Science Learning and Environment : Analysis of Student's Scientific Literacy Based on Indonesia's Waste Problem

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ABSTRACT
The purpose of the study to analyzes 7th junior high school student's scientific literacy about Indonesia's waste problem. The study used survey research. The subject of the study was students of 7th-grade junior high school by using random sampling. The instrument was arranged based on the scientific literacy aspect, according to the OECD. The data were analyzed by using quantitative descriptive. The result shows that all of the competence domains are in the medium category and the average of all aspects was 58,6. The result of each aspect to explaining phenomena scientifically was 57,14 %, evaluating and designing scientific inquiry was 58,95%, interpreting data and evidence scientifically was 64,3%. The criteria of scientific literacy category was developed based on the answer each item. The Student's scientific literacy was facilitated by Problem Based Learning (PBL) model on the learning.

Keyword : *Scientific literacy, Indonesia's waste problem, Problem based learning*

1. INTRODUCTION

The 21st century learning is learning that is focuses on developing technology and student visual literacy. Furthemore, in the 21st century science and technology are indispensable in various aspects of life in society[1], [2]. The competencies needed in the 21st century are "The 4C" they are communication, critical thinking, collaboration and creativity. They have been packaged in the 2013 Curriculum learning process. In 2013 curriculum, students are expected to have high scientific literacy. Scientific literacy is the ability to relate existing issues to scientific knowledge and scientific idea. To develop scientific literacy, several competencies are needed, there are explaining phenomena scientifically, evaluating and designing scientific inquiry interpreting data and evidence scientifically [3]. Students skills for decision making, critical thinking skills and basic knowledge are also included in scientific literacy skills [4]. Scientific literacy focuses on developing students's knowledge of meaningful science concept, critical thinking and overcoming problems that have relevance to student life. However, in science learning several countries ignore to development of students's skills in the social dimension needed to actively participate in society [5]. Scientific literacy is also a necessary ability for harmony in a cultural environment [6] .

OECD programme for International Student Assesment (PISA) measures various student abilities, including student literacy. Seventy in countries including all 35 OECD, one of which Indonesia participated in the PISA asesement [7]. The result of PISA (Indonesia) be depicted in Figure 1.

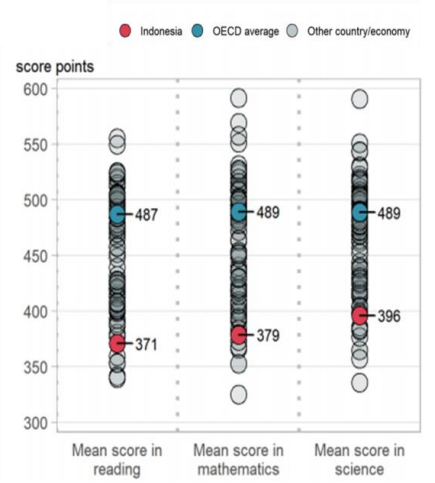

Figure 1 Indonesian PISA result 2018

The Figure 1 shows that Indonesia's score lower than OECD average, it explains that scientific literacy of students in Indonesia were low.

Indonesia is one of the countries where plastic waste is a huge problem. Currently, Indonesia is second country after China when it comes to dumping plastic waste into the oceans. Waste causes various kinds of pollution, including soil, air and water or ocean. Not only that, many problems can occur due to waste, including decreased soil quality, disease of humanity, death of marine animals, poisoning due to microplastics etc. Items of waste problem that are adjusted to the context items in the PISA science assesment. The context item is environmental quality at the national/local scope, the category is disposal of waste [7]. Furthermore, the students's scientific literacy ability in the context of waste in the world and managing it is essential to master seeing the increasing waste problem in Indonesia . Therefore, this study purpose to analyze ability of the scientific literacy of junior high school students on environmental pollution topics.

2. METHOD

This study used survey research and quantitative descriptive research method. Subject in this study was 32 students of 7 th grade of junior high school in Yogyakarta in the even semester of the academic year 2020/2021. The technique of selecting sample (students) uses random sampling. The form of questions in this study is multiple choice and there are 12 questions about waste problem in Indonesia and the topic of grade 7 namely environment pollution. The instrument of questions about scientific literacy adapted by Ida Nur Fatmawati (2015) [8]. Instrument were arranged by competencies in OECD [9].

After obtaining data from students based on the questionnaire, the data was processed using the following formula

$$\text{Percentage value (\%)} = \frac{\text{score obtained}}{\text{maximum score}} \times 100\ \% \qquad (1)$$

Meanwhile, to investigate score of scientific literacy using score the rubric was developed based on the answer each item. The results of the rubric score are converted into five criteria according to Table 1. The conversion of the rubric score aims to describe, analyze and categorize students' scientific literacy skills.

Table 1. Categories of scientific literacy skills.

Precentage Score (%)	Criteria
0-20	Very low
21-40	Low
41-60	Medium
61-80	High
81-100	Very high

3. RESULT AND DISCUSSION

The study was to analyze the junior high school students' scientific literacy in Yogyakarta. The topic of study was Indonesia's waste problem and managing it. One strategy for educators to increase scientific identification of science topics of interest and integrate into teaching literacy topics in science classrooms is a curriculum. Science teacher should make list of interesting and important topics before planning their lesson. After that, the teacher add the interest topic to learning and hope students will enjoy to studying [2]. Indonesia's waste problem is an essential topic for everyone, and one of them is a junior high school student. The topic was include the subject material of Junior High School. The 12 questions tested students' scientific literacy and the descriptive analysis was presented on Table 2.

