
Environmental literacy portrait of pre-service science teacher in Indonesia

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Abstract: This article aims to picture the environmental literacy of the pre-service science teachers at Universitas Muhammadiyah Riau (UMRI). The highlighted environmental literacy consists of aspects of knowledge, attitudes and behavior of students related to environmental issues which are also part of the two themes of Educational for Sustainable Development (ESD), namely the theme of water and the theme of energy. Data were obtained through validated test items and questionnaire instruments. The results of this study obtained that students' environmental literacy was in the sufficient category, with an overall average percentage of environmental literacy for prospective science teacher students of 59.19. In addition, it was also obtained that the average percentage of environmental literacy of female students for the three aspects was higher than that of male students, although statistically it was concluded that there was no difference in environmental literacy of male students compared to female students. These results indicate that it is necessary to innovate lectures so that students' environmental literacy increases. One of the potential courses is Environmental Education which can be implemented on a project basis in accordance with the issues or themes in ESD.

Keywords: Environmental Literacy; Educational for Sustainable Development; Pre-Service Science Teacher

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Introduction

Recent conditions of the nature are very tormenting (Vilmala et al, 2022). These conditions are caused by two things, namely the direct effects of nature and the effects caused by human activities. The consequences of nature cannot be avoided. However, natural disasters caused by human activities can be prevented and even avoided. Particularly in the Indonesian region, the most frequent natural disasters are floods, landslides and extreme weather.

The United Nations launched global goals known as the Sustainable Development Goals (SDGs). The SDGs are 17 global goals consisting of economic, social and environmental dimensions (UNESCO 2018). The tool for achieving SDGs is known as Educational for Sustainable Development (ESD) (Kioupi & Voulvoulis 2019). The environment is one of the dimensions that must exist in the SDGs. Therefore, everyone must have good environmental knowledge. Even more for the pre-service science teachers, who will equip their students with the concepts of ESD and SDGs which include an environmental dimension (Vilmala et al, 2022).

Identifying the description of the environmental insights of pre-service science teacher students is very important because it can be input in the design of lecture development, especially in

Environmental Education courses. An overview of student environmental literacy was obtained through various instruments, such as test questions (Nunez et al, 2015), questionnaires (Safitri et al, 2020), and interviews (Barota et al, 2016). The selection of these instruments is adjusted to the concept of environmental literacy used.

The term environmental literacy is always being refined by experts (Volk & McBeth 1998). Environmental literacy refers to individuals and groups who make the right decisions about the environment and take actions based on these decisions to improve the welfare of other individuals, society, and the global environment, as well as participate in the life of the nation (Hollweg et al, 2011). According to (Disinger & Roth, 2000) and (Hollweg et al, 2011) Environmental literacy consists of three interactions, namely cognitive components (knowledge and skills), affective (environmental dispositions which include values, environmental sensitivity, attitudes, assumptions of self-responsibility) and behavioral component. Behavior is the highest expression in environmental literacy. In the context of environmental literacy, cognitive and affective components must be seen in the behavior of individuals who care about the environment (Goldman et al., 2018). From the several sources above, the cognitive components discussed relate to the environment such as biodiversity, human population, natural resources, environmental health and quality, extreme weather, and global warming. In this study, the cognitive aspects discussed consisted of two sustainable themes related to the environment, namely the theme of water and the theme of energy. One must have environmental knowledge first. By having knowledge about the environment, it is hoped that the attitudes and behavior shown by that person will lead to attitudes and behaviors that care for the environment. The measurement results of these three components can describe a person's environmental literacy. In this study, apart from measuring environmental literacy, pre-service science teacher are also associated with efforts to succeed in sustainable development goals.

This study aims to look at the environmental literacy profile of pre-service science teacher students at Universitas Muhammadiyah Riau in general. In addition, this research will also present environmental literacy in each aspect of the environment. Environmental literacy based on gender is also presented in this study. The environmental literacy instruments used in this study consisted of two types, namely test questions to measure aspects of environmental knowledge and questionnaires to measure attitudes and behavior aspects of science teacher candidate students. The instrument used has been validated by several experts and declared very feasible to be applied to see the environmental literacy profile of prospective science teacher students.

Method

This research includes survey research. This research involved 57 students of the Science Education Study Program at Universitas Muhammadiyah Riau. The instrument for environmental knowledge test consisted of 30 multiple choice questions, 20 statement items to measure attitudes, and 15 statement items to measure behavior towards the environment of pre-service science teacher students.

