Profiles of Environmental Literacy of Senior High School Students

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Abstract. This study aimed to describe the environmental literacy of high school students in Bali Province, Indonesia. For that reason, the study conducted was survey research. The population of the study was high school students in the Bali Province, Indonesia. Population of the study was 40,608 students. Samples were drawn by a multistage random sampling technique. Each district was chosen 50 students randomly. Thus, there were a total of 450 students as research samples. The research samples consisted of the tenth, eleventh, and twelfth-grade students, each of which amounted to 131, 263, and 56 people and the number of male and female students was 151 and 299 people, respectively. Students’ environmental literacy data were collected with an environmental literacy inventory developed by researchers. This inventory consisted of five dimensions, including knowledge (15 items), concern (15 items), sensitivity (16 items), attitude (9 items), and behavior (8 items) towards the environment. Inventory is created in Google forms and circulated online. The data obtained in this study were analyzed by calculating the average score of environmental literacy and then changed from a scale of 5 to a scale of 100, then grouped into the categories of very low (0 - 20%), low (21 - 40%), moderate (41 - 60%), high (61 - 80%), and very high (81 - 100%). The results showed that overall the environmental literacy of students was classified as a high category. However, the dimension of knowledge was in the medium category, while the other dimensions were in the high category.

1. Introduction
Humans and the environment cannot be separated from each other [1], [2]. Humans live on earth or the environment and humans obtain needs from the environment, such as food, water, and oxygen [3]. A clean environment will affect the quality of human life. Conversely, humans are also able to form a quality environment. This is caused by humans having the ability to process, maintain, and repair the damaged environment. Even because of human activities, the environment can become damaged, such as illegal logging, excessive taking over of mining products, and the disposal of hazardous and nondegradable wastes into the environment.

Nowadays, the population growth is very rapid. Currently, the world population has reached around 7.7 billion [4]. With a large world population, of course, all human needs are sourced from the environment. The environment will be difficult to meet human needs if humans do not maintain the environmental sustainability. In other words, humans will not be able to meet their needs if humans do not do sustainable development of the environment. If humans only take their needs from the
environment without trying to reform, then within a long time there will be a scarcity of natural resources that can cause disasters for humans [5].

In the global era, the development of the industry takes place very rapidly. This very rapid development of the industry certainly requires sources of fuel energy to drive industrial machinery. The energy sources to drive this industrial engine generally comes from fossil fuels. Burning fossil fuels will have an impact on the environment, such as air pollution. CO2 gas produced from burning fossil fuels can lead to global warming. Global warming can cause melting of polar icebergs so that sea levels will rise every year. Besides, global warming can also result in climate change which affects life on earth. Meanwhile, nitrogen oxides and sulfur oxides produced from burning fossil fuels can cause acid rain. Acid rain can cause environmental damage.

Along with the rapid development of the industry, industrial products are also very diverse in number. Some of these industrial products are chemicals used in daily life, such as plastics, fertilizers, paints, detergents, batteries, and accumulators. Wastes from these products were discharged into the environment. As a result, the environment becomes a waste bin from industrial products. The environment becomes polluted so that the ecosystem will be disrupted.

Awareness of the importance of a sustainable environment must always be fostered. Therefore, all parties must have a concern for environmental issues or problems. These environmental problems are not trivial problems, but are very serious problems because they can threaten life on this earth. Environmental education must be part of the school curriculum. In addition, the movement to save the environment must always be encouraged to make the community aware of the importance of a quality environment. An environmental literacy is a movement of awareness and concern for the environmental problems. This movement must be built for all citizens of the world so that we can save the environment from damage.

The environmental literacy is the capacity to understand and interpret the health of environmental systems and take appropriate actions to maintain, restore, or improve environmental quality [6]. Roth [7] stated that a person needs to be an environmentally minded citizen and have adequate knowledge about environmental issues. The environmental literacy is the ability to maintain and solve environmental problems [8], [9]. The environmental literacy emphasized by the Environmental Education and Training Partnership is the ability to overcome environmental problems and avoid new problems. The concept of environmental literacy is emphasized in three aspects, namely nature, environmental issues, and appropriate and sustainable solutions to environmental problems [10].

