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Analysis of Biological Science Literacy Ability of Students' Grade IX at Ujung Batu Junior High Schools

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ABSTRACT

The purpose of this research is to analyze the biological science literacy ability of students' grade IX at Ujung Batu Junior High Schools. Students' biological science literacy abilities are affected by many things, such as untrained students' to solve characteristic questions such as the questions on PISA. This research used a descriptive method with a quantitative approach. The instrument used to capture students' biological science literacy ability is a test. The research conducted at Ujung Batu Junior High Schools Accredited "A" population distributed in three schools with the population in this study was all the students in grade IX at Ujung Batu Junior High Schools in the 2019/2020 academic year. The Sampling technique used in this research is simple random sampling. The comprehensive scientific literacy score is 69.15, which is in the middle level. Based on aspects of scientific literacy (1) science content, amounted to 71.18 medium categories; (2) science process, 59.73 medium categories and (3) science context, 76.53 medium categories. The research conclusion is that there is a different capacity of students' biological science literacy after using test questions on students' scientific literacy ability.

1. Introduction

Education systems in Indonesia need to prepare the nation's next-generation who are capable and skilled, that it is necessary to have the 21st-century capability in the education scope (Dhani, 2015). The key to success in confronting 21st century challenges is having scientific literacy ability because someone with a great science literacy ability can use their scientific information to solve problems in daily life and produce useful scientific products (Yuliati, 2017). Science has the meaning of science, so science is defined as the acquisition of systematically arranged knowledge. In particular, biology is part of teaching science. Depdiknas (2011) states that science learning is effort to understand various natural

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phenomena systematically, so that learning science is not only mastery of knowledge in the form of facts, concepts, principles, but also a process of discovery. Science learning plays an important role in advancing the nation. Science has a crucial role in the educative process and technological development, because science has a way of generating human interest and ability in developing science and technology (Fidiantara et al., 2020).

Based on the depth of how to study science, Chiappetta and Koballa (2010) state that science is viewed from four dimensions, namely science as a way of thinking, science as the body of knowledge, and science and its interactions with technology and society. Hence, in teaching activities, it must include 4 dimensions of science, so that the purpose of science education, namely growing students' who are scientifically literate. Scientific literacy according to PISA (2009) is the ability to use scientific knowledge, identify questions and describe evidence for conclusions to help make conclusions about nature and nature changes due to human activities. Scientific thinking is not just a systematic and empirical thinking process but able to master the knowledge and apply it in life situations. Scientific literacy among Indonesian students remains low (Wulandari, 2017).

Scientific literacy is a goal achieved by subjects belonging to science, one of which is biology (Nofiana, 2017). Science education is an important role in preparing quality human resources to face the industrial era and globalization. Educational development in Indonesia is not encouraging. This situation is due to the weakness in all aspects, especially the weakness of scientific capacity. Based on the results of the Program For International Student Assessment (PISA) 2015, Indonesia ranking 64th out of 72 participating countries, Indonesia's scientific literacy score is 403 in the low category. The low score of science literacy in Indonesian students' reflects the low learning achievement of Indonesian students'. The lack of availability of instruments that demand or train students' scientific literacy often escapes the teachers' attendance, where teachers only focus on teaching activities so that they forget the importance of learning assessment (Hidayani et al., 2021).

The written tests used to get data on students' scientific literacy ability using multiple-choice questions are one of the solutions to measure students' literacy ability. The questions asked are based on aspects of scientific literacy, namely: scientific content, scientific process, and scientific context. The aim of this research is to analyze the biological science literacy ability of students' in grade IX at Ujung Batu Junior High Schools.

2. Methodology

The methodology used in this study is descriptive, using a quantitative approach to accurately and systematically describe the facts and characteristics of the population. Descriptive research explains and describes what happened in terms of facts and data (Arikunto, 2021). Hence, to describe the biological science literacy ability of students' in grade IX at Ujung Batu Junior High Schools in this

research used a descriptive method. The data in this study are in the form of quantitative data, and the data examined are students' biological science literacy abilities in biological learning, which are obtained from the assessment scores of competency-based science literacy test questions.

