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# ECOLITERACY ANALYSIS AND SCIENCE TEACHING MATERIALS: SURVEY IN JUNIOR HIGH SCHOOLS

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**ABSTRACT**

The study aims to analyze ecoliteracy and the teaching materials required for 21st century learning these days. The study employs the survey method by involving population of 104 junior high school students in grade VIII in Bogor City. The data are collected using ecoliteracy tests and interviews and analyzed using descriptive statistics techniques. The results showed that 48 students (46.15%) fall into the category of lacking ecoliteracy cognitive competence. The results of the questionnaire on the competence of attitudes, skills, and human relations with nature fall into the medium category. Therefore, in order to support the improvement of students' ecoliteracy, interactive teaching materials are required in order to attain more meaningful environmental learning.

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## INTRODUCTION

The current era of globalization has created rapid technological development in society. However, at the same time, society has also had to face numerous natural disasters and environmental problems such as forest fires, extreme rainfall, droughts, floods, and landslides that have led to a lot of losses and caused an imbalance in the ecosystem or ecological crisis. The environment consists of biotic and abiotic factors that constitute significant factors in life and thus can affect human survival (Setiawan & Afriani, 2019). The fact has been shown that the number of humans is increasing as time goes on, which has become one of the causes of environmental damage (Nurfajriani et al., 2018). Environmental damage that occurs as a result of human activities will also have an impact on human life. Therefore, as humans, it is very important to deal with these environmental problems. One of the efforts to increase environmental awareness is through education. Environmental education can provide a society with skills, understanding, and caring attitudes towards the environment so that later the community can play an active role in preserving the environment and solving problems that exist in the surrounding environment (Wihardjo & Rahmayanti, 2021).

Ecoliteracy refers to a state of understanding and comprehending the interactions of living things with their environment (Setyaningrum & Gunansyah, 2020). Goleman stated that ecoliteracy is a movement that can increase emotional and social intelligence to realize education, social attitude, and environmental welfare by preserving nature and reducing environmental damage (Kurniasari, 2019). Ecoliteracy constitutes an understanding of how to act to preserve the environment in the future (Siregar et al., 2020). Ecoliteracy creates goals so that all people have ecological literacy or are aware of the importance of protecting the environment. Apart from that, ecoliteracy also has the goal of creating a person's sensitive attitude towards the preservation of the surrounding environment in order to reduce problems that exist in the environment (Kim et al., 2017). Therefore, the improvement of ecoliteracy in schools, especially in junior high schools, is necessary in order to develop students competence to make them responsible citizens, and hence, it is important in science learning to apply concepts relevant to ecological literacy that are both practical and applicable (Edison, 2015). Environmental problems that occur around us, particularly in Bogor City, have proven that people's understanding of ecology remains low, and thus teachers need to improve students' ecoliteracy understanding in this 21st century of learning. One of the supporting components in the process of learning is the teaching materials that are used. Teaching materials refer to a set of materials or a guide for teachers and students that are arranged systematically. These materials contain certain knowledge, attitudes, values, actions, and skills to achieve learning objectives (Magdalena et al., 2020). The teaching materials are used in order to make it easier for teachers to

teach the materials learned by students, giving students an easier way to understand the content of the learning taught to students (Sari & Yustiana, 2021). Therefore, teaching materials are one of the essential components of the process of teaching and learning.

A number of previous studies have explained the importance of ecoliteracy, such as a study conducted by Kurniasari (2018), which investigated the improvement of students' ecoliteracy in organic and inorganic waste through the group investigation learning model. Further research was conducted by Nadiroh et al. (2019), which studied the ability to solve environmental problems and student ecoliteracy. Similarly, research was carried out by Setiawan & Afriani (2019), which identified the level of ecoliteracy in Biology Education of FKIP students at Kapuas Sintang University, and research was conducted by Aditya & Oktavilia (2020), which identified the level of ecoliteracy of FISIB educators at Jenderal Soedirman University. Despite all the studies aforementioned, there has been no research that analyzes the level of ecoliteracy and teaching materials needed for 21st century learning at Bogor City Junior High School. Thus, this study aims to determine the level of ecoliteracy of students and the teaching materials that are currently needed in 21st century learning in environmental education.