The environmentally minded citizens must be able to solve problems, plan, and collaborate on environment-based action strategies. With mastery of environmental literacy, a person will have the knowledge, sensitivity, awareness, and concern to act to maintain, save, and repair environmental damage so that the environment becomes sustainable. By this way, the sustainable development will be achieved. The sustainable development is development that enables the current generation to utilize natural resources without disrupting future generations to meet their needs from the environment [11].

2. Method

This study is a quantitative type of survey research. The study population was the tenth, eleventh, and twelfth-grade students in Bali Province, Indonesia. Population of the study was 40,608 students. With the Slovin formula, the number of samples needed was a minimum of 396 students. Samples were drawn by a multistage random sampling technique. Each district was taken 50 students as a sample. Because there are nine districts, the total sample size was 450 people. The number of students in class X, XI, and XII was 131, 263, and 56 people, respectively. The number of male and female students was 151 and 299 people, respectively. The environmental literacy instrument was in the form of an inventory consisting of five dimensions, including knowledge (15 items), concern (15 items), sensitivity (16 items), attitude (9 items), and behavior (8 items). Thus, the entire inventory contained 63 items. The dimension of knowledge was measured by an objective test in which each question was provided with five choices, while the other dimensions were measured by non-test, where each statement was provided five response choices from a scale of 1 - 5 which each described from strongly
disagree to strongly agree. The inventory was developed by researchers. It was created in Google forms and distributed online to students by sending URL link addresses. The data obtained in this study in the form of environmental literacy scores on a scale of 5 and analyzed by calculating the average score of environmental literacy and then changed from a scale of 5 to a scale of 100. The average scores were then categorized based on Table 1. The validity of items and the reliability of each instrument amounted to 0.31 - 0.78 and 0.92.

Table 1. Categories of student environmental literacy

| No. | Range of scores | Categories |
|-----|----------------|------------|
| 1   | 0 - 20         | Very low   |
| 2   | 21 – 40        | Low        |
| 3   | 41 – 60        | Medium     |
| 4   | 61 – 80        | High       |
| 5   | 81 - 100       | Very high  |

3. Result and Discussion

3.1. Results of the study

The environmental literacy inventory was a data collection instrument for the environmental literacy in this study. This inventory was distributed online to students. Responses given by students were recorded online in Google forms and a summary of the results of students’ responses could be downloaded in the form of Excel. The overall average score of students’ environmental literacy was 68.35 (high category) with a deviation standard of 13.90. The following was the environmental literacy profiles of high school students in Bali Province, Indonesia.

Figure 1. Profiles of the environmental literacy of high school students in Bali Province, Indonesia

Figure 1 showed that the average score of students’ environmental literacy varied for each dimension. The lowest average score was found in the dimension of knowledge, while the highest average score was found in the dimension of concern.

3.2. Discussion

The environmental literacy inventory used in this study consisted of five dimensions, namely knowledge, concern, sensitivity, attitude, and behavior. The dimension of knowledge is related to the mastery of cognitive aspects. The dimension of knowledge is general knowledge about the environmental issues, such as global warming, acid rain, non-biodegradable substances, eutrophication, plastic recycling, renewable energy, and the ozone layer. All questions on the dimension of knowledge require students’ understanding of environmental issues in general. The dimension of knowledge is an insight that students must possess that encourages them to have
concern, sensitivity, attitude, and behavior towards the environmental issues. Without the adequate knowledge of environmental issues, it is rather difficult for students to behave and act in dealing with environmental problems. While in other dimensions, namely concern, sensitivity, attitude, and behavior are non-cognitive aspects so that measured by attitude scale, in this case using a Likert scale. The Likert scale used is in the range of 1 - 5 which shows the response choices from strongly disagree to strongly agree.

