



Student Teaching Materials and Science Literature in Science Learning during the COVID-19 Pandemic

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ABSTRACT

The research aims to analyze the teaching materials needed by the teacher and the level of students' scientific literacy in the science learning process in the COVID-19 pandemic era. The descriptive quantitative method was utilized in the present study. The subject of the survey is 35 science teachers in Bogor and 150 grade VIII students at one of the junior high schools in the Bogor district. The instruments used in this study were questionnaires and scientific literacy tests. The collected data were analyzed quantitatively by calculating the percentage acquisition of students' scientific literacy then categorized. The study results revealed that the teaching materials used were not proportional in containing aspects of scientific literacy; 50% of students have scientific literacy ability in the low category, 40% in the moderate category, and 10% in the high category. The questionnaire results indicate that the factors affecting students' scientific literacy are their interest in science, learning motivation, teacher strategies in learning, and the facilities.

INTRODUCTION

At the beginning of 2020, the world was shocked by the outbreak of the coronavirus or Coronavirus disease 2019 (COVID-19). The COVID-19 pandemic is the most significant health crisis facing the entire world (Ahorsu et al., 2020; Pan, 2020; Salzberger et al., 2020). This outbreak originated in Wuhan, China (Tian et al., 2020); the COVID-19 infects the respiratory tract and can even cause death (Yuliana, 2020). COVID-19 spread to Indonesia in February 2020 and became a pandemic because the virus spread over a wider geographic area. This pandemic case has also had a significant impact on various sectors such as the economy, transportation, politics, and even the education system in Indonesia, where distance learning has been carried out since March 2020.

On the advice of WHO, world leaders have promoted a new life order (new normal), and people must be prepared to face this transition to a new normal. The United Nations Educational, Scientific, and Cultural Organization (UNESCO) has, since March 4, 2020, advised the use of distance learning and opened up educational platforms that schools and teachers can use to reach students remotely and limit educational interruptions (UNESCO, 2020). Closing schools and implementing distance learning is one of the effective ways to prevent the spread of diseases and viruses to school residents (Jackson et al., 2013). Educators need to wisely interpret Distance Learning (i.e., PJJ) in the midst of a pandemic. Implementation of PJJ requires the education system's readiness that includes teachers, students, schools, and parents in the face of sudden PJJ panic attacks. Teachers, students,

and parents must adapt quickly in order to get through the challenges of education amid this pandemic.

The challenge of science education is because of the COVID-19 pandemic and the acquisition of student scientific literacy. Scientific literacy is one of the skills needed in the 21st century. Scientific literacy is the knowledge and understanding of scientific concepts, the scientific processes that people need to make decisions, as well as participation in civil and cultural affairs and economic productivity; scientific literacy also includes certain types of abilities (National Science Education Standards, 2016). Scientific literacy can train scientific thinking competence, which every citizen must reflect scientific knowledge in everyday life. Scientific thinking will be beneficial in following the rapid development of science and technology (Hendri, 2019).

The following abilities characterize someone who has scientific and technological literacy: (1) solving problems using scientific concepts obtained in education according to their level; (2) getting to know the technology products around them and their impacts; (3) using technology products and maintain them; and (4) creative in making simplified technological results so that students can make decisions based on the values and culture of the community. Indonesia's science literacy scores are still shallow; based on Trends in International Mathematics and Science Study (TIMSS) data, Indonesian students' scientific literacy scores from 1999-2015 only ranged from 397-510. In 2015, Indonesia ranked 44th out of 47 participants (Martin, 2016). Based on PISA, Indonesia is ranked 62 out of 70 participants with a score of 403 (OECD, 2016) and ranked 70th out of 78 countries with a score of 396 in 2018 (OECD, 2019). The data shows that the level of scientific literacy of students in Indonesia is low. Science literacy of junior high school students in Bogor City was still common in 2014 with an average score of 30% in all aspects. Students' scientific literacy increased to moderate in 2017 by implementing science literacy teacher development based on science literacy in science literacy science learning. Low scientific literacy does not only occur in students, but teachers who play a role as the main component in the learning process also have a low level of scientific literacy (Rubini et al., 2016; Rubini et al., 2017)

