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The role of environmental knowledge: Predictor for environmental attitude among biology students at Universitas Negeri Malang?

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Abstract: Environmental issues have been extensively discussed worldwide, including in Indonesia. Various human activities contribute to environmental degradation, affecting soil, water, and air quality. This study investigates environmental knowledge, environmental attitudes, and the relationship between environmental knowledge and attitudes among biology students at Universitas Negeri Malang (N = 126). Conducted in November 2020 in Malang, Indonesia, this study employed purposive sampling to select participants. Data were collected using a questionnaire and analyzed through descriptive quantitative methods and simple linear regression. The results indicate that students exhibit a high level of environmental knowledge and attitudes. Moreover, a moderate positive correlation (R = 0.427) was observed between environmental knowledge and attitudes. The linear regression analysis yielded the equation (Y = 2.211 + 0.488X), demonstrating that environmental knowledge contributes 18.2% to variations in environmental attitudes. These findings suggest that while knowledge of environmental issues is crucial, fostering active engagement in sustainable practices and advocacy is essential to strengthening environmental attitudes.

Keywords: Environmental attitude, environmental knowledge, biology student

Abstrak: Isu lingkungan telah banyak dibahas di seluruh dunia, termasuk di Indonesia. Berbagai aktivitas manusia berkontribusi terhadap degradasi lingkungan, yang memengaruhi kualitas tanah, air, dan udara. Penelitian ini menyelidiki pengetahuan lingkungan, sikap lingkungan, dan hubungan antara pengetahuan lingkungan dan sikap di kalangan mahasiswa biologi di Universitas Negeri Malang (N = 126). Dilakukan pada bulan November 2020 di Malang, Indonesia, penelitian ini menggunakan purposive sampling untuk memilih peserta. Data dikumpulkan menggunakan kuesioner dan dianalisis melalui metode kuantitatif deskriptif dan regresi linier sederhana. Hasilnya menunjukkan bahwa mahasiswa menunjukkan tingkat pengetahuan dan sikap lingkungan yang tinggi. Selain itu, korelasi positif sedang (R = 0,427) diamati antara pengetahuan dan sikap lingkungan. Analisis regresi linier menghasilkan persamaan (Y = 2,211 + 0,488X), yang menunjukkan bahwa pengetahuan lingkungan berkontribusi 18,2% terhadap variasi sikap lingkungan. Temuan ini menunjukkan bahwa meskipun pengetahuan tentang masalah lingkungan sangat penting, mendorong keterlibatan aktif dalam praktik dan advokasi berkelanjutan sangat penting untuk memperkuat sikap lingkungan.

Kata kunci: Sikap lingkungan, pengetahuan lingkungan, mahasiswa biologi

INTRODUCTION

Humans and the environment are closely connected, influencing each other directly or indirectly, but human activities have increasingly led to various environmental problems (Jorgenson & Dunlap, 2018; Muflihaini et al., 2020). Various studies show various problems in the aquatic environment (Sueb & Merit Novitasari, 2019; Suhadi, Sueb, & Syamsussabri,

2019), soil (Rina Fiji Lestari & Wayan Sumberartha, 2020; Suhadi, Sueb, & Wedhanto, 2019), and water (Okibe, 2020). The emergence of environmental problems can be reduced if the community develops environmental literacy (Veisi et al., 2019). An environmentally literate society will be more responsible for protecting the environment (Liu & Tobias, 2024).

In higher education, environmental education has an important role in shaping students' environmental literacy and caring attitude, especially through environment-based curriculum and field practice activities. One of them is by utilizing courses or learning processe, implementing a learning model (Mardiana et al., 2016), and developing an environmental-based module as an effort to develop environmental literacy and environmental awareness (Anggereini, 2017; Mahfudhillah et al., 2016; Syamsussabri et al., 2019). Higher education can serve as an ideal sustainable model, as a learning laboratory for the community, and can provide a place for learners to develop new habits related to environmental literacy (Veisi et al., 2019). Developing environmental literacy is very important to answer current environmental challenges and issues and support a more advanced transformation of society (Fazal et al., 2023). Students and the community must have problem-solving skills, planning, and action strategies to deal with environmental problems. In addition, the awareness, expertise, skills, attitudes, and values of individuals to the environment must be improved through environmental literacy (Husamah et al., 2022).