The results of the study showed that the environmental literacy of students varied from one dimension to the other. The lowest average score was found in the dimension of knowledge (classified as a medium category), while the highest average score was found in the dimension of concern. The average scores in all dimensions except for the knowledge dimension were in the high category. These results are in line with the findings of Varisli [12], where the average score on the knowledge dimension is the lowest average score among the average scores on other dimensions. From the results of the study, it can be interpreted that the dimension of knowledge is the dimension that is least mastered by students. This is caused by several reasons. Firstly, the dimension of knowledge is related to cognitive aspects. Generally, in the case of mastery of competencies, mastery of knowledge aspects by students is the lowest among mastery of skill and attitude aspects. This is caused by the mastery of knowledge aspects requires higher-order thinking skills. The results of the other study showed that students’ mastery of higher-order thinking skills was still low [13]. Secondly, the dimension of knowledge of environmental literacy is measured by an objective test using five choices in which the measurement with the test results in the right or wrong answer. Students only choose the most appropriate answer. If students guess the answer, then the chance for students to correctly answer is 20%. Another interesting finding is that the dimension of knowledge showed the greatest standard deviation among the standard deviation of the other dimensions. This happened because the dimension of knowledge was related to extreme answers, which were right and wrong. Thus, the difference in scores among students would be so high that the standard deviation of the knowledge dimension was the greatest among the other dimensions. On the other hand, on the other dimensions, they related to students’ responses or opinions on the environmental issues whose choices range from strongly disagreeing to strongly agreeing. Generally, the choices of students’ responses are not extreme, for example, the choice of scale of 3 or 4 so that the standard deviation is smaller.

The measurement of students’ environmental literacy is very important. This is because we will get a picture of students’ understanding and concern for the environmental issues. With the understanding of environmental issues, students can behave and act in overcoming the environmental problems. Everyone’s understanding and concern for the environmental issues or problems must be fostered because human beings can cause problems to the environment and human beings can overcome problems found in the environment. By understanding and caring for the environmental issues, the environment can be saved from damage.

Research on the importance of measuring the environmental literacy has been carried out by several researchers. Ozsevgec et al. [14] have developed an environmental literacy scale for prospective teachers. The environmental literacy subscale consisted of environmental responsibility (14 items), natural balance (4 items), environmental attitude (3 items), and environmental activity (3 items). Spínola [15] investigated the environmental literacy of the eleventh-grade students in Portugal’s Madeira Island. He found that students had a good level of environmental literacy, but needed to improve on several dimensions, namely on the dimensions of knowledge, attitude, and also the behavior of environmental responsibility. On the other hand, Karakaya et al. [16] measured the environmental literacy in three dimensions, namely attitude, behavior, and perception towards the environment. Their results showed that there were no significant differences between the dimensions of environmental literacy based on gender and students’ residence. However, a significant difference was found among the three dimensions of environmental literacy based on grade levels. There was a positive relationship between attitude and perception of the environment. Szczytko et al. [17] have developed instruments to measure the environmental literacy for adults. This instrument was made short enough so that it could be done in 5-15 minutes. The instrument measured the dimensions of
knowledge, hope, cognitive skill, and environmental behavior. The instrument is very valid and reliable for measuring the environmental literacy for adults. Wardani et al. [18] measured the students’ environmental literacy using three dimensions, namely knowledge (14 items), attitude (15 items), and attention (15 items). Their results showed that the environmental literacy of students was still low.

Meanwhile, increasing the environmental literacy of students through the development of learning models has also been assessed by several researchers. Farida et al. [19] developed a problem-based learning model to internalize students’ environmental literacy based on Islamic values. Kidman and Casinader [20] have developed teachers’ environmental literacy through good practices based on inquiry. The assumption is that if the teachers have good environmental literacy, then they will be able to develop students’ environmental literacy. On the other hand, King and Franzen [21] reported that environmental-themed educational programs have a significant influence on students’ perceptions of the environment.

4. Conclusion
Measurement of the environmental literacy is very important. This is caused by the current many environmental issues or problems that occur today due to the explosion of population growth in the world and the rapid development of industry in the global era. Based on the results achieved in the study it can be concluded that the environmental literacy of high school students in Bali Province is classified from moderate to high. The dimension of knowledge is the lowest dimension among the other dimensions (concern, sensitivity, attitude, and behavior). Teachers need to measure the students’ environmental literacy to map learning programs to improve the students’ environmental literacy.

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