# The Study of Postgraduate Students' Scientific Literacy Based on the Ability to Solve the Environmental Problems

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**ABSTRACT**
This study aims to measure students' scientific literacy in their ability to solve environmental problems based on the COVID-19 issue. The main problem in this research is "How to improve students' scientific literacy in their ability to solve environmental problems based on the COVID 19 issue?" Based on the formulation of the main problem, several research questions can be formulated, including: (a) What is the understanding of postgraduate science education's students on the COVID 19 issue?, (b) What is the student's ability to solve environmental problems related to the COVID-19 issue? This study uses a mail survey technique considering that until this research was carried out it was still in a social distancing situation, so it was not possible to meet with respondents directly. Based on the results of the study, it can be concluded that students' scientific literacy related to environmental issues based on COVID-19 can be categorized as good because students can provide solutions to the problems asked.

***Keywords:*** *Scientific literacy, Problem solving skills, Environmental issues.*

## 1. INTRODUCTION

Science education is an essential material in the preparation of a reliable generation responding to the challenges of the modern era now. However, the quality of science education in Indonesia is still seen as poor compared to other countries in the world. This is indicated by the low scientific literacy level [1]. This condition causes the greatest number of pessimists to ensure that the Indonesian state can easily get out of all forms of crisis.

Scientific literacy is an important element of science education and is the primary objective of science learning [2]. This component is needed to develop knowledge, competencies and attitudes [3]. People with scientific knowledge will be aware of issues related to science and will be able to make decisions to improve their quality of life [4]. Scientific literacy is very positively related to problem-solving. Scientific literacy taught in a social context is very important for the development of science and provides opportunities for students to learn to make decisions [5]. Scientific literacy and social and environmental issues cannot be separated. Through good mastery related to scientific literacy, it is hoped that environmental and social issues can be resolved properly. The higher your literacy level, the quicker you can solve a problem.

Right now, the world is shocked by the spread of the coronavirus, which continues to expand into the global community. This is triggered by the growing number of deaths exposed to the lethal virus. As of August 25, 2021, 96% countries in the world have been infected with the coronavirus. The number of cases reached 216.77 million. The number of deaths reached 4.49 million people and that people recovered 193.70 million people (HTTPS: //www.worldometers.info/coronavirus/). The number of people exposed to the virus continues to rise and no one is able to predict when this coronavirus problem will end.

Even though Indonesia is a tropical country, the spread of COVID-19 is still high. This means that the temperature and humidity factors do not fully affect the spread of COVID-19 in Indonesia [6]. Indonesia is among the countries hardest hit by the COVID-19 pandemic in Southeast Asia. The mortality rate is comparatively high compared with other countries. According to data from

 

https://www.worldometers.info/coronavirus/country/indonesia/ by the end of August 2021, there were 4.07 million cases of coronavirus, 131,372 people died and 3.71 million people were cured. This information is not as high as in Europe and the United States, which are grappling with the COVID-19 pandemic. However, the trend in positive self-identification and the number of deaths that continue to rise have raised concerns in the community as a whole. Unless this is remedied immediately, the situation in Indonesia will worsen and will certainly be more alarming.

In dealing with scientific problems, one of the efforts that can be done is to build public awareness in responding to them. This means that the community must have good knowledge and understanding of developing issues, so that they are able to provide appropriate solutions to all problems. This concept is known as scientific literacy. Scientific literacy is very important to be mastered by the community. With good mastery of scientific literacy, the community will be more resilient in dealing with every problem.

The emergence of the Corona pandemic issue has become a challenge for the Unesa Postgraduate Science Education Study Program in continuing to develop students' scientific literacy skills, especially in solving environmental problems related to the COVID 19 issue. There are so many interesting things that can be done along with the social problems that are currently developing. . One of them is developing students' abilities in solving social scientific issues or SSI-based problems. SSI has the opportunity to provide opportunities for students to be actively involved in making decisions regarding problem solving through dialogue, discussion, and debate [7], and most importantly, SSI can help develop essential scientific skills to train citizens actively integrated with social issues [8].

This research is very important given the low understanding of the community regarding the COVID-19 issue and the low ability to solve related problems. One clear evidence is that some people still think that the corona virus is an ordinary influenza virus and is considered harmless. This causes some people to ignore the safety factor while still violating health regulations from the government. As a result, the number of victims exposed to the corona virus is increasing. The main problem in this research is "How is postgraduate student science literacy in terms of their ability to solve environmental problems based on the COVID 19 issue?" Based on the formulation of the main problem, several research questions can be formulated, including: (a) How is the understanding of S2 Science Education students on the issue of COVID 19? And (b) How is the student's ability to solve environmental problems related to the COVID-19 issue?