## METHOD

This study is a preliminary study that utilizes the field survey method. The study involved 104 junior high school students and four junior high school Science teachers in Bogor City. In order to collect the data, a random sampling technique from junior high school students in grade VIII at two different schools was employed. The study was carried out by collecting data from instruments of core competence of students' ecoliteracy on environmental pollution material distributed via Google Form and conducting interviews with teachers regarding teaching materials needed in the 21st century of learning nowadays. The instruments of the study were developed by referring to a study conducted by Setyaningrum & Gunansyah (2020). The four core competences of ecoliteracy include cognitive, attitudes, skills, and human relations with the natural environment, each with several indicators.

### Ecoliteracy Cognitive Competence

The instrument compiled by referring to ecoliteracy cognitive competence was based on three ecoliteracy cognitive indicators. Those questions consist of five items in the form of an open essay discussing the analysis and identification of one of the cases of forest fire pollution in Indonesia. The data collection process utilized the analysis of students answers using a rubric. In order to calculate and find out the percentage of students ecoliteracy cognitive scores, the Equation 1 is applied (Husamah et al., 2017). The score percentage of each student is further classified based on five categories (Husamah et al., 2017), as shown in Table 1.

$$\text{Score Percentage} = \frac{\text{Score Obtained by Students}}{\text{Maximum Score}} \times 100\% \quad (1)$$

The cognitive competence of ecoliteracy can also be seen in every aspect of the indicator through the average score on the indicators of problem analysis. Critically think of the source of the problem and of the solution to environmental problems. These can be obtained by calculating the score percentage with the average category classification presented in Table 2.

### Attitudes, Ecoliteracy Skills, and Human Relations with Nature

Instruments, which were compiled by referring to three core competences of ecoliteracy, including attitudes, skills, and human relations with nature, have three different indicators (Setyaningrum & Gunansyah, 2020). The rubric for competency assessment uses a Likert scale consisting of 25 statements in the form of 14 positive statements and 11 negative statements. The competency indicators are presented in Table 3. Competences of attitudes, skills, and human relations with nature can be seen from every aspect of an indicator through the average of the score on each indicator, which is further calculated and analyzed by using the guide of score categories as follows (Ekamilasari & Pursitasari, 2021).

**Table 1.** Percentage and category of ecoliteracy cognitive.

| No. | Percentage (%) | Category |
|---|---|---|
| 1 | 80–100 | Very Good |
| 2 | 65–80 | Good |
| 3 | 55–64 | Fair |
| 4 | 40–54 | Less |
| 5 | <40 | Very Less |

**Table 2.** Average and percentage of ecoliteracy component category.

| Average | Percentage (%) | Category |
|---|---|---|
| 1.00–2.33 | 0.00–39.99 | Low |
| 2.34–3.66 | 40.00–69.99 | Medium |
| 3.67–5.00 | 70.00–100.00 | High |

**Table 3.** Indicators of ecoliteracy competences.

| Core Competences | Indicators | Number of items |
|---|---|---|
| Attitudes | Care about environment | 1, 2, 3, 4, 5, 6, 7 |
| | Develop an attitude of respect for environment | 8, 9, 10, 11 |
| Skills | Create an instrument needed by society | 12, 13, 14 |
| | Make use of existing natural resources | 15 |
| | Save existing energy as best as possible | 16, 17, 18 |
| Human relations with environmental nature | Respect nature with the whole components | 19 |
| | Be grateful for condition of environment | 20 |
| | Active in preserving the environment | 21, 22, 23, 24, 25 |

### The Needs of Teaching Materials

This study uses interviews with a total of 26 questions with four junior high school teachers in Bogor City. This interview method employs four different indicators relevant to the current learning process, including learning techniques, teaching materials, student attitudes towards the environment, and science learning on environmental pollution materials.

