
Profile of Students' Environmental Literacy and the Needs of Science Teaching Materials Integrated with the Local Potential of Rawa Bento Based on Problem Based Learning

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Abstract. The achievement of environmental literacy of students in Indonesia still faces various problems. Even though environmental literacy is one of the important literacy for students to have. This study aims to determine the profile of environmental literacy among junior high school students and the need for integrated science teaching materials based on problem based learning (PBL) at Rawa Bento. The population of this study consists of junior high school students from six schools in Kerinci Regency. The research sample includes 90 students selected using a purposive random sampling technique. Data collection is conducted through instruments such as tests to measure environmental literacy and student response questionnaires to determine the need for integrated science teaching materials based on PBL at Rawa Bento. The data in the study are analyzed using quantitative descriptive analysis techniques. The research findings are as follows: 1) the majority of students have low to moderate levels of environmental literacy. 38.9% of students still have a low level of environmental literacy, 54.4% fall into the moderate category, and only 6.7% are in the high category; 2) the lowest ability of students is in analyzing the impacts resulting from environmental issues; 3) there is a need for the development of integrated electronic teaching materials based on PBL at Rawa Bento to enhance students' environmental literacy. Based on the results of the study, it can be concluded that the environmental literacy of students from six schools in Kerinci Regency is in the medium category.

Keywords: environmental literacy, science teaching materials, local potential, Rawa Bento

Introduction

Environmental literacy pertains to an individual's grasp of how human activities impact the world and its resources. It can be defined as the capacity and knowledge needed to address environmental issues effectively (Indriyani et al., 2020; Shamuganathan & Karpudewan, 2015). This literacy also encompasses awareness of related issues, positive attitudes and values, and the skills, motivation, and commitment required to participate in solving these problems (Fang et al., 2018).

Environmental literacy among Indonesian students has emerged as a vital concern in 21st-century development. This stems from the recognition that fostering both a deep

appreciation for nature and a commitment to safeguarding our abundant natural resources is pivotal. It is equally essential in addressing pressing sustainability issues such as climate change, resource scarcity, and biodiversity loss (Kuruppuarachchi et al., 2023; Panjaitan et al., 2021; Sriyati et al., 2022). Environmental awareness is reflected through attitudes and responsibilities in preserving the environment, but many Indonesian students lack such awareness due to a lack of education and awareness programs regarding environmental issues (Indriyani et al., 2020).

Several assessment results show students' low environmental literacy in Indonesia. Assessment of Indonesian students revealed that their environmental literacy level is still relatively low, especially in the cognitive aspect (Nasution, 2016; Santoso et al., 2021). The low level of environmental literacy among Indonesian students is also reflected in the program for international student assessment (PISA) results, where the performance of Indonesian students in environmental science and geoscience ranks 51 out of 57 participating countries. Therefore, it is important to make efforts to facilitate students in improving their environmental literacy.

Students often face several challenges in developing their environmental literacy. Some of these challenges include a lack of basic knowledge about environmental concepts and issues, a lack of interest in environmental topics, a deficiency in critical thinking skills necessary to analyze complex issues, limited real-world experiences essential for deep understanding, and constrained educational resources such as textbooks and field trips (Shri & Tiwari, 2021; Widiyana & Wardani, 2017). To overcome these barriers, it is crucial to provide students with access to comprehensive environmental education and real-world experiences through methods such as field trips, hands-on activities, and the integration of technology in learning (Kuswendi & Arga, 2020). Furthermore, it is important to promote students' critical thinking skills through various problem-solving activities and discussions. By taking these actions, we can assist students in building a solid foundation in their environmental literacy.

Strengthening environmental literacy is crucial by integrating various interdisciplinary into the curriculum. Several studies recommend integrating environmental concepts into formal curricula to develop learners' environmental literacy (De & Durage, 2020; Sachitra & Kaluarachchi, 2018). The integration of environmental concepts in learning can be done through the integration of local potential in science learning which can have a positive impact on students' environmental skills and literacy (Rahardini et al., 2017; Sriyati et al., 2021).