## 2. METHODS

This research is a survey research with the main focus is to measure students' ability to solve problems based on environmental issues. There are 6 stages in the research, namely defining the problem, identifying the target population, choosing data collection techniques, preparing instruments, conducting surveys in the field, and analyzing survey data. (1) Defining problems, the problem formulation is focused on the ability to solve problems based on the COVID-19 issue., (2) Identify the target population: The target population is all students in Science Education Program Postgraduate students Universitas Negeri Surabaya., (3) Data collection techniques: Data collection techniques using mail surveys. This is done considering the rules to comply with social distancing in order to reduce the spread of COVID-19., (4) Preparing instruments: Develop instruments together with the research team in accordance with the research objectives, namely measuring students' abilities in solving environmental issues-based problems regarding COVID-19., (5) Survey implementation: After all instruments are ready, they will be delivered in parallel to students. The survey implementation is given a time limit, (6) Analyzing the survey data: after all the data has been collected, an analysis of the survey results is carried out to be used to answer the research problems that have been formulated.

## 3. RESULTS AND DISCUSSION

To measure student literacy, research instruments were used which were compiled by the research team in accordance with the research indicators and then validated to three validators who were experts in the development of test instruments. The results of instrument validation are presented in Table 1.

Based on the results of instrument validation, it can be seen that the instrument developed by the researcher is considered suitable for use in research with an average value between 3.33 - 4.00 and it was said that valid [9]. Some of the notes submitted by reviewers are only related to technical problems in terms of writing, writing is recommended according to the Indonesian Spelling (EBI), consistency of use of terms, redundancy, and it is recommended to include references. Instruments that have been validated are then revised according to the validator's suggestions

**Table 1.** Validation results of three validators

| No. | Rated aspect | Validator Assessment Results | | | Average value |
|---|---|---|---|---|---|
| | | Validator I | Validator II | Validator III | |
| 1 | The suitability of the questions with the indicators. | 4 | 4 | 3 | 3,67 |
| 2 | Clarity of instructions for doing questions | 4 | 2 | 4 | 3,33 |
| 3 | Ease of understanding the information on the question | 4 | 3 | 3 | 3,33 |
| 4 | Opportunity questions can be done | 4 | 3 | 3 | 3,33 |
| 5 | The sentence in the question does not have a double meaning | 4 | 3 | 3 | 3,33 |
| 6 | The language used is communicative and easy to understand | 4 | 3 | 4 | 3,67 |
| 7 | The instrument can be used to measure the ability to solve problems | 4 | 4 | 4 | 4,00 |

Note: minimum score is 1 and the maximum score is 4

The questionnaire on environmental issues-based scientific literacy consists of 10 open-ended questions. The questions are arranged based on the readings presented on the questionnaire sheet that is submitted to the students. The question and answer can be seen in Table 2.

**Table 2.** Students answer recapitulation

| Questions | Students' answers |
|---|---|
| What are the behaviors or actions to be able to leave the house to shop but avoid COVID-19? | ● Maintain personal and environmental hygiene.<br>● Adhere to health protocols.<br>● Utilize e-commerce to shop online from home. |
| Give solutions or suggestions so that you can still work in the office but avoid Covd-19? | ● Office space should have open ventilation.<br>● Office employees must continue to apply health protocols before entering the office and during the process of working in the office.<br>● Minimize the use of air conditioning in the room.<br>● Limitation on the number of employees working in the office.<br>● Checking the health condition of employees through periodic swab tests. |
| Give advice so that a closed room, lack of lighting in our home or environment does not become a cause of COVID-19 transmission? | ● Provide ventilation holes and add transparent parts, so that air circulation can occur optimally and solar radiation can enter the room.<br>● The room is always cleaned and sterilized spraying with disinfectant.<br>● Maintain the condition of the room is not humid by installing an exhaust fan.<br>● Putting green plants that function to filter dirty air around the house. |
| What behaviors and actions have you taken to prevent the spread of COVID-19 and not to be infected by other people? | ● Complying with and implementing health protocols.<br>● Maintain body condition by staying healthy through regular exercise, eating nutritious foods, and taking multivitamins.<br>● Avoid people who are sick with influenza. |
| What actions and behaviors will you take to boost your immune system? | ● Regular exercise<br>● Eat fruits and vegetables and nutritious foods that are rich in vitamin C (immune booster) and vitamin E (an antioxidant to fight infection).<br>● Enough rest.<br>● Caring (sunbathing in the morning). |
| Explain what is meant by "undergoing isolation"? | ● Limit yourself not to do social interaction in the form of physical contact either with family or community. |
| Is the education office's decision to issue an order for teachers to take the swab test the right decision? Give an explanation! | ● The education office's decision is the right one because by doing a quick swab test, the percentage of teachers who are reactive, negative, and positive will soon be known, so that further treatment can be done better.<br>● Appropriate. So that teacher who becomes OTG immediately known.<br>● Appropriate. Swab tests can minimize the number of people exposed to COVID. |
| What action do you recommend so that the teacher who is found to be positive for COVID-19 can recover? | ● Perform self-isolation by complying with health protocols.<br>● Keep the spirit and positive thinking.<br>● Not ostracized.<br>● Doing WFH (Work From Home) |

Based on the respondents' answers, we know that the dominant behavior or action is taken to be able to go out of the house to shop, but to avoid COVID-19 is to comply with the health protocol (90%). Another answer is to maintain personal and environmental hygiene (5%) and use e-commerce to shop online from home (5%).

