Analysis of Scientific Literacy Ability Junior High School Students in Science Learning on Environmental Pollution

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Abstract: The development of science in the 21st century science has an important role, especially natural science. Scientific developments in the field of education require students to have skills that will continue to be used to improve the quality of human resources. One of the skills needed is scientific literacy skills which are important for students to have because they can make students not only memorize subject matter but can make students able to understand and analyze science concepts and processes that occur contextually. Scientific literacy has indicator aspects namely explaining phenomena scientifically, evaluating and designing scientific investigations, and interpreting data and evidence scientifically. This research is descriptive research. Research subjects of grade 8 students in the academic year 20 21/2022. The purpose of this study was to analyze the scientific literacy abilities of SMPIT Al-Ghozali students in science learning on environmental pollution. Data collection techniques used scientific literacy tests with reference to aspects of scientific literacy indicators and interviews. The results showed that students' scientific literacy achievement was 54.14% with sufficient criteria and the highest achievement indicator was 60% in the aspect of the indicator explaining phenomena scientifically. The results of this study indicate that students' scientific literacy needs to be improved in science learning activities

Keywords: Environmental Pollution; Science Learning; Scientific Literacy Skills

Introduction

The development of science and technology in the 4.0 revolution era in the 21st century, Natural Sciences has an important role in determining the quality of human resources so that they have various skills. These skills can be prepared for all levels through education. Education can be said to be the main basis for contributing to all sectors that students need both skills and knowledge (Choi et al., 2019). The main focus of education in this century is 21st century skills, especially in science education (Nina et al., 2020). Science education which contains science learning is important for students to have because science learning will continue to develop in improving the quality of human resources and developing rapidly according to the times (Mills et al., 2019). Therefore, in 21st century learning, the target of learning should not only be learning outcomes, but also skills that accommodate students' skills needed in the 21st century.

There are several important skills that must be possessed by students in the 21st century. *The World Economic Forum* (2015) states that there are three components that students must have at every level of education, namely: basic literacy, competence, and personal character. Basic literacy consists of five literacy, namely: literacy, numeracy, science, digital, financial. Scientific literacy is an important literacy for students to have in learning science. The science curriculum emphasizes scientific literacy skills that students must have because these skills are closely related to developments in the 21st century (Haug & Mork., 2021). Scientific literacy is an understanding of scientific concepts and processes that allows students to be able to make decisions with their knowledge (Hasasiyah et al., 2020). Scientific literacy is important for students to have in carrying out learning activities, especially learning

natural sciences. The importance of scientific literacy has become an international concern, especially in the field of science education. This scientific ability can make a person take advantage of scientific progress to make decisions and accept alternative points of view based on scientific evidence (Sultan et al., 2021). Thus, the scientific ability can facilitate one's welfare, social, and economic.

The scientific literacy ability has many benefits for students in understanding science in everyday life. However, in fact the results of scientific literacy in Indonesia are still not encouraging. This is shown from the results of *the Program for Student Assessment* (PISA) survey from 2000 to 2018 which showed low results, because they were below the average PISA passing requirements. The results of the scientific literacy test conducted by PISA determined that Indonesia was ranked 70th out of 78 participating countries and for almost the last 20 years Indonesia has been at the bottom (OECD, 2019). This is in accordance with several studies conducted by researchers in Indonesia regarding the profile of scientific literacy abilities, including by (Nofiana, 2017; Merta et al., 2020; Sujudi et al., 2020; Zulaiha & Kusuma, 2021) all of which state that literacy skills science junior high school students in his place belong to the low criteria. Thus, science learning needs to apply aspects of scientific literacy to be able to overcome the low scientific literacy.