The success of science learning needs to be supported by appropriate and adequate learning tools. One of the learning tools that can help students learn is teaching materials. Suitable science teaching materials are teaching materials that contain components of scientific literacy, namely scientific knowledge (a body of knowledge), investigation of the nature of science (a way of investigating), science as a way of thinking (a way of thinking), and the interaction of science, technology, and society (interaction of science, technology, and culture). The research results by Ardianto & Pursitasari (2017) show that the circulating teaching materials cover four aspects of scientific literacy. Still, these teaching materials do not yet contain the components of scientific literacy in a balanced way. Teaching materials are still focused on scientific knowledge, such as presenting facts, concepts, principles, laws, and others, but contain a little investigation of the nature of science as a way of thinking and the interaction of science, technology, and society.

Pursitasari et al. (2019) explained that the scientific literacy of Indonesian students is still low and the teaching materials used have not trained students to understand the nature of science. Therefore, students' scientific literacy needs to be improved through teaching materials that present natural phenomena and problems that occur around students. An

adequate understanding of the nature of science is expected to understand the content of science by cultivating the ability to connect scientific concepts so that scientific knowledge will be obtained in an integrated manner (Nelson et al., 2019). During the COVID-19 pandemic, learning was carried out online using various applications such as Whatsapp, zoom meeting, google classroom, google meet, and others. The implementation of online learning also uses teaching materials to understand science subject matter and the nature of science well. Therefore, it is necessary to conduct research on teacher assessments of teaching materials used in science learning and students' scientific literacy during the COVID-19 pandemic.

RESEARCH METHOD

Participants

The sample in this study were 35 science teachers in Bogor and 150 junior high school students in class VIII. Sampling was done by purposive sampling. The instrument used in this study was a questionnaire for teachers and students to analyze the need for teaching materials during the COVID-19 pandemic and a scientific literacy test that was tested on students with 20 multiple-choice questions.

Instrument and Procedures

This study uses a quantitative descriptive method that aims to describe a situation in natural conditions comprehensively and accurately (Fraenkel et al., 2012). The scientific literacy test was used to assess students with 20 multiple-choice questions. The steps used in this study are contained in Figure 1.

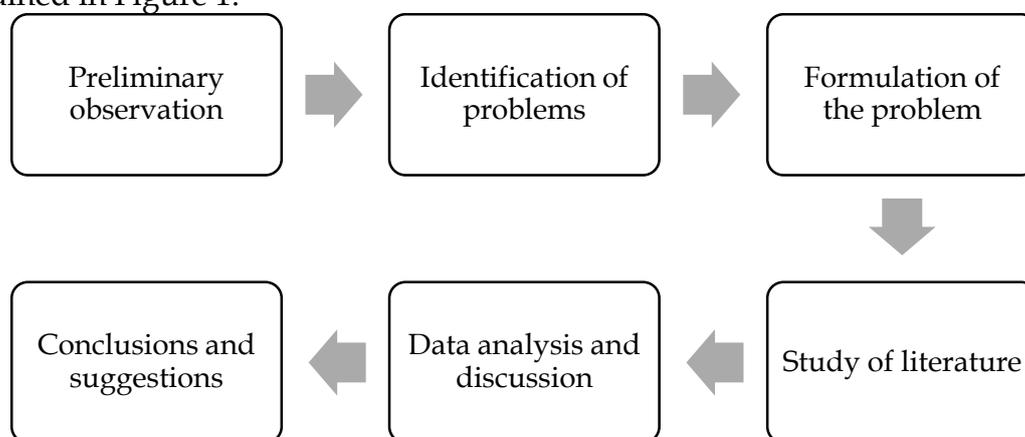


Figure 1. Research procedure flowchart.