## RESULTS

### Students Ecoliteracy Cognitive Competence

Cognitive competence has three indicators, for which an average score of each indicator is calculated and is also converted into percent, as can be seen in Table 4. The score reveals that the low understanding of the source of environmental problems existing in the surroundings is due to a large number of students who do not care about the root of the problems that happen. It proves that students' knowledge regarding the environment is still classified as moderate. This statement is also supported by research done by Kurniasari (2019) showing that students' knowledge of ecoliteracy is categorized as low, as shown by their indifferent attitudes towards the school environment.

Based on the results of the data on the percentage score of each student on the ecoliteracy competence, Table 5 shows that the highest percentage is 46.15% in the less category, so there are still many students who have low knowledge of ecoliteracy regarding environmental problems that occur around them. This is also supported by research by Ionita & Simatupang (2020), who evidently demonstrated that students' knowledge of literacy by solving environmental problems on the learning topic regarding pollution remains low due to a lack of understanding of the sources, impacts, and solutions to apply to the existing environmental problems. The concept of students' understanding of the environment will develop according to the teacher's way of teaching environmental material, so a teacher needs to use appropriate learning strategies and methods to develop student activity during the learning process. Development can also be improved through the experiences of students during the learning process, such as environmental observations or school practica. Therefore, it is expected to be able to develop students' cognitive skills so that they can form positive behaviors and attitudes towards the environment (Agustin & Maisyaroh, 2020). For that reason, strategy is highly needed and important in the improvement of competence in ecoliteracy knowledge in order to improve students' understanding of ecology (Putri et al., 2019).

**Table 4.** Students ecoliteracy cognitive score per indicator.

| No. | Indicators of Ecoliteracy Cognitive | Score Average | Percentage (%) |
|---|---|---|---|
| 1 | Analyzing existing environmental problems | 2.65 | 53.08 |
| 2 | Critically and deeply the source of a problem | 2.13 | 42.69 |
| 3 | Planning a solution for environmental problems in a long-term period | 2.75 | 55.00 |
| | **Average** | **2.51** | **50.28** |

**Table 5.** Category of ecoliteracy cognitive of the whole respondents.

| No. | Cognitive Category | Achievement | |
|---|---|---|---|
| | | Number of Students | Percentage (%) |
| 1 | Very Good | 6 | 5.77 |
| 2 | Good | 18 | 17.31 |
| 3 | Fair | 12 | 11.54 |
| 4 | Less | 48 | 46.15 |
| 5 | Very Less | 20 | 19.23 |
| | **Total** | **104** | **100.00** |

### Competences of Attitudes, Skills, and Human Relations with the Natural Environment

Attitude competence, ecoliteracy skills, and human relations with the natural environment are three other competencies in ecoliteracy. These three competencies are calculated and analyzed in order to determine the score for each indicator. The data shown in Table 6 demonstrates that the competence of ecoliteracy skills, such as skills in the use of recycled goods and the use of natural resources, is still low. There are still many students who do not understand the usefulness of recycled goods to maintain the ecosystem, as a result, students' understanding of solutions and problem solving for environmental problems is still low. This statement is also proven in research by Setyaningrum & Gunansyah (2020), who found that students application of care for the environment remains low, as can be seen in the large number of plastics used in school areas. Research by Karlina et al. (2017) also showed that care about the environment is still described as low, as proven by the large number of students who do not take care of their school environment well. Another factor that can influence students attitudes toward caring about the environment is learning activities that are supported by school facilities (Irfianti et al., 2016).