This research was conducted at Ujung Batu Junior High Schools accredited "A" and will take place in the odd semester of the 2019/2020 school year, held from 5 to 22 November 2019. The Population in this research is all grade IX Junior High School students' in Ujung Batu for the 2019/2020 Academic Year who accredited "A" with population distribution in three schools. The sampling technique used in this study was simple random sampling. The data collection techniques used in this study used data collection tools, namely: tests and questionnaires, as follows:

Science Literacy Ability Test

The written test was used to obtain data on the students' grade IX scientific literacy ability using 20 multiple-choice questions. The test questions arrange according to several aspects of scientific literacy, namely: scientific content, scientific process, and scientific context. For more details shown in Table 1.

Table 1. Scientific Literacy Ability Aspects

| No | Scientific Literacy Aspects | Indicator |
|----|-----------------------------|---|
| 1 | Science content | Relevant to the real situations The important knowledge so that is use long term Suitable for children 15 years old development level |
| 2 | Science process | Identify scientific issues Explaining phenomena scientifically Using scientific evidence |
| 3 | Science context | Health Natural resources Environmental quality Danger Science and technology development |

Source: PISA, 2009

The test material is a nine-level biological material based on basic ability 3.2, that is, the analysis of the reproductive system of animals and plants and the application of technology in the reproductive system of animals and plants. The data were analyzed descriptively to determine the results of the analysis of students' biological scientific literacy ability. The test consists of multiple-choice questions, students' who answer correctly get a score of 1, and students who answer incorrectly get a score of 0. Then calculate the total score obtained by students' and calculate the average score. The maximum score that students get if they answer all questions correctly is 20. The following formula using in processing students' scientific literacy scores.

$$LS \text{ scores} = \frac{n}{N} \times 100$$

Description:

LS = value of the scientific literacy

n = score obtained by students'
 N = mac score
 100 = fixed number
 (Purwanto, 2013).

The results obtained are then described based on the range with the intervals of Table 2.

Table 2. Interpretations of Test Scores Criteria

| Range | Criteria |
|----------|-----------|
| 86 – 100 | Very High |
| 76 – 85 | High |
| 60 – 75 | Medium |
| 55 – 59 | Low |
| ≤ 54 | Very Low |

3. Results and Discussion

Results of scientific literacy skills were carried out on grade IX students' at Ujung Batu Junior High Schools accredited "A". Data collection techniques used tests and questionnaires given according to scientific literacy indicators, aspects of scientific literacy in namely: science content, scientific process, and science context. Documentation of the activity is shown in Figure 1.



Figure 1. Documentation of Data Collection on Grade IX Students' at Ujung Batu Junior High Schools

The assessment of scientific literacy is not merely a measurement of the level of understanding of scientific knowledge but also an understanding of various aspects of the scientific process as well as the ability to apply knowledge and scientific processes in real situations faced by students, this means that the assessment of scientific literacy is not only oriented towards mastering science material, but also on the mastery of life skills, thinking skills, and the ability to carry out scientific processes in the real life of students' (Yuliati, 2017). The basic qualities of scientific literacy include the ability to apply science and an understanding of life situations involving science (Jamaluddin et al., 2019).

Biological Science Literacy Ability Based on Aspects of Science Content

Student achievement for biological science literacy on the test analyses to determine students' insight, knowledge, and mastery of the material. The Science Literacy Tool for Science Content consists of 6 questions. The scores obtained by students in the aspect of science content are shown in Table 3.

