06%) show that most students can assume certain problems or conditions appropriately. The questions given are to provide an opinion on the problems given to prevent the extinction of biodiversity. Students answered the best answer were 27.08%, and one of the student's best answer was, "I agree with the government's policy in preventing the extinction of this plant where Rafflesia is an iconic plant in the city of Bengkulu that must be protected; of course, the actions of irresponsible individuals who destroy the habitat of Rafflesia must be punished or prevented. So that this rare plant is not included in the list of extinct plants".

Supposition and integration with a percentage of 57.81%, which is classified as low critical thinking skills. Although low, at this stage it has reached more than 50%. This also means that some students have not provided alternative solutions to the problems presented and formulating alternative solutions that must be done. The questions given are about assessing community activities that threaten to reduce the population of Mungkus fish and the best solution to prevent threats that can lead to the extinction of Mungkus fish in Bengkulu Province. Students answered with the best answers were 18.75%, and one of the best answers from students was, "Based on the above article, the activities carried out by the community in overfishing and using battery-powered stingers, putas and nets are not very good because this

will threaten the dwindling population of Mungkus. The best solution to prevent threats that can lead to the extinction of Mungkus fish is to cultivate Mungkus fish in the community, not to catch Mungkus fish using battery-powered, puta, and net-powered stingers, and take action against the conversion of forest to agricultural land and oil palm plantations upstream of the Nelengau River".

Based on study results, average low critical thinking skills made researchers assume that students were not used to getting tests based on phenomena to solve problems. According to Mukarromah & Sartono [26], to train critical thinking skills, it is necessary to have a varied learning model to solve the problems presented with their ideas. Meanwhile, to improve critical thinking skills, students need to develop instructional pedagogy with directed learning activities that encourage critical thinking skills, and students are taught how to think critically [27].

4. CONCLUSIONS

Student's critical thinking skills in Senior High School in Bengkulu on biodiversity material obtained 77.08% low critical thinking skills, 18.75% fair critical thinking skills, and 4.17% good critical thinking skills. Five categories sub-skills of critical thinking (elementary clarification, the bases for a decision, inference, advanced clarification, and supposition and integration); the advanced clarification category is included in the "fair" level of critical thinking skills because more than 60% of students can properly assume certain problems or conditions. Besides, the students' lowest critical thinking skills category in this research were elementary clarification, the bases for a decision, inference, and supposition and integration.

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