Data Analysis

The scientific literacy ability of students is the score obtained by students after taking a scientific literacy ability test which refers to scientific literacy indicators in the aspect of competence, namely identifying scientific problems, explaining scientific phenomena, and using scientific evidence. Science literacy scores in students were analyzed using the following equation:

$$\text{Score} = \sum \frac{X}{X_t} \times 100\% \quad (1)$$

Note : $\sum X$ = Total value of acquisition
 $\sum X_t$ = Overall total value

The percentage of achievement of scientific literacy is then interpreted with a table of criteria as Table 1.

Table 1. Score interpretation criteria (Arikunto, 2016).

Criteria Interval	Criteria
80 % N < 100%	Very high
66 % N < 79%	Tall
56 % N < 65%	Enough
40 % N < 55%	Low
N 39%	Very low

RESULTS AND DISCUSSION

Science learning carried out during the COVID-19 pandemic certainly encountered various problems. Based on the results of research conducted on 35 science teachers in Bogor, it is known that the learning process during this pandemic has not been effectively implemented. This is because of sudden conditions, no one can predict the outbreak of COVID-19, and there is no readiness to deal with it; the community must be ready to face the transition period to the new normal era. There are several obstacles when conducting online learning, including 1) lack of adequate online learning facilities and media; 2) there are materials that are difficult to convey online to students; 3) lack of skills of teachers and students in using technology; 4) teachers use learning media such as google classroom, google form, quiz, and WhatsApp, but in general students have not been able to understand the material well, because there are no adequate learning media. This is known based on student responses regarding online learning that has been implemented.

The research results of Azhari & Fajri (2021) stated that the implementation of distance learning during the COVID-19 pandemic was carried out through online education, various obstacles faced by teachers in Indonesia. Different online learning platforms are widely available but cannot be used directly by teachers to support learning implementation. In addition, geographical factors where students live, many students do not have access to a good internet network, and the financial ability of students' families is less supportive in the implementation of online learning with various online learning platforms.

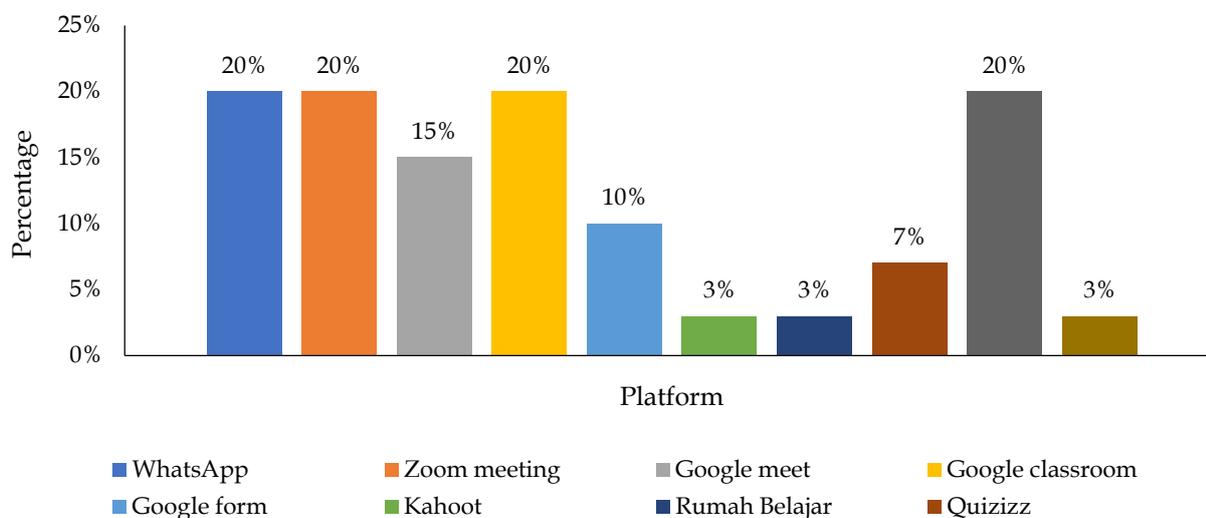


Figure 2. The use of online learning applications.