Table 2. Result of students's scientific literacy generally

Parameter	Score
Total Score	225
Number of students	32
Average score	6,65
Precentage (%)	58,6
Category	Medium

Table 2 showed the general category of students' scientific literacy is medium. Result of the study

showed that scientific literacy is medium category while result of PISA 2018 is low category. Differences of the category may be affected by various factor, the example development of test, number of participant, ability of students, etc. However, both results indicate that there is a need for improvement to achieve better scientific literacy and to get better score on teh next PISA. In the study, students' scientific literacy skills were based on 3 compentencies there were aspects of explaining scientific phenomena, aspects of identifying scientific issues and aspects of interpreting data and evidence scientifically [3]. The result of each competences was shown on Table 3.

Table 3. Data of student' scientific literacy based on competence

Knowledge	Competence Domain	Number of questions	Average	Category
Content	Explaining phenomena scientifically	8	57.6 %	Medium
Prosedural	Evaluating and designing scientific inquiry	2	58.95 %	Medium
	Interpreting data and evidence scientifically	2	64.3 %	Medium

Table 3 shows average presentage of competence's scientific literacy. From the table showed that each of competence is in medium category. Furtheremore, the result were presented in Figure 2.

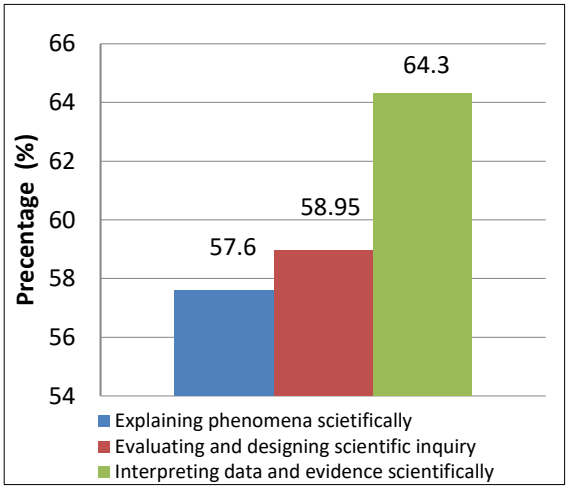

Figure 2 Average precentage of scientific literacy in each compentence

The Figure 2 showed that all of competence domain is in medium category and the higest percentage were interprete data and evidence scientifically. From that, also showed that some students haven't know about waste problem in Indonesia although many information discuss about it. Through student's knowledge about waste and the effect, it was hoped can invite student to reduce waste especially plastic waste around them. Result of each competence shows a certain ability in students. Explain phenomena scietifically competence shows that students need to practice a lot in order to improve their understanding of science concepts that are integrated with natural phenomena, especially environmental pollution or waste in Indonesia. Evaluate and design scientific inquiry competence shows that the student's inquiry ability needs to be improved. While the interprete data and evidence scientifically competence, shows the students need to practice to interpret data data from information in the approach scientific [10].

Lack of student's scientific literacy caused by many factors. One of the factors that influence students's scientific literacy is reading ability. The factor indicated that the reading ability of junior high school students is low. Lack of interest of reading can affect students' low literacy [11]. Besides reading ability, writing ability can increase student's scientific literacy skills. Students's ability to write popular science can help student to develop scientific literacy [12]. Designed an alternative environment from the informal environment in science learning can help to develop students' scientific literacy [13] . The cause of low literacy Indonesian student science is also caused by several things among others example : learning that is teacher centered, the low level positive attitude of students in studying science, there are several competencies that are not liked respondents (students) regarding content, process and context [14].

Improvement of scientific literacy skills can be improved through the science learning approach or method used by the teacher. Learning that is able to arouse students' curiosity regarding learning topics and encourage students to solve problems is part of

the aspect of scientific literacy [15]. Scientific literacy can be related to one of the learning models, there is Problem Based Learning (PBL). Some of previous research explain that PBL can improve students's scientific literacy value [16]. Through PBL, teacher can guide atudents to find a problem and train them to think about finding solutions of these problems [17]. The 5 stages of PBL were (1) Provide an orientation about problem, (2) organize students to learn , (3) Guiding student investigations individually or group, (4) Developing and presenting of problem solving results, and (5) Analyze and evaluate the problem solving process [18]. The use of PBL in scence learning can be used to develop scientific literacy in content and competency aspects. Inquiry skills are required to be given to junior high school students. Teachers can develop student's inquiry skills in science learning by PBL learning [19]. Based on the explanation above, one of the ways to improve students's scientific literacy is by applying PBL to science learning . The stage of PBL can be adjusted according to the competence of scientific literacy.

4. CONCLUSION

The results of the research that have been carried out show that the student'scientific literacy skills especially three aspect is in medium category. The aspect of scientific literacy is explaining scientific phenomena for content knowledge, aspects of identifying scientific issues and aspects of interpreting data and evidence scientifically for prosedural knowledge. Science learning by PBL model can facilitate to improve students' scientific literacy.

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