The environment influences individuals continuously, shaping their responses—either positive or negative—through learning and experience. These responses are based on three key elements: cognitive (perception and understanding of the environment), affective (emotions and feelings associated with environmental conditions), and conative (the tendency to act or behave accordingly) (Ortegón-Cortázar & Royo-Vela, 2019). Environmental attitude is a collection of beliefs and intentions to act on environmental issues. In this situation, it is a tailored adaptation to find solutions to environmental issues (McIntyre & Milfont, 2015). People's attitudes towards the environment are especially relevant because they will eventually be influenced and must address environmental issues resulting from current behavior (Berame et al., 2022). Previous research on knowledge and attitudes in environmental literacy has been widely carried out (Ariyatun et al., 2024; Suhartinah et al., 2019; Ymeri et al., 2023).

While numerous studies have explored environmental literacy, including knowledge and attitudes (Ariyatun et al., 2024), few have specifically examined the relationship between these aspects among biology students. Most existing research focuses on general student populations or specific interventions rather than assessing biology students' inherent environmental knowledge and attitudes. This gap in the literature leaves uncertainties about how well-equipped biology students—who are expected to be more environmentally conscious—are in terms of their environmental literacy. Therefore, this study aims to fill this gap by investigating the environmental knowledge, attitudes, and their correlation among biology students at Universitas Negeri Malang.

METHOD

The research was carried out as a cross-sectional study with a survey method. Participants are college students in biology at the Biology Department Universitas Negeri Malang. Participants in this study were 126 Biology students at Universitas Negeri Malang. Students were selected by purposive sampling to represent the criteria that should be taken. Students were chosen because their field of study is closely related to environmental knowledge and attitudes. Additionally, students who had taken courses or participated in activities related to environmental science may have been prioritized. By using purposive sampling, the researchers ensured that the selected participants had relevant knowledge and experiences to provide meaningful insights into the study's focus. Participants' willingness to take part in the study was announced via WhatsApp Story and Instagram Story. Participation in this study was voluntary, and only those who were willing to take part were included in the research.

Environmental knowledge and environmental attitudes have been derived from a student survey using a questionnaire to examine environmental knowledge and environmental attitude. The questionnaire was tested for validity and reliability based on previous research and was categorized as valid and reliable, with a Cronbach's alpha value of 0.76. The environmental knowledge survey was adapted from (Veisi et al., 2019). Environmental attitude survey taken (Dunlap, 2008), the revised New Ecological Paradigm Scale was adapted to meet these aims. The Likert-type scale was used in all respects, and tests were carried out in five ways, from strongly agree (5) to strongly disagree (1). The questionnaire was distributed using Google Forms and shared through social media platforms, including WhatsApp and Instagram

The survey responses were submitted in Excel 2019, which then was coded according to the Likert scale in terms of information and attitudes. In addition, for statistical analysis, the data was imported into statistical software analysis. The normality test was measured by the Kolmogorov-Smirnov test, the linearity test measured linearity and the correlation between environmental knowledge and attitudes was measured by simple linear regression. These tests were conducted at the $\alpha = 0.05$. As shown in Table 1, students' environmental knowledge scores were categorized into low, medium, and high levels. Similarly, environmental attitude scores were classified into negative, moderate, and positive categories (Table 2). These categories were used to interpret the survey results descriptively. Students' environmental attitude level is determined by Table 2.