Furthermore, there are no clear technical guidelines and instructions for teachers in implementing distance learning, making teachers not have a reference in implementing distance learning, so teachers carry out different learning without any minimum standards in the implementation of distance learning. In addition to this, the teaching materials used are not proportional in containing aspects of scientific literacy. They have limited scientific literacy-based online teaching materials that can be accessed anytime and anywhere. Based on the results of the teacher's response to the use of teaching materials contained in online learning applications, it is shown in Figure 2.

Based on Figure 2, online learning media that are widely used are WhatsApp, Zoom meetings, Google classroom, learning videos via Youtube by 20%, and online learning media that are rarely used, namely Kahoot, Learning House, and Edmodo at 3%. The content contained in the teaching materials delivered through online media does not fully have aspects of scientific literacy; the proportion of content containing scientific literacy is only 20%. Most teachers cannot motivate students in the implementation of online learning, the learning strategies used by teachers, school facilities, and the teacher's lack of understanding in the use of online learning media facilities are also factors in delivering material to students because there are teachers who give assignments only in the form of students having to summarize the material. From textbooks or modules provided by the school. So that in delivering the material, the teacher seems monotonous and unattractive, it makes students bored, unable to develop potential, scientific literacy, and creativity optimally. Even though the teacher has made a video or given a video from Youtube, students don't need to understand the material presented. Students feel burdened because the video consumes too much quota to download it.

The results of the research by Kurniasari et al. (2020) explain that teachers are required to be able to design learning activities from home in a lighter, effective and creative way by utilizing the suitable media according to the material the teacher wants to convey. The types of assignments given must also be designed in such a way so that students remain enthusiastic in learning online and do not become a psychological burden. Although learning from home activities will provide wider opportunities to explore the material to be taught, the teacher must choose and limit the extent to which the material is covered. The application is suitable for the material and learning methods used. Teachers also need to give understanding to students that the task given during learning is not a burden, but a study is a process that must be passed to make it easier for students to understand the material.

Multimedia development as a solution to overcome educational problems that require the latest learning media innovations is needed (Corresponding, 2018). It is appropriate because media technology in learning must be following learning needs (Zhu, 2018). Multimedia has proven to improve the learning outcomes of junior high school students (Muhtadi et al., 2017). The use of multimedia can also provide understanding and motivation for students to learn (Osman & Lee, 2014). Teaching materials designed by teachers creatively, innovatively, contain aspects of scientific literacy, and are included in interactive multimedia are expected to motivate students and make it easier for students to carry out online learning in this pandemic era.

Based on the results of research on students at one school in Bogor Regency, it is known that teaching materials are needed that can support online learning so that it can be carried out correctly. The online teaching materials can be in educational magazines that can

contain exciting pictures and videos and motivate them to learn because students' interest in science and students' motivation to learn is still relatively low. Students' scientific literacy related to respiratory system material and COVID-19 is still low because based on the results of questionnaires and scientific literacy tests, students have not been able to apply health protocols properly, even though this must be accustomed from now on to prepare for the transition period to the new normal era and must implement health protocols to break the chain of COVID-19 spread. The facilities owned by students related to devices that support learning are also relatively minimal because each student has a different economic condition and students' residences are less able to access the internet properly, which affects students' scientific literacy during the pandemic. Based on the scientific literacy measurement test results for students, the results were obtained in Figure 3.

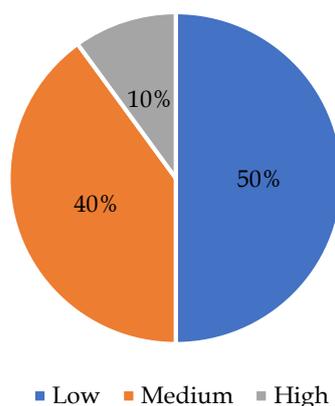


Figure 3. Student scientific literacy profile.