The results of the instrument are then analyzed. Objective questions have a weight score of 1 for each question item that is answered correctly. For the attitude scale, the score weight for each statement item is 1-4. Each student has their own total score. The total score is then converted to a scale of 100, then the average value of environmental literacy is calculated for prospective science teacher students. The percentage of answers is calculated based on Table 1 below.

Table 1. Environmental literacy category for prospective science teacher students

Percentage (%)	Category
>80	Very Good
>60-80	Good
>40-60	Moderate
>20-40	Poor
≤20	Very Poor

Results and Discussion

The environmental literacy measured in this study is based on two sustainable themes, namely water and energy. The environmental literacy of pre-service science teacher students is in the sufficient category. In general, the environmental literacy score of pre-service science teacher was 59.19 which belongs the moderate category. Student environmental literacy is also measured based on each aspect. The knowledge aspect is in the moderate category with an average percentage of 52.24. Aspects of attitude and behavior are in the good category with an average percentage of 64.96 and 60.38. Student environmental literacy scores can be seen in Figure 1 below.

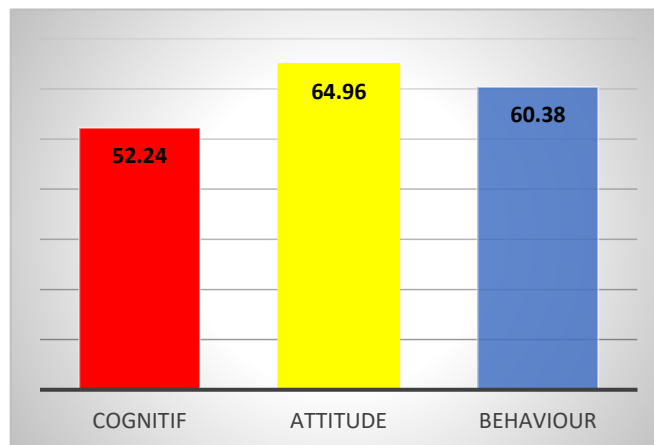


Figure 1. Average Percentage of Environmental Literacy for Pre-service Science Teacher Students

The cognitive aspect measures the definition of the environment, environmental functions, pollution, environmental damage, renewable energy, and efforts to protect and preserve the environment. The highest score is question number 11 about pollution. About 94.70% of students know that human activities that can cause water pollution are throwing solid and liquid waste into rivers and using excessive pesticides. While the lowest score was about determining renewable energy, namely questions number 16, 20 and 25 which only 30% of students answered correctly. The aspects of attitude and behavior that are measured are how the attitude of prospective science teacher students towards environmental issues and what their daily behavior is like in caring for the environment.

The findings have the same trend as several studies. An example is the pre-service teacher students at a campus in Turkey who are quite literate in their environment and their environmental literacy level does not vary according to class and gender. The students use various learning resources such as articles, books, and magazines to improve their environmental literacy skills (Yilmaz, 2021). School members who have good environmental literacy will have a good influence on students' environmental literacy and knowledge (Putra et al., 2021). The similarity of these findings could be due to a positive relationship between students' environmental knowledge and their attitudes and behavior toward the environment. It also influences understanding and action in discussing environmental issues. A research result which suggests that a person's environmental literacy level score will influence his understanding and action on environmental issues, especially in providing increasingly complex explanations related to identifying environmental problems and tending to provide suggestions for actions to be taken regarding these environmental problems (Hunter & Jordan, 2022).

The average percentage score for the cognitive aspect of students has a relatively lower percentage compared to the other two aspects. This is because in the cognitive aspect the issues raised are issues that are in accordance with the ESD theme, namely the issue of the theme of water and the issue of energy. This is different from the environmental education material contained in science education study programs. There are several key issues on ESD, such as climate change, biodiversity, sustainable production and consumption, and others (UNESCO, 2018). The theme of water is directly related to SDGs 4 and the theme of energy is directly related to SDGs 7. Another reason could be because so far environmental education lectures have only been carried out in theory. That is, only

discussing environmental issues from various reference books and from the slides displayed by the lecturer. So that it causes students not to directly find environmental problems around them to do an in-depth analysis. The respective scores on the environmental literacy aspect of male students have an average percentage that is relatively lower than that of female students. As shown in Figure 2 below.