Table 1. Student's environmental knowledge level

Score	Categories
0-2.49	Low-level knowledge
2.50-3.49	Mid-level knowledge
3.50-5.00	High-level knowledge

Source: Veisi et al. (Veisi et al., 2019)

Table 2. Student's environmental attitudes level

Score	Categories
0-2.49	Negative attitude
2.50-3.99	Moderate level attitude
4-5	Positive attitude

Source: Veisi et al. (Veisi et al., 2019)

RESULTS AND DISCUSSION

Environmental knowledge

The environmental knowledge scale consists of 13 items adapted from Veisi et al. (2019). Its division consisted of two categories: awareness of environmental concerns, including local issues such as energy consumption, waste, recycling, and the protection and maintenance of creature ecosystems.

Table 3. The mean and standard difference in environmental knowledge of the student

Statements	Mean	Std. Dev
Environmental issues are a focus region for Indonesia	4.51	0.73
Ecology deals with the relationship between species and their physical environment.	4.72	0.47
The combustion of fossil fuels for electricity is the primary source of air pollution and global warming.	4.16	0.79
Shore ice melting has increased to sea level	4.41	0.64
Only in industrial areas is acid rain	3.07	1.04
Dam construction accelerates the ongoing changes in natural ecosystems	3.31	0.85
Eutrophication, characterized by elevated phosphate and nitrate levels, also negatively impacts the environment indirectly by promoting bacterial growth and excessive algal blooms.	4.13	0.71
Sulphur hexafluoride (SF6) is the primary source of ozone depletion.	3.36	1.02
The primary cause of pollution of water and soil and environmental degradation is household waste discharge.	4.16	0.78
Human habitat destruction is the primary explanation for the extinction of plants and animals.	4.45	0.65
Environmental concerns exacerbated by overpopulation	4.12	0.87
Changes in wetlands within the local water cycle influence dust emissions.	3.63	0.69
Migration and the associated remittances are key factors shaping land use in both urban and rural areas.	3.70	0.76
Average	3.98	1.3

Table 3 displays presents the results for each item on the scale based on student responses. The findings indicate that all questions were of high quality. The higher number is in the item "ecology examines the interactions between organisms and their physical

environment, as well as their relationships with one another," which number (Mean = 4.72, Std. Dev = 0.47). Overall, student's environmental knowledge is good, which number (Mean = 3.98, Std. Dev = 1.3). Based on Table 1, the mean of 3.98 means students have good environmental knowledge at a high level. This finding indicated that students have good environmental knowledge. Transferring environmental awareness to make it possible for people to think rationally about their behavior and then act carefully on this basis was the dominant example of environmental education (Bissinger & Bogner, 2018). Students may have a good sense of environmental knowledge because they already studied basic environmental subjects. By having studied basic environmental subjects, they possess a solid foundation of environmental knowledge, which can influence their attitudes and behaviors toward sustainability (Akash, 2024). For students, this emphasizes the importance of reinforcing and applying their knowledge through practical experiences, critical discussions, and environmental initiatives to cultivate a deeper commitment to environmental protection (Kasim et al., 2018; Sasea et al., 2023; Wu & Tham, 2023).

Environmental attitudes

The environmental attitudes survey consisted of 15-item questions taken from the Revised New Ecological Paradigm Scale (Dunlap, 2008). Table 4 shows the results of the student's environmental responses that students have a positive attitude in all respects. The higher one is "Plants and animals have the same right to live as humans," which number (Mean = 4.75, Std. Dev = 0.54). Overall, the student's environmental attitude is good which number (Mean = 3.82, Std. Dev = 0.89). Based on Table 4, the mean of 3.82 means students have good environmental knowledge at a moderate level. Student's environmental attitude is good because they have obtained the basic material of environmental course.

Furthermore, the correlation between environmental knowledge and attitudes was determined by simple linear regression analysis. Before being tested for linear regression, the data were tested for normality using Kolmogorov-Smirnov and linearity. The result of the environmental knowledge normality test showed a p-value of 0.603 > 0.05, which means environmental knowledge is distributed normally. The environmental attitude normality test showed a p-value of 0.274 > 0.05, which means environmental attitude is distributed normally. The result of the linearity test showed a p-value of 0,000 < 0,05, which means environmental knowledge and environmental attitude can be explained by a linear relationship. Simple linear regression is shown in Table 5 and Table 6.