**Table 6.** Scores of competences of attitudes, skills, and human relations with the natural environment per item.

| No. | Statement | Average Score |
|---|---|---|
| 1 | I care about the surrounding environment | 4.0 |
| 2 | I do not litter | 3.9 |
| 3 | I read a book about environment and everything in it | 3.4 |
| 4 | My family does not litter, throw garbage into the trash cans that have been provided in the home environment | 3.5 |
| 5 | I do not follow my friends who throw trash into the river | 4.0 |
| 6 | If I find trash on the street, I will pick it up and put it in the trash | 4.1 |
| 7 | Wet waste and dry waste must be placed in different places | 3.7 |
| 8 | It is important for me to know the impacts of environmental pollution | 3.7 |
| 9 | I let the environmental conditions which is affected by the pollution because it is not where I live | 3.4 |
| 10 | I keep rare animals at home | 3.8 |
| 11 | I know information I got regarding the impacts of environmental pollution for myself | 3.5 |
| 12 | I use used things to change them into something useful | 3.6 |
| 13 | I take care of plants at home and water them every morning and afternoon | 3.1 |
| 14 | I use things that produce greenhouse gases | 3.7 |
| 15 | I bring my own drink bottle from home when I travel | 3.7 |
| 16 | In my opinion, we need to use water economically and as we need | 3.8 |
| 17 | I use mosquito repellent spray morning and night to get rid of mosquitoes at home | 2.2 |
| 18 | I turn on the light every morning and night so I do not feel dark | 2.9 |
| 19 | In my opinion, trees were created by God only for decoration of the earth | 3.3 |
| 20 | I will preserve the environment as best as I can as a form of gratitude | 4.1 |
| 21 | I let excessive tree cutting activities in my environment | 4.1 |
| 22 | In my opinion, protecting the environmental ecosystem is the government's business | 3.7 |
| 23 | I burn household trash every day | 3.4 |
| 24 | I will let it if I see people who destroy and disturb the ecosystem | 3.5 |
| 25 | I will ask everyone to join to save the earth | 4.0 |
| | **Average** | **3.6** |

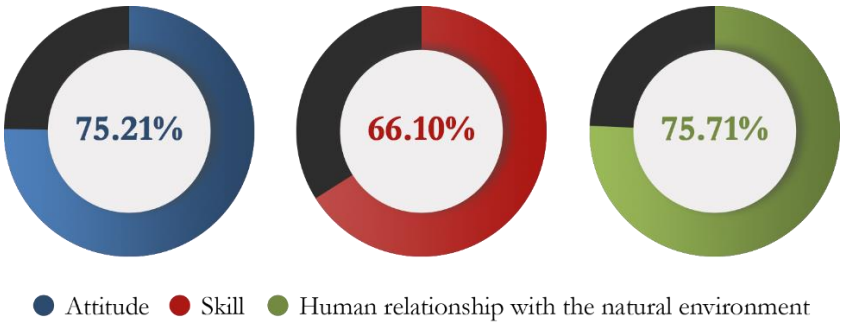


**Figure 1.** Diagram of the percentage of competence of attitude, skill, and human relationship with the natural environment per indicator.

Figure 1 analyzes the average percentage of three ecoliteracy competencies, covering attitudes, skills, and human relations with the natural environment. Based on the average of the three competencies as viewed above, the highest score obtained is the indicator of human relations with nature, followed by the attitude indicator. This proves that students are able to apply an attitude of gratitude and respect for nature. Students have also been able to develop an empathetic attitude towards the environment. However, based on the results of the Table 6, the lowest score is in the skill indicator. Based on observations, there are still many students who litter by throwing garbage under the Table 6, by keeping the lights on during the day in the classroom, and by letting the toilet water faucet that is already running. This means that the students' level of ecoliteracy is still quite low.