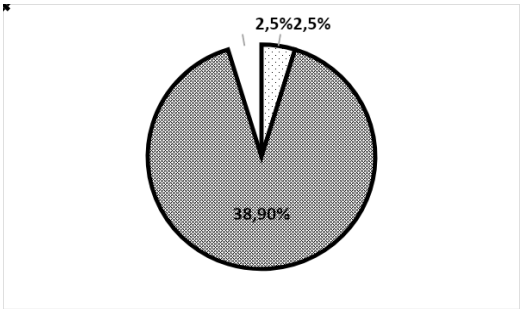


**Figure 1** Respondent's behavior to stay safe shopping outside the house.

E-commerce is actually an important choice in protecting the public from the spread of the COVID-19

virus. However, although many people have used online shopping facilities a lot, there are no reasons related to efforts to minimize the risk of spreading COVID. Regarding activities in the office, a potential suggestion to follow in order to prevent the spread of the COVID-19 virus is that office employees must continue to apply health protocols (71%), minimize the use of air conditioning in the room (10%), office rooms must have open ventilation (7 %), limiting the number of employees in the office (7%), and checking the condition of employees through periodic swab tests (5%).

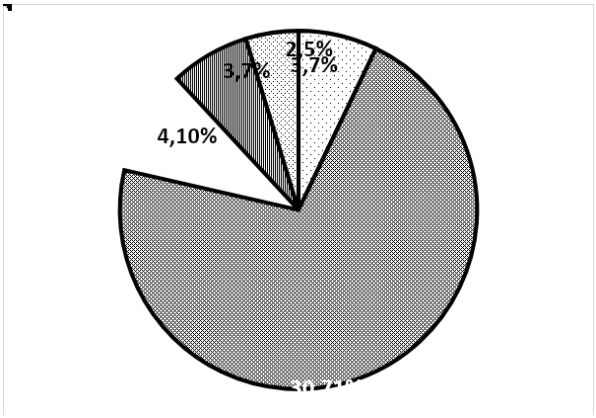


**Figure 2** Behaviour of respondents to stay safe working in the office.

Compliance and discipline with health protocols are the keywords to be safe from exposure to COVID-19. For this reason, in daily activities, especially related to office activities, it is highly recommended to continue to comply with the health protocol. It is certain that if the protocol is carried out seriously, the number of corona victims due to activities in the office can be reduced properly.

Regarding the transmission of COVID 19 due to goods from outside the home, most of the respondents answered to carry out sterilization measures for all goods entering the house (88%) and did not have direct contact with the seller (5%). While the other answers are not in accordance with the questions posed. The act of direct contact with the seller is a dangerous action because it has the potential to help spread the COVID-19 virus.

Based on respondents' answers related to closed rooms so that it is not easy to spread the COVID-19 virus, the room must always be cleaned and sterilized by spraying with disinfectant (48%), providing ventilation holes and adding transparent parts of the room so that solar radiation can enter (40%), keep the condition of the room so that it is not humid by installing an exhaust fan (7%) and putting green plants to filter dirty air (5%).

Another very interesting response was responding to the actions of the East Java Provincial government in instructing all teachers in the city of Surabaya to take a swab test, including 45% agreed that the swab was carried out because through a swab test the patient's condition was immediately handled, 10% thought that the swab test was able to minimize the number of people exposed to COVID-19.

A good response from students cannot be separated from the high level of scientific literacy they have. In addition to this, it also proves that through science education, students can practice using science and technology in developing life to adapt to changes that occur in the environment and society directly [10].

## 4. CONCLUSION

Based on all the information above, it can be said that the science literacy of postgraduate students of science education is good. This is based on two things, namely the level of understanding of the problem and the ability of students to solve problems. Students' understanding of the COVID 19 issue is good. This can be seen from the respondents' answers to several problems given through the google form. The average student understands the issue of COVID 19 and is able to explain what actions can be taken to prevent the spread of the COVID-19 virus. Students are also able to provide an assessment of the implementation of various forms of health protocols and government policies regarding Large-Scale Social Restrictions. Based on the results of the analysis, it can be seen that all respondents were able to provide answers according to the problems developed. This shows that students' ability in environmental literacy based on the COVID 19 issue is already good.

## AUTHORS CONTRIBUTION

All authors conceived and designed this study. All authors contributed to the process of revising the manuscript, and at the end all authors have approved the final version of this manuscript.

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