The importance of scientific literacy is revealed in school curriculum standards in many countries in international studies, for example PISA, OECD. Scientific literacy plays a role in learning related to cognitive achievement and competence in science, where from these two competencies students are expected to be able to perform the following abilities: asking or determining answers to questions originating from curiosity, describing, explaining, and predicting natural phenomena, read with an understanding of articles about science, identify scientific issues, evaluate arguments based on evidence and apply appropriate argument conclusions (Reiska et al., 2015). On the other hand, according to PISA (2015) scientific literacy consists of aspects: explaining phenomena scientifically, evaluating and designing scientific investigations, and interpreting data and evidence scientifically. This aspect of scientific literacy enables students to be creative in making decisions to solve problems in a social environment. However, there are still many students who have not implemented scientific literacy and make students unable to apply these aspects of scientific literacy.

Students still have many difficulties in applying scientific literacy and its aspects to science learning. These difficulties can make students' scientific literacy levels low. This makes it similar to research (Anshar et al., 2023) which states that the analysis of scientific

literacy in junior high school students shows a low category due to factors such as a lack of interest in reading, evaluation tools, and the teacher's lack of knowledge about scientific literacy. In research conducted by (Srihanaty et al., 2022) students' scientific literacy skills in several schools stated that students' scientific literacy was in the low category. The low scientific literacy can be overcome by studying one of the science learning materials that can be related to the environment around students.

Environmental pollution material is one of the materials that can be applied to students' daily lives. Environmental pollution material is one of the materials chosen because there are still many people's behaviors that can pollute the environment. This material is closely related to students' scientific literacy which is still low as can be seen from the behavior of students who still often litter, have not sorted out organic and inorganic waste and in learning environmental pollution material, many students are still passive and lazy to read about this material (Mudawamah, 2020). This environmental pollution material is also one of the right materials if used to increase students' scientific literacy. In accordance with research conducted by previous studies which stated that when in science learning students were given real examples and given worksheets for reflection on environmental pollution material, the level of wanting to read literature about the environment and their attitude of caring for the environment increased (Kurokawa et al., 2023). Therefore, environmental pollution material is suitable for measuring scientific literacy abilities of junior high school students.

Based on the description above, it is necessary to analyze students' scientific literacy abilities in science learning on environmental pollution. Thus, this research is entitled "Analysis of Science Literacy Ability of Junior High School Students in Natural Science Learning on Environmental Pollution Materials"

Method

This research uses descriptive research which aims to analyze the scientific literacy skills of SMPIT Al-Ghozali students in science learning on environmental pollution. The research subjects were class VIII students for the 2021/2022 school year who learned about additives and addictive substances. Data collection techniques using written tests and interviews with science teachers. The instrument used is a scientific literacy ability test developed by the author with reference to indicators of scientific literacy. The questions used are in the form of description questions of 10 questions. The indicator will be in the written test questions. Scientific literacy questions using reference to the scientific literacy indicators listed in Table 1.

Table 1. Science Literacy Indicators

Science Literacy Indicator
Explain phenomena scientifically
Evaluating and designing scientific investigations
Interpret data and evidence scientifically

(PISA, 2015)

To find out students' scientific literacy using the following scientific literacy criteria:

Table 2. Criteria for Scientific Literacy Score

Score	Criteria
86-100	Very good
72–85	Good
58–71	Enough
43–57	Low
≤ 43	Very low

(Erniwati et al., 2020)

Result and Discussion

This study analyzed the scientific literacy abilities of junior high school students in learning science on environmental pollution. This analysis was conducted to determine scientific literacy skills at SMPIT Al-Ghozali in class VIII students who studied environmental pollution. Students' scientific literacy abilities can be seen from the results of scientific literacy tests done by students. The percentage of data on students' scientific literacy test results can be seen from Table 3.

Table 3. Percentage of Scientific Literacy Criteria

Category	The number of students	Percentage (%)
Good	6	28.57
Enough	12	57.14
Low	1	4.76
Very low	2	9.52

From the percentage results in table 3 it is illustrated that the analysis of students' scientific literacy shows that most students get sufficient criteria in their scientific literacy skills. The criterion is sufficient with a total of 12 students and a percentage of 57.14%. The achievement of scientific literacy still gets a lot of sufficient criteria and not all students get good criteria because there is still a lack of students in analyzing and understanding the scientific literacy questions that have been done. Students' lack of interest in reading is the cause of students' lack of memory in working on scientific literacy questions. The low initial understanding of students in explaining scientific phenomena in questions will make it more difficult for students to analyze, evaluate and make conclusions on scientific literacy questions. In addition, in learning teachers still do not apply aspects of scientific literacy. Students must be accustomed to applying aspects of scientific literacy, accustomed to reading about the

subject matter to be studied and must also be familiar with questions that are contextual with real life that surround students.