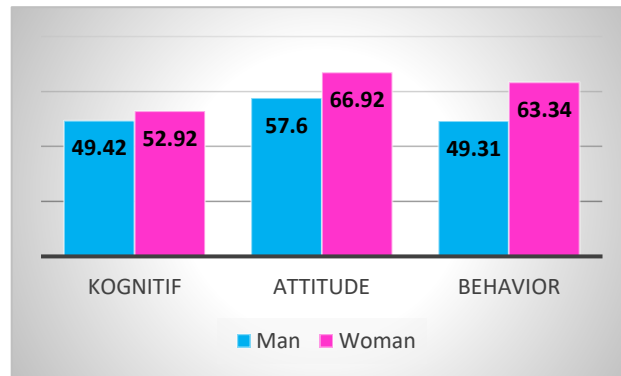


Figure 2. Average Percentage of Environmental Literacy for Pre-service Science Teacher Students by gender

Based on Figure 2 above, for the cognitive aspect the average percentage of male students was 49.42 and 52.92 for the female students. This is because male students rarely read various kinds of literature either books, journals, or news in print and electronic media compared to female students. Based on random interviews with students, it can be concluded that they prefer learning that involves many senses compared to learning that is monotonous in the classroom, for example of problem-based learning and project-based learning. Likewise on the aspect of attitude and behavior towards the environment. The average percentage of the attitude aspect of male students is 57.60 and that of female students is 66.92. The average percentage of male students in the behavioral aspect was 49.31 and that of female students was 63.34. A similar study was also conducted with students of modern Islamic boarding schools in Malang district which stated that based on knowledge and cognitive skills, there were no significant differences in the environmental literacy of male and female students, but there were significant differences in their attitudes and behavior (Mardiani et al., 2021). The results of research conducted on students in Jembrana Bali show that the environmental literacy of male and female students is still in the low category and there is no difference in environmental literacy between male and female students (Parwati et al., 2021). To see whether there are differences in environmental literacy profiles between students based on gender, the results of the T test are presented in Table 2 as follows.

Table 2. Results of T-test

	Levene's Test for Equality of Variances		t-test for Equality of Means
	F	Sig.	Sig. (2-tailed)
Equal variances assumed	.667	.418	.392
Equal variances not assumed			.446

Based on Table 1 above, the sig. F is 0.667, meaning that the two population variants are identical (Equal Variance assumed). Sig F has an Equal Variance assumed decision, so the t test used is the Equal Variance assumed t test with Sig. 2 tailed is 0.392 or greater than 0.05. So, it can be concluded that there is no difference in the environmental literacy of male students and female students. These findings tend to be the same as research conducted on students in Pemalang district which also stated that there is no difference in environmental literacy between male students and female students (Santoso et al., 2020).

Environmental literacy is one of the main parts of 21st century education (Environmental Literacy Task Force (ELTF), 2015). The findings contained in this study can be used as a basis for developing environmental education courses. Project-based learning has the potential to encourage students to

use their environmental knowledge in overcoming existing environmental problems. Especially if the environmental themes or issues raised are themes and issues related to existing ESD themes. The Education for Environmentally Sustainable Development (EESD) approach with the help of Student Worksheets (LKS) can be implemented in science education to provide valuable insights to students about the environment (Wilujeng et al., 2019). Approaches and learning models that require students to make products will provide more experience in dealing with environmental problems and can create a sustainable future, both from their cognitive aspects, attitudes, and behavior towards the environment. Pro-environmental activities are carried out as a form of environmental responsibility such as eco-management, education, and economic action, by inviting residents to carry out environmental management proactively and consistently and develop a sense of togetherness in forming a network of environmental concerns in the local context for global effects (Astheria et al, 2016).

Conclusion

The environmental literacy of prospective science teacher students includes a description of their knowledge, attitudes, and behavior towards the environment. Environmental literacy learning can be carried out thematically according to the themes in ESD. In general, the results of the research conducted were the same as the findings of previous researchers which stated that students' literacy scores were still in the low category and there were no significant differences in male and female students' environmental literacy. Various efforts can be made to increase student environmental literacy such as innovating in lectures using the STEM approach and the Education for Environmental Sustainable Development (EESD) approach. Both of these approaches are project-based learning and can be adapted in Environmental Education lectures at Muhammadiyah University of Riau.

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