## DISCUSSION

The results of the research on knowledge competence show that students' knowledge of ecoliteracy is still in the low category, while competence in attitudes, skills, and human relations with the natural environment is in the medium category. This is supported by research by Sulistianingsih & Dalu (2020), who state that the low ecoliteracy of students is caused by several problem factors, such as strategies and learning methods that still use conventional methods, so that students' knowledge and attitudes toward caring for the environment are still low. Apart from that, there is still a lot of used goods waste in the community and an environment that has not been utilized properly and optimally, as similarly stated by Nadiroh et al. (2019), explaining that awareness of protecting the environment in people's lives is still very lacking. According to Agustin & Maisyaroh (2020), there are several factors that can affect student ecoliteracy, including internal factors within oneself, the influence of others, and the influence of culture and education. Meanwhile, the environment has a particular role in the sustainability of all living things on earth (Nadiroh et al., 2019). The increasing environmental problems that occur in the neighborhood can cause various pollutants and have major impacts such as floods and landslides (Nadiroh et al., 2019), and hence, human involvement in the effort of improving environmental quality is highly needed. One of the efforts realized in ecoliteracy education is the development of students experiences so that they play an active role in solving problems in the real world of the surrounding environment and the improvement of students' awareness and care for the environment (Sucia et al., 2018).

### Teaching Materials

The results of an interview carried out with four teachers illustrated that most teachers rely highly on printed teaching materials, even two of those four teachers do not always use the teaching materials in the teaching and learning process. Consequentially, there is no student involvement in the learning process because their understanding of the type of teaching materials that support their own learning remains low, and this is due to the teachers who are not used to compiling and developing teaching materials. It is supported by research done by Arga et al. (2019), which states that teachers' understanding is still low in the preparation of teaching materials. Many of the teaching materials used today focus on the mastery of concepts and do not highlight the improvement of students' attitudes and skills. As a result, the learning process tends to be passive, and students' skills are less honed. Whereas in current learning, students need to apply 21st century skills in accordance with the 2013 curriculum for sustainable development education.

The result of the interview done with these teachers also describes that teaching materials that are needed by students to support the learning process are those that are interesting and digital-based, not boring, and are in line with technological developments. Therefore, the teaching materials can now be made digitally interactive to make it easier and more likely to attract students' attention since interactive teaching materials can be used independently or with teacher guidance. Interactive teaching materials will make learning more meaningful than using printed teaching materials, therefore, interesting interactive teaching materials are needed in the current learning process.

Based on both analyses of ecoliteracy and teaching materials as explained above, an effort to improve ecoliteracy is highly necessary, and one of which is through the use of learning sources. The current teaching materials still focus on mastering concepts, which is very different from what students need at this time. Now, students need teaching material that can support the learning so that the teaching and learning process can actively run. It can be realized through the use of interesting interactive teaching materials that can be used independently by students and teachers. Therefore, further analysis and research are needed regarding the implementation of interactive teaching materials to increase students' ecoliteracy.

## CONCLUSION

The improvement of ecoliteracy competence is highly instrumental to do so that students will be able to both understand the concept of the environment and critically and deeply think of existing environmental problems in order to improve students skill in problem solving and to increase attitude of care for the environment. The findings of this study showed that the students' knowledge of ecoliteracy was still in the low category, while the attitudes, skills, and human relations with nature were in the medium category. As a result, ecoliteracy needs to be improved so that students will have high ecological literacy and can participate in solving environmental problems. The teaching materials needed today are interesting interactive teaching materials that can motivate students to make learning more meaningful, especially in environmental learning. Therefore, further research and analysis are required regarding the implementation of interactive teaching materials to increase students' ecoliteracy.

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## AUTHOR CONTRIBUTIONS

GNR and IDP contributed to conceptualization, methodology, investigation, writing original draft, and visualization. IR conceived and designed the study, data curation, formal analysis, writing review and editing. All authors approved the final version of the manuscript.

## CONFLICT OF INTEREST STATEMENT

The authors have disclosed any conflicts of interest with respect to the research, authorship, and publication of this article.

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