Table 3. Percentage of Biological Science Literacy Ability Based on Aspects of Science Content

| No | Question Number | Total Score of Students' Who Answered Correctly | Percentage (%) | Criteria |
|----------------|-----------------|---|----------------|---------------|
| 1. | 1 | 175 | 63,18 | Medium |
| 2. | 2 | 269 | 97,11 | Very High |
| 3 | 3 | 244 | 88,09 | Very High |
| 4. | 4 | 237 | 85,56 | High |
| 5. | 7 | 196 | 70,76 | Medium |
| 6. | 10 | 62 | 22,38 | Very Low |
| Total | | 1183 | 427,08 | |
| Average | | | 71,18 | Medium |

Based on the data, Table 3 shows that the highest score of the question is question number 2 with a total score of 269 (63.18%) with medium criteria. This question describes the breeding of the Cocor Bebek (*Bryophyllum*) plant. While the question that has the lowest score is question number 10 with a total score of 62 (22.38%). This problem describes the distribution of seeds in angiosperms. Overall, the average for science content is 71.18%, a medium standard.

Based on the explanation above, it can analyze that in question number 2 most of the students have been able to answer well, this is because the question is an aspect of science content that is experienced and discovered by students in everyday life. While in question number 10, only a small number of students can answer correctly. This item is possible because the question is part of new knowledge that is not necessarily owned by every student. But overall, questions related to science content were answered well by students'. According to the statement Suciati et al., (2013) that science content refers to the key concepts of science needed to understand natural phenomena and natural changes that occur through human activities. This fact can shed light on various aspects of the physical environment (Narut & Supardi, 2019).

Biological Science Literacy Ability Based on Science Process Aspects

The scientific process of students' achievement of biological science literacy tests was analyzed to determine students' ability to understand the nature of science and students' scientific processes in solving a problem. The Science Literacy Tool for Science Content consists of 9 questions. Average student achievement based on science process scores is shown in Table 4.

Table 4. Percentage of Biological Science Literacy Ability Based on Aspects of the Science Process

| No | Question Number | Total Score of Students' Who Answer Correctly | Percentage (%) | Criteria |
|----------------|-----------------|---|----------------|------------|
| 1. | 5 | 132 | 47,65 | Very Low |
| 2. | 6 | 126 | 45,49 | Very Low |
| 3. | 8 | 216 | 77,98 | High |
| 4. | 9 | 144 | 51,99 | Very Low |
| 5. | 11 | 268 | 96,77 | Very High |
| 6. | 12 | 43 | 15,52 | Very Low |
| 7. | 13 | 217 | 78,34 | High |
| 8. | 14 | 186 | 67,15 | Medium |
| 9. | 15 | 157 | 56,69 | Low |
| Total | | 1489 | 537,56 | |
| Average | | | 59,73 | Low |

Based on the data, Table 4 shows that the highest question score is question number 11 with a total score of 268 (96.77%) with very high criteria. This question discusses the phenomenon of reproductive technology in cows. While the question that has the lowest score is question number 12 with a total score of 43 (15.52%). This problem describes the process of metagenesis in ferns. Overall, the average for the scientific process is 59.73%, which is a low standard.

Based on the explanation above, shows that not all students are able to work on questions that discuss aspects of the scientific process well. However, some of the questions were answered by some students'. It's This means that students' are not good enough to address scientific literacy issues in all aspects of the scientific process. According to Sriyati et al., (2011) In the scientific process refers to the mental process in answering questions from problems that arise, such as identifying and interpreting evidence and explaining conclusions. Scientific literacy views the importance of thinking and acting skills that involves mastering thinking and using scientific thinking in recognizing and responding to social issues (Pratiwi et al., 2019).

Biological Science Literacy Ability Based on the Aspects of the Science Context

The context of students' science in the achievement of biological science literacy tests analyses to determine students' ability to understand the nature of science to apply science concepts. The scientific literacy instrument in the context of science consists of 5 questions. Average student grades based on science background scores are shown in Table 5.