Table 4. The mean and standard deviation of the student's environmental attitude

Statements	Mean	Std. Dev
The global population is approaching the Earth's carrying capacity.	3.69	0.78
People are capable of altering the natural world to suit their needs.	3.49	1.09
It also has devastating consequences when people mess with nature.	4.52	0.60
Human capital ensure that the planet is not unliveable.	3.28	0.95

Humans are grossly abusing the atmosphere	3.57	0.95
Plants and animals have an equal right to exist alongside humans.	4.73	0.54
The planet holds abundant natural resources, provided we learn how to cultivate and sustain them.	3.91	1.07
In order to fulfil the impact of modern industrial nations, natural balance is good enough.	3.29	1.15
Given our unique abilities, human beings are nevertheless subject to the laws of nature.	4.09	0.72
The severity of the so-called "ecological crisis" facing humanity has been significantly underestimated.	3.44	0.94
Humans are often viewed as stewards of the natural world, but their role in governing existence remains a subject of ethical and philosophical debate.	3.99	0.94
If things move in their current path, we will soon encounter a major ecological disaster.	4.33	0.61
Humans will finally understand enough about how nature works to regulate it.	3.55	0.88
The equilibrium of nature is very fragile and easy to disturb.	4.00	0.85
Planet is like a spacecraft with a very small space and resource.	3.39	1.23
Average	3.82	0.89

Table 5. Table of summary

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.211	0.309		7.144	0.000
	Environmental Attitude	0.488	0.085	0.458	5.743	0.000

Table 6. Table of summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.427[a]	0.182	0.175	0.30113

Table 5 confirms that environmental attitude is a significant predictor of environmental knowledge (B = 0.488, p = 0.000), meaning that a higher environmental attitude is associated with increased knowledge. Table 6 shows that environmental attitude explains 18.2% of the variance in environmental knowledge (R^2 = 0.182), indicating a moderate relationship. The remaining 81.8% is influenced by other factors. This contribution percentage can be seen in Figure 1. The linear regression analysis yielded the following regression equation: Y = 2.211 + 0.488X. Environmental knowledge and attitude have a positive relationship. While environmental attitude plays a role in shaping knowledge, its

impact is moderate, suggesting that other factors also contribute. Future research should explore additional influences to gain a more comprehensive understanding.

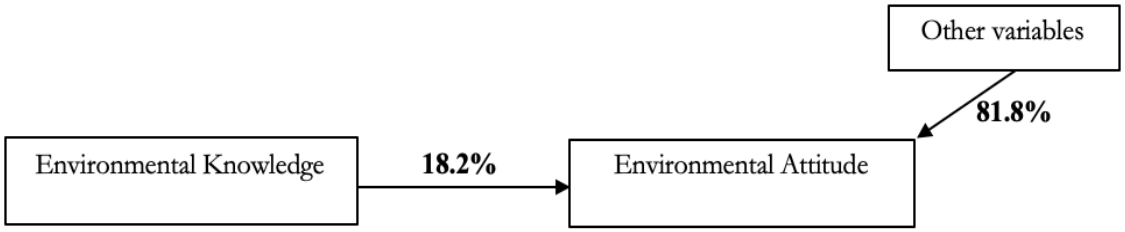

Figure 1. Simplified competence model of environmental knowledge contribution percentage to the environmental attitudes

The positive correlation between environmental knowledge and attitude suggests that students who are more knowledgeable about environmental issues tend to have more positive attitudes toward the environment (Maria Geiger et al., 2018; Sapanova et al., 2024). This aligns with the theory that knowledge is a foundational factor in shaping attitudes, as it provides individuals with the necessary understanding of environmental problems, their causes, and potential solutions (Maghfiroh et al., 2024). When students are well-informed about climate change, pollution, and biodiversity loss, they are more likely to recognize the importance of protecting the environment and develop a sense of responsibility toward sustainable practices (Tibola da Rocha et al., 2020)