The development of students' environmental literacy has been positively impacted by the use of integrated science learning with local potential, according to a number of studies. The creation of online worksheets for science students combined with the potential of nearby sugar refineries can raise students' environmental curiosity (Fuadati & Wilujeng, 2019). In accordance with this study's findings, Suryawati et al (2020) also put forward a finding that the potential of the local environment based on problem based learning (PBL) also contributes to strengthening students' environmental literacy. Integrating the local potential into science instruction can also be a successful alternate teaching method for raising students' environmental literacy (Habellia & Suyanta, 2021).

PBL implementation can also help students become more environmentally aware. PBL is a student-centered strategy in which teachers support learning by assisting students in recognizing and resolving complex problems (Liu et al., 2018; Maulidiya & Mercuriani, 2023; Merritt et al., 2017). The PBL process has characteristics that have the potential to influence students' attitudes, including being able to shape their attitudes toward the surrounding environment indirectly (Wajdi et al., 2022). The implementation of authentic PBL model in real-life situations can significantly enhance students' understanding of the environment and foster a favorable outlook towards it (Ural & Dadli, 2020).

Several previous studies have demonstrated the influence of the PBL model on learners' environmental literacy. The integration of PBL with local environmental issues has been found to enhance students' ability to identify, analyze, evaluate, and plan actions related to both local and global environmental problems, as well as increase their sensitivity towards such issues (Suryawati et al., 2020). Similarly, research conducted by Wajdi et al. (2022) has shown that the implementation of PBL, supported by environment-based comics, effectively improves students' environmental literacy. Moreover, when PBL is integrated with local wisdom and oriented towards socio-scientific problems, it significantly impacts students' conceptual knowledge and environmental literacy (Chang et al., 2022; Kim, 2021).

The novelty of this study is to obtain new findings on the profile of environmental literacy and integrated learning of local potential based on PBL, as well as recommendations for the implementation of integrated science learning local potential to improve the environmental literacy of students. Based on the explanation above, the purpose of this study is to determine the environmental literacy profile of junior high school students and the need for the implementation of integrated science teaching materials based on PBL-based Rawa Bento.

Methods

This study used quantitative descriptive research method. The population in this study was junior high school students from six schools in Kerinci Regency. The research sample was determined by purposive random sampling so that 90 students from class VII junior high school were selected. This study has a focus on the environmental literacy profile of students in terms of aspects of knowledge/content and competence as well as the needs of integrated science teaching materials for Rawa Bento in terms of the variables of student knowledge about Rawa Bento, and the types of teaching materials expected by students, and students' attitudes towards the environment.

The instrument for collecting data on environmental literacy skills uses a multiple-choice test consisting of 17 questions. The measured literacy aspects focus on content and competencies, with indicators adopted from Hollweg et al (2011). The aspects and indicators measured can be seen in Table 1.

Table 1. Aspects and Indicators of Environmental Literacy

Environmental Literacy Aspect	Indicators
knowledge/content	explaining ecosystem components analyzing interdependencies in ecosystems explaining energy flows in ecosystems identifying interactions between ecosystem components explaining various environmental problems that arise due to biophysical impacts that appear in nature explaining various environmental problems arising from human conflicts
competence	analyze the impact of environmental problems identify environmental issues, 8) analyze the impact of environmental problems choose appropriate solutions to overcome environmental problems

The process of environmental literacy data collection followed systematic steps, starting with the distribution of multiple-choice test questions. The test comprised 17 questions, with a maximum score of 17. Each correct answer was assigned a score of 1, while incorrect answers received a score of 0, based on the established assessment criteria. The calculation of the final grade is carried out by dividing the score obtained by the student by the maximum score. Furthermore, scores are categorized as the following Table 2.