Based on research (Fuadi et al., 2020) states that there are several factors causing low scientific literacy including low interest in students' reading, learning that is carried out is not contextual, and students have misconceptions in understanding and analyzing the scientific literacy questions they are working on. Another study conducted by (Putri et al., 2022) states that students only memorize the material provided by the teacher without understanding, applying and re-reading the material provided by the teacher to students. These factors affect that not all students can have good student scientific literacy skills. The results of interviews with students also stated that students only copied the material provided by the teacher and did not reread it when the lesson was finished. While the results of interviews with teachers stated that teachers still had not implemented scientific literacy in learning, especially science learning. Therefore, support from teachers in the form of directions for students who are able to learn or re-read learning material independently must be applied so that students can increase scientific literacy in students (Holbrook et al., 2009). In addition, the achievement of aspects or indicators of scientific literacy is also one of the things that can be analyzed on the scientific literacy test.

The results of the scientific literacy test can also be known from the achievement of indicators or aspects of scientific literacy. Achievement of indicators of scientific literacy test results can be seen through Table 4.

Table 4. Percentage of Science Literacy Indicators

Science Literacy Indicator	Percentage (%)
Explain phenomena scientifically	60
Evaluating and designing scientific investigations	25
Interpret data and evidence scientifically	15

Based on the research results shown in Table 4, it shows that the aspect of scientific literacy shows that the first aspect or indicator, namely explaining phenomena scientifically, gets a percentage of 60% and the aspect with the lowest percentage, namely interpreting data and evidence scientifically is 15%. The lowest aspect or indicator, namely explaining phenomena scientifically, is at the highest percentage among other indicators because it is easier for students to explain a phenomenon presented in the simple knowledge that students have compared to analyzing the phenomenon presented in the problem. The indicators interpret data and evidence scientifically with the least percentage because in interpreting data and evidence scientifically students still have difficulty, this is because students only memorize theories and concepts that have been

presented by the teacher. However, students never try to apply scientific phenomena and phenomena that occur around them in everyday life, so it is difficult for students to interpret data and evidence scientifically.

Based on research (Rahmadani et al., 2022) states that aspects or indicators that explain phenomena scientifically are classified as moderate criteria and aspects or indicators of data interpretation are classified as low criteria. The aspect of explaining phenomena is higher than the aspect of interpreting data and evidence scientifically in accordance with research conducted by Ziedler (2009) which states that students' habits only memorize material when doing assignments rather than using their thinking skills. Other research also states the same thing that the aspect of explaining high scientific phenomena is 57% and the lowest is the aspect or indicator of deciding solutions from solving the same problem by interpreting data and evidence scientifically (Rohmah & Hidayati, 2021). Thus, students' scientific literacy is still in the sufficient criteria and aspects or indicators of interpreting data and evidence scientifically still get a fairly low percentage, so that students' scientific literacy still needs to be improved, especially in science subjects.

Conclusion

The results of this study regarding the analysis of students' scientific literacy abilities can be concluded that the average value of scientific literacy abilities of SMPIT Al-Ghozali students is classified as sufficient with a percentage of 57.14%. In addition, the achievement of aspects or indicators of scientific literacy is not evenly distributed, but only the aspect of understanding scientific phenomena is classified as high, namely 60% and the lowest is in the aspect of interpreting data and scientific evidence. Factors that influence the results of the scientific literacy assessment are students' lack of interest in reading, learning that is not contextual, students only use copying and memorizing methods but do not understand science, and the teacher's lack of knowledge about scientific literacy. Suggestions for future researchers who test scientific literacy should use test instruments that have different levels on each question tested on students.

Acknowledgements

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