Table 5. Percentage of Biological Science Literacy Ability Based in Science Context Aspect

| No | Question Number | Total Score of Students' Who Answer Correctly | Percentage (%) | Criteria |
|----------------|-----------------|---|----------------|-------------|
| 1. | 16 | 243 145 | 87,73 | Very High |
| 2. | 17 | 145 | 52,35 | Very Low |
| 3. | 18 | 205 | 74,01 | Medium |
| 4. | 19 | 247 220 | 89,17 | Very High |
| 5. | 20 | 220 | 79,42 | High |
| Total | | 1060 | 382,68 | High |
| Average | | | 76,54 | |

Based on the data, Table 5 shows that the highest question score is question number 19 with a total score of 247 (89.17%) with medium criteria. This question discusses the dangers of a rat population explosion. While the question that has the lowest score is question number 17 with a total score of 145 (52.35%). Learn about amber flower reproduction in this issue. Overall, the average value in the context of science is 76.54% with high criteria.

Most of the questions were answered by most of the students'. It means that most students are able to apply science concepts in solving everyday problems. As stated by Kusuma (2016), the context of the application of science emphasizes more on everyday life, as well as applying the concepts of science in solving everyday problems, both in the fields of life and health, the earth and the environment and technology.

Biological Science Literacy Ability of Students' Grade IX at Ujung Batu Junior High Schools

The calculation of the average value based on the total score aims to describe the achievement of students' scientific literacy from all aspects of the assessment. The average value based on the total score achieved by students is shown in Table 6.

Table 6. Percentage of Biological Science Literacy Ability of Students' Grade IX at Ujung Batu Junior High Schools

| No | Aspect | Total Scores | Value (%) | Category |
|----------------|-----------------|--------------|--------------|---------------|
| 1. | Science Content | 1183 | 71,18 | Medium |
| 2. | Science Process | 1489 | 59,73 | Low |
| 3. | Science Context | 1060 | 76,53 | High |
| Total | | 3732 | 207,44 | Medium |
| Average | | | 69,15 | |

Table 6 shows that the value of the highest scientific literacy aspect is in terms of the scientific context aspect, which is 76.53. The lowest value was in the scientific

process aspect, with a value of 59.73. However, the average score in the achievement of scientific literacy ability of students' grade IX at Ujung Batu junior high school has a score of 69.15 in the medium category.

The factor that causes the students' scientific literacy ability to be not greatest is that according to students' the questions given on the scientific literacy test are more difficult than the exam questions that giving by the teacher. This response is because students' do not know about PISA characteristic questions and also the teacher's lack of knowledge about the development of scientific literacy so that students do not know information about PISA and the characteristics of the PISA questions. According to Pulungan (2014) information obtaining that the teacher's very little knowledge about scientific literacy caused success in achieving scientific literacy not to maximize. The PISA feature questions require a high level of understanding of reasoning and problem-solving.

Someone who has scientific and technological literacy characterizing by having the ability to solve problems with scientific concepts obtained in education according to their level, recognizing technology products that are around them and their impacts, being able to use technological products and maintaining them, creative in making simplified technological results. so that students are able to make decisions based on the values and culture of the community (Toharudin et al., 2011). The application of a scientific approach can train scientific literacy in the competence domain and knowledge domain of junior high school students in science subjects (Novili et al., 2017). The meaning of applied science learning emerges when students' are scientifically literate (Bagasta et al., 2018). Consistent with Jufrida et al. (2019), science learning must be oriented towards scientific literacy development in order to improve student achievement.

4. Conclusion

The scientific literacy ability of students' grade IX at Ujung Batu Junior High Schools based on the results of research through test questions and questionnaire sheets given, students' have quite good scientific literacy skills with the results obtained in the medium category. Based on the aspect of scientific literacy, we get: (1) the medium category of scientific content; (2) the moderate category of the scientific process, and (3) the moderate category of scientific context. Scientific literacy can be used as a reference for the development of Biology learning because scientific literacy is considered efficacious to developing biology learning in Junior High Schools.

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