Table 2. Range of environmental literacy categories

Range of Score	Category
$75 < \text{score} \leq 100$	High
$45 < \text{score} \leq 75$	Medium
$\text{Score} \leq 45$	Low

(Rohmah & Prahani, 2021)

The data collection on students' needs for integrated science teaching materials based on PBL in Rawa Bento is carried out by distributing questionnaires with a four-point scale. The scale levels that students can choose from are strongly agree (SA), agree (A), disagree (D), and strongly disagree (SD). The needs questionnaire is composed of three aspects to be measured: students' knowledge about Rawa Bento, students' responses to the expected types of teaching materials, and students' attitudes towards the environment. Data processing is done by calculating the percentage of each response selected by the students.

Results and Discussion

Environmental Literacy of Students

Based on research, results were obtained about environmental literacy of students which were reviewed on the material of interaction of living things with their environment. The environmental literacy profile of students is reviewed from the aspects of content and competence using multiple-choice questions. The environmental literacy ability profiles of students from the six sample schools are presented in Figure 1.

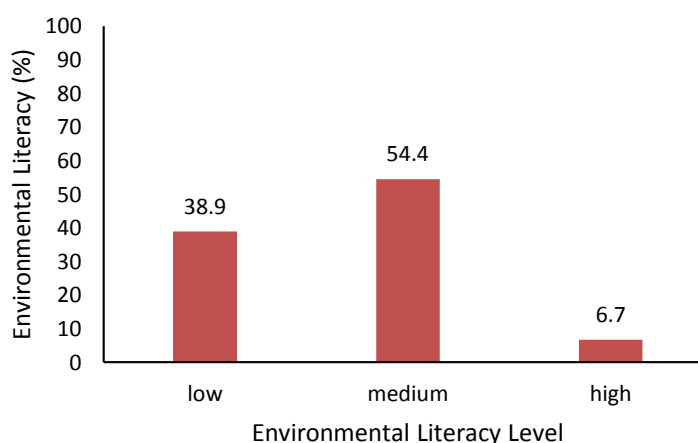


Figure 1. The Results of Environmental Literacy Assessment of Students

Figure 1 explains that the environmental literacy level of students is in the low to medium category. 38.9% of students still have a low level of environmental literacy, 54.4% are in the medium category, and only 6.7% are in the high category. Based on data analysis, it was found that students' environmental literacy in the content aspect was in the medium category while in the competency aspect, it was still relatively low.

Environmental literacy measured from the aspect of content and competence amounts to nine indicators, namely: 1) explaining ecosystem components, 2) analyzing interdependencies in ecosystems, 3) explaining energy flows in ecosystems, 4) identifying interactions between ecosystem components, 5) explaining various environmental problems that arise due to biophysical impacts that appear in nature, 6) explaining various environmental problems arising from human conflicts, 7) identify environmental issues, 8) analyze the impact of environmental problems, 9) choose appropriate solutions to overcome environmental problems. The results of the assessment of each indicator can be presented in Figure 2.

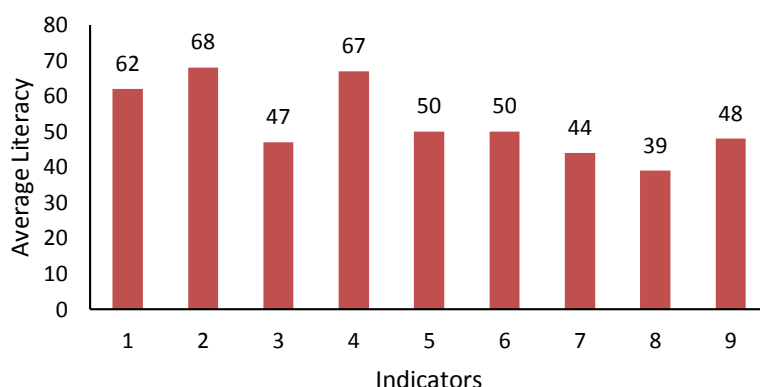


Figure 2. Average Environmental Literacy of Learners of Each Indicator

Based on Figure 2 can be represented the results of environmental literacy research from each indicator. The lowest ability of students is in the indicator of analyzing the impact that occurs from environmental problems, while the highest gain is in the indicator of analyzing interdependence in the ecosystem.

