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Analysis of Environmental Literacy Profile Indonesian Students at STKIP Pesisir Selatan, West Sumatera

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ABSTRACT
Environmental literacy is considered an achievement of environmental education. Preservice teachers with good environmental literacy knowledge are more likely to align their actions with their understanding. Preservice teachers have two roles: as behavioural models for their students and as members of society. This research is a descriptive study that utilizes the survey method. The subjects of this research are 50 students from the Mathematics Education, Geography Education, and Technology and Informatics Education programs at STKIP Pesisir Selatan, West Sumatera-Indonesia. The data collection instrument in this research is a questionnaire. The data analysis technique used to process knowledge data utilizes the NELA score. This research indicates that students from all three programs have moderate environmental knowledge. The environmental literacy of Geography Education students has a minor standard deviation, showing relatively low variation in the scores. On the other hand, students in the Mathematics Education and Technology and Informatics Education programs have a higher standard deviation, indicating a more significant variation in their science literacy scores. Geography Education students have higher knowledge of ecology and pollution than students from the other two programs. Meanwhile, mathematics education students have the highest scores in environmental problem-solving skills.

INTRODUCTION

Humans are highly dependent on natural resources to meet their needs. The utilization of these natural resources inevitably affects environmental conditions. Therefore, humans should take care of the environment so that it responds positively to their actions. The global environmental conditions are deteriorating rapidly and causing concerns (Fitri & Hadiyanto, 2022). Currently, the world is facing serious environmental conservation and preservation challenges. The exponential growth of the population is a significant factor leading to increased demand for food, energy, and land expansion. This demand has resulted in deforestation, environmental pollution, water scarcity, loss of biodiversity, and energy crises (Shende et al., 2015). Indonesia is also facing numerous environmental issues. The Environmental Quality Index (Indeks Kualitas Lingkungan Hidup or IKLH) and the Indonesian Environmental Status (Purba et al., 2017) reported that approximately 30% of Indonesia's water resources are contaminated. Air quality has also declined over the decades in Indonesia. In 2016, 80% of Indonesia's 250 million population lived in areas with pollution levels above the

WHO guidelines, which has impacted the life expectancy of the population (Greenstone & Fan, 2019). These concerns and global environmental crises threaten the preservation of nature for future generations.

The current environmental issues are primarily caused by human activities (Khitam, 2018), including illegal logging and excessive utilization of natural resources without sustainable conservation practices (Nasution, 2016; Hariyadi et al., 2021; Ahmadi, 2022). Extreme environmental exploitation without considering environmental carrying capacity and ecological functions will diminish the quality of the living environment (Azmi & Elfayetti, 2017). Every human activity that exploits natural resources without conservation and awareness of the importance of environmental preservation will undoubtedly negatively impact the environment. These negative impacts include pollution in rivers and coastal areas, increasing pollution levels, and waste. If these conditions persist, they will lead to severe and concerning environmental damage. Addressing these environmental issues requires efforts such as environmental literacy (Hariyadi et al., 2021).

Humanity's awareness of the importance of the sustainability of both human beings and the environment on Earth is demonstrated through the emergence of the Sustainable Development Goals (SDGs) program, which includes initiatives related to environmental preservation. According to (Ghany, 2018), sustainable development is defined as the ability to ensure that the current generation meets their needs without compromising the ability of future generations to meet their own needs. Education is one of the targets of the SDGs program in achieving this objective.

Understanding and addressing environmental issues are necessary to shape a society that is aware of and cares for the environment. These competencies need to be instilled through both formal and non-formal education processes. It is essential to cultivate these competencies in the younger generation, who will be responsible for environmental preservation in the future (Widowati, 2011). Wahyudin (2017) suggests that preserving and protecting the environment is the government's responsibility and the community's duty. Current students are the generation responsible for the environment in the future.

Environmental literacy is understanding the importance of preserving the environment for both the present and future generations (Ramadani & Aprilia, 2021). Environmental literacy refers to an individual's knowledge and understanding of the aspects that contribute to the environment, the principles that govern the environment, and the ability to make effective decisions in maintaining environmental quality in daily life (Sari et al., 2020; Hollweg et al., 2011).

Environmental literacy needs to be instilled in students as an individual foundation, enabling them to think critically and logically when faced with various situations (Ramadani & Aprilia, 2021) and to cultivate behaviours that demonstrate care for the environment and influence the environmental literacy skills of their families (Mardiani et al., 2020). A practical environmental education concept can strengthen environmental literacy and readiness for environmentally responsible behaviour (Idris et al., 2022). Integrating environmental education into every subject allows knowledge and a caring environmental character to be instilled, leading students to be more mindful and responsible towards the environment (Kresnawati, 2013). Low environmental literacy can impact the behaviour of society in utilizing the environment. The low environmental awareness among the public is partly due to their low level of environmental literacy. One effort to improve environmental literacy is through formal education by implementing learning activities to enhance students'

environmental literacy skills (Ahmadi, 2022; Agustina et al., 2022).