However, the moderate correlation (R = 0.427) indicates that knowledge alone does not fully determine environmental attitudes. External factors, such as life, socioeconomic status, and community, have possibly also affected environmental attitudes (Gifford & Nilsson, 2014). The statistics show that improved awareness will help to improve the environment. Environmental attitudes are seen as the motivational basis for having a good environmental attitude (Ahmadi et al., 2018). Indeed, there is evidence suggesting a relationship between environmental knowledge and environmental attitude. Simarmata et al. (2018) have revealed there is a correlation between student's environmental knowledge and attitude with a correlation value of 0.324. Ahmadi et al. (2018) revealed student's environmental knowledge and attitude correlation value by 0.50. Ramadhan et al. (2024) reveal positive correlations between environmental awareness, knowledge, attitude, and purchase intent. People who had higher knowledge levels compared with students with lower knowledge levels were more beneficial to the environment. These studies showed a student's environmental knowledge and attitude can be explained by a linear equation. This means if the students have better environmental knowledge, they have a good environmental attitude. In contrast, if students have bad environmental knowledge, they will have a bad environmental attitude. As mentioned by Ahmadi et al. (2018), the higher the environmental knowledge that students have, the higher the attitude, environmental attitude and awareness. People who have a stronger understanding of the world are more positive about the environment and vice versa (Kasim et al., 2024; Zheng et al., 2018).

An individual's attitude and behavior toward the environment are influenced by their level of environmental knowledge. This attitude can manifest through actions or responses such as maintaining environmental cleanliness, engaging in pro-environmental activities, purchasing and using eco-friendly products, and participating in forest conservation efforts (Istiana et al., 2014). There is a close relationship between the human view of the environment, environmental literacy, and environmental awareness, depending on the knowledge and experience that they have acquired. As a concept that needs to be developed, the primary performance in environmental education has been understood as environmental literacy (Veisi et al., 2019). The concepts and components are developed in various definitions and frameworks. A person with environmental awareness perceives and understands objects and phenomena in their surroundings in a way that influences their attitudes and behaviors toward the environment (Kuswendi & Arga, 2020). Ecological knowledge was an interdisciplinary subject that was an awareness of nature, social science, and anthropology (Araghi et al., 2014). The argument leads us to the conclusion that environmental knowledge can serve as a predictor of environmental attitude.

This finding reinforces the importance of integrating environmental education beyond theoretical knowledge. To cultivate stronger pro-environmental attitudes, educational programs should focus on interactive and problem-based learning approaches that connect students emotionally and practically with environmental issues (Balcerak & Woźniak, 2022). Additionally, fostering a sense of agency and responsibility by involving students in environmental decision-making and advocacy can further enhance their commitment to sustainability (Akash, 2024). Future research should explore the influence of affective and social factors on environmental attitudes to develop more effective strategies for environmental education and behavior change.

CONCLUSION

With the increasing prevalence of environmental issues across the country, research on these topics has also gained attention. Many scholars have explored the relationship between ecological knowledge and attitudes, emphasizing the importance of assessing these aspects, particularly among college students studying biology. A study conducted on biology students indicated that they possess a strong understanding of environmental issues and generally hold positive attitudes toward them. Statistical analysis confirmed a significant correlation between environmental knowledge and attitudes, showing a moderate relationship between the two. The regression analysis further suggested that while knowledge plays a role in shaping attitudes, other influencing factors also contribute significantly to students' perspectives on environmental issues.

This finding implies that while understanding environmental issues is important, students should also actively engage in sustainable practices and advocacy to reinforce their attitudes. Enhancing critical thinking and problem-solving skills related to environmental issues can further improve individuals' ability to apply their knowledge effectively. To

improve environmental attitudes and behaviors, it is recommended that educational programs integrate experiential learning, such as fieldwork or community-based projects, to deepen students' environmental commitment. Further research should explore additional factors, such as motivation and social influence, that contribute to environmental attitudes. Additionally, targeted educational initiatives should be developed to not only enhance knowledge but also encourage pro-environmental behaviors among students.

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