Figure 3 shows that the scientific literacy ability of students in the low category is 50%, the medium category is 40%, and the high category is 10%. The data explains the main problems in the science learning process in junior high schools. The test material given is relatively easy, namely about the respiratory system and COVID-19, it is hoped that all students will be able to complete it. The scientific competence identified in this study consists of three indicators that are adjusted to the 2013 PISA scientific literacy indicators. These indicators are; 1) identify scientific problems, 2) explain scientific phenomena, and 3) use scientific evidence. Data analysis of the percentage of correct answers on each indicator of scientific literacy competence can be seen in Table 2.

Table 2. Results of students' science literacy competence.

No.	Indicators	Scientific Literacy Achievement (%)
1.	Identify scientific problems	40.0
2.	Explain scientific phenomena	36.0
3.	Using scientific evidence	33.0
	Average	36.3

Based on the results of research obtained from written tests carried out by students, it was found that the average percentage of students' scientific literacy achievement as a whole was 36.3%. The ability of students to identify scientific problems is 40%. Students' ability to explain scientific phenomena got a result of 36%. This demonstrates that students' abilities are still lacking in recognizing problems and key characteristics of the situations contained

in the questions (Asyhari & Hartati, 2015). Then, students' ability to use scientific evidence got the lowest score of 33%. This illustrates that students' abilities have not been optimal in interpreting scientific evidence or drawing conclusions from the data presented in the problem. It can be said that students have not been able to describe a clear and logical relationship between evidence and conclusions (Wulandari & Sholihin, 2016). Based on the analysis of the questionnaire used in the study, it shows the factors that cause students' scientific literacy skills, namely student interest in science, learning motivation, teacher strategies in carrying out the learning process in the pandemic era, one of which is the existence of learning media that can support distance learning, school facilities, and other facilities. Students have at home.

The low scientific literacy of students is influenced, among other things, by the scientific literacy of teachers in the aspect of identifying scientific problems and explaining phenomena (Rubini et al., 2016) which also results in the learning carried out and the selection of teaching materials used by teachers (Rusilowati, 2016). According to Yuliati (2017), to improve scientific literacy skills besides requiring student motivation, teachers also need to consider learning strategies that are following the conditions and potential of students, which in the learning process focuses on providing direct experience and the application of the nature of science. However, the challenge teachers face in this era of the COVID-19 pandemic is the difficulty of monitoring students directly because of online learning, which is, of course, a direct learning experience. It is difficult to obtain so that it impacts students' low scientific literacy.

Scientific literacy combines attitudes, skills, and knowledge of students that need to be developed in terms of inquiry, problem-solving, decision making, even becoming lifelong learners, and maintaining curiosity about the world around them (Kermin, 2015). Students' scientific literacy needs to be improved because Indonesia's science score in 2018 was 396; it is hoped that in 2025 the PISA score could reach 500. Okada (2013) states that scientific literacy is interpreted as the ability to read and understand science and the ability to understand and apply principles of science in life. Everyone needs to have scientific literacy skills, but this ability has not been optimally trained in science learning. For example, the use of chemicals in everyday life, without being balanced with an understanding of the impact of their service, can cause various problems for themselves, their families, and the environment. Therefore scientific literacy is important for every student (Harlina et al., 2020).

CONCLUSION

The teaching materials used were not proportional in containing aspects of scientific literacy. The scientific literacy level of junior high school students is still low. Factors that cause students' soft scientific literacy skills are student interest in science, learning motivation, teacher strategies in carrying out the learning process in the pandemic era, and school facilities and facilities owned by students at home. The weakness of this research is the lack of depth in interviews or digging up information regarding the difficulties of teaching materials needed in the era of the COVID-19 pandemic because questionnaires are distributed online due to pandemic conditions, if observations and interviews directly to schools may be discussed in more depth. Further research that can be carried out is that the results of this research can be used as a reference for the development of interactive learning media that can improve students' scientific literacy in the era of the COVID-19 pandemic.

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