Pesisir Selatan, West Sumatra (Indonesia), has experienced significant and complex environmental damage, including the destruction of mangrove forests, land and forest fires, damage to coral reef ecosystems, sand mining, conversion of forest land to plantation areas, and pollution of river systems due to waste disposal (Government of Pesisir Selatan Regency, 2007). Document of Environmental Management Performance Information for Pesisir Selatan Regency for the Year 2016 (Government of Pesisir Selatan Regency, 2017) indicates that the priority environmental issues in this area are the destruction of mangrove and coral reef areas, landslides and flash floods, as well as forest fires and illegal logging.

Information about the environmental condition in the Pesisir Selatan region is quite alarming, and if no action is taken to address it, various problems will arise. Education plays a crucial role in building knowledge and attitudes of the younger generation towards the environment and the use of natural resources. Pauw et al. (2015) stated that Education for Sustainable Development (ESD) truly impacts sustainable awareness and can pave the way for a sustainable future.

In the field of education, the role of teachers is crucial in implementing ESD in teaching and learning. ESD can be integrated into various relevant subjects. The understanding and attitudes of teachers in environmental-based education are determinants that greatly influence students' learning outcomes. According to Mantsosey (Pandey et al., 2022), teachers are essential in raising students' environmental awareness. In this regard, universities should be able to produce future teachers with good knowledge and a caring attitude towards the environment as educators and members of society. The study conducted by (Erbasan & Erkol, 2019) indicates a positive correlation between environmental attitudes and knowledge. Environmental knowledge is also related to learning about natural disasters. According to (Fitri et al., 2021), understanding natural disasters will affect mitigation. The findings of the study conducted by (Junaidin et al., 2023) show that the role of lecturers is highly significant in students' literacy skills.

Based on the above description, it can be concluded that efforts to promote environmental literacy are needed among prospective teachers, especially those in higher education institutions in Pesisir Selatan District. To assess the level of knowledge and attitudes of future teachers toward the environment, a study is needed to determine the profile of environmental literacy among them. Therefore, this research aims to analyze the profile of environmental literacy among students at STKIP (College of Teacher Training and Education) Pesisir Selatan. STKIP Pesisir Selatan is an educational institution located in Pesisir Selatan Regency, making it highly suitable to select respondents from this campus to assess the environmental literacy profile related to the coastal area. Additionally, this campus has two locations in the Pesisir Selatan regency, approximately 73 km apart. Therefore, choosing prospective teacher respondents from this educational institution would be more representative. The results of mapping students' environmental literacy competencies will facilitate decision-making to enhance environmental literacy.

RESEARCH METHODS

This research is a descriptive study using the survey method. The survey method is used to determine the profile of environmental literacy among the research sample. The total number of active students in the year 2023 is 113, with a breakdown of 63 students from the Technology and Informatics Education program, 16 from the Geography Education program, 24 from the Mathematics Education program, and ten from the English Education program. For this study, students from three programs, namely Mathematics Education, Technology and Informatics Education, and Geography Education, were selected as participants.

However, students from the English Education program were not included in the research sample due to a significant difference in sample size compared to the other programs.

The study was conducted at STKIP Pesisir Selatan. The subjects of this study were 50 students from STKIP Pesisir Selatan, consisting of 15 students from the Mathematics Education program, 13 from the Geography Education program, and 22 from the Technology and Informatics Education program. The respondents were selected from the academic years 2019, 2020, 2021, and 2022.

The data collection instrument in this research is a questionnaire. The questionnaire was developed and modified by (Hariyadi et al., 2021). The questionnaire instrument consists of environmental knowledge. The environmental knowledge section consists of 15 questions related to the environment. The environmental issues included in the environmental knowledge questions are relevant to the environmental issues in the Pesisir Selatan Regency, West Sumatra Province, Indonesia. These issues include waste management, sea turtle conservation, and forest conservation. The indicators for environmental knowledge are presented in Table 1.

Table 1. Environmental literacy indicators

No	Sub-Indicator of environmental literacy
1	Knowledge about the environment and local environmental issues
2	Knowledge about environmental pollution
3	Problem-solving skills related to environmental issues

(Source: Hariyadi et al., 2021).

The data analysis technique for processing knowledge data uses the NELA score with 15 knowledge questions. The maximum score on the NELA score is 60, so the multiplier factor for each question is 4. The environmental literacy categories for students are determined