Based on research guests, students still have difficulty achieving an adequate level of environmental literacy. Although they have a positive attitude towards environmental issues, their knowledge and behavior related to environmental issues remains inadequate (Shri & Tiwari, 2021). In parallel with this, investigations carried out at the primary school level, aimed at improving environmental literacy through the use of memos, revealed that students showed inadequate levels of environmental literacy (Kuswendi & Arga, 2020). These findings emphasize the importance of formulating effective strategies to improve environmental literacy among students. Low levels of environmental literacy among individuals can have negative repercussions for the environment itself (McBride et al., 2013). The study's findings underscore the need for more intensive efforts to promote environmental literacy among individuals, as it is a key determinant in shaping a sustainable future.

Student Response to the Needs of Science Teaching Materials Integrated with the Local Potential of Rawa Bento Based on PBL

The need for integrated science teaching materials based on PBL-based Rawa Bento is viewed from the first aspect of students' responses to knowledge about Rawa Bento. Knowledge of local potential by learners can optimize the learning process and help learners understand science concepts better. The results of the questionnaire dissemination of students' knowledge of the local potential of Rawa Bento are presented in the form of percentage of approval with categories strongly agree (SA), agree (A), disagree (D), and strongly disagree (SD) as in Table 3.

Table 3. Student's Knowledge of Rawa Bento

Statement	Answer (%)			
	SD	D	A	SA
I know the environment of Rawa Bento as one of the tourist attractions in Kerinci Regency	0	7.8	28.9	63.3
I learned that the tourist attraction of Rawa Bento has various advantages and potential to be developed	3.3	7.8	10	78.9
There are various tourist spots such as bird watching and camping areas that can be accessed by tourists at the Rawa Bento tourist attraction	1.1	2.2	16.7	80
Rawa Bento has various types of living things either in the form of animals or plants	2.2	10	21.1	66.7

Based on Table 3 it can be seen that learners have a good knowledge of the local potential of Rawa Bento. In the statement about the knowledge of Rawa Bento as one of the tourist attractions in Kerinci Regency, 63.3% of students expressed strong agreement and 0% strongly disagreed. In the statement about the knowledge of Rawa Bento tourist attractions having various advantages and potential to be developed, 78% of students expressed strong agreement and 3.3% strongly disagreed. Furthermore, 80% of students strongly agree that there are various tourist spots such as bird-watching and camping areas that can be accessed by tourists in Rawa Bento tourist attractions, and only 1.1% strongly disagree. Students also know that Rawa Bento has various types of living things in the form of animals or plants with the highest percentage of 66.7% strongly agreeing and only 2.2% strongly disagree.

The needs of students for the availability of integrated teaching materials for the local potential of Rawa Bento are also reviewed from the type of teaching materials expected by students. This aspect is considered important because it can help increase the effectiveness of learning. The response of students to the type of teaching material expected as in Table 4.

Table 4. Student Response to the Type of Teaching Material Expected

Statement	Answer (%)			
	SD	D	A	SA
I like the science teaching materials that are integrated into the surrounding environment	1.1	12.2	16.7	70
Learning will be more interesting if you use teaching materials that are integrated into the advantages of an area that I know	3.3	3.3	5.6	87.8

I enjoy reading teaching materials that present environmental issues	0	3.3	12.2	84.4
I prefer electronic teaching materials that can be accessed via smartphone (android) rather than printed teaching materials such as books	0	1.1	16.7	82.2
Learning will be more fun if the teaching materials are equipped with learning videos	2.2	5.6	10	82.2

Based on Table 4 there are six statements that describe the type of teaching material expected by students. In the first statement, 70% of students strongly agreed that they liked science teaching materials that were integrated with the surrounding environment. Furthermore, 87.7% of students strongly agree that learning will be more interesting if using teaching materials that are integrated into the advantages of an area that I know. In the statement about liking to read teaching materials that present environmental problems, 84.4% of students strongly agreed. Then there are 82.2% of students who strongly agree that they prefer electronic teaching materials that can be accessed via smartphones (android) rather than printed teaching materials such as books and students strongly agree that learning will be more fun if teaching materials are equipped with learning videos.

Based on these data, it can be described that the use of teaching materials that are integrated with the surrounding environment, the manufacture of teaching materials that take advantage of the advantages of an area, and the use of teaching materials that are relevant to environmental issues can increase the interest and motivation of students in learning science. In addition, the use of teaching materials that can be accessed electronically and equipped with learning videos can be more attractive to students so a teaching material that is integrated with environmental problems, local excellence, and electronic-based is needed. This explains that teaching materials integrated with local potential are needed in learning.

The aspect of students' needs for integrated teaching materials for the local potential of Rawa Bento is further reviewed from the attitude of students towards the environment. This aspect is part of students' understanding of the environment which is shown through positive feelings, curiosity, critical, caring, using wisely materials that cause change, maintaining balance, caring for land, water, and air, and caring for flora and fauna. The results of the questionnaire distribution on students' attitudes toward the environment are presented in Table 5.

Table 5. Attitude of learners towards the environment

Statement	Answer (%)			
	SD	D	A	SA
I always show positive feelings towards the environment	6.7	81.1	10	2.2
I am curious, critical, and care about the environment	6.7	75.6	15.6	2.2
I always use wisely materials that cause environmental changes and maintain the balance of the surrounding environment	3.3	81.1	13.3	2.1
I always care about land, water, and air	10	71.1	14.4	4.4
I always care about flora and fauna	0	72.2	26.7	1.1

Based on the data in Table 5, it can be described that students still have problems in aspects of attitudes toward the environment. 81.1% of students expressed disapproval that they always show positive feelings towards the environment. Furthermore, 75.6% of students expressed disapproval that they were curious, critical, and concerned about the environment. In the statement about always using wisely materials that cause environmental changes and maintaining the balance of the surrounding environment, there are 81.1% of students disagree. The attitude of students' concern for land, water, and air also experienced problems, namely there were 71.1% of students disagreed. Then in the statement always caring about flora and fauna, there were 72.2% of students disagreed. The results of the analysis of the data obtained show that students still have problems in aspects of concern for the environment. This is a crucial part that needs to be resolved so that teaching material is needed that is able to support an attitude of concern for the environment.

Addressing the issue of low environmental care is imperative. Several contributing factors compound this problem, including a lack of environmental education, which limits students' comprehension of key ecological issues and their significance. Additionally, insufficient awareness of the environmental consequences of their actions has resulted in a reduced concern for environmental well-being (Budak et al., 2005; Karadag et al., 2022; Wibowo et al., 2023). Furthermore, the absence of positive role models exemplifying environmental care has diminished students' motivation to protect their surroundings. The limited opportunities for students to engage with nature have also diminished their appreciation for the natural world and their inclination to preserve it (Istiqomah et al., 2020; Le Hebel et al., 2014). Lastly, cultural and social influences have led some cultures to prioritize economic growth over environmental conservation. To overcome these obstacles, we must focus on enhancing environmental education, promoting awareness, providing positive role models, fostering connections with nature, and gaining insights into the cultural and social dynamics that shape students' environmental attitudes.

Conclusion

Based on the results of research from the findings and analysis of the data above, it can be concluded that the environmental literacy of students from six schools in Kerinci Regency is in the medium category and science teaching materials integrated with the local potential Rawa Bento based on PBL are needed in learning. Thus, an innovation is needed in the development of teaching materials that can be used to improve environmental literacy. One of the efforts that can be used is to develop and implement integrated teaching materials for the local potential of PBL-based Rawa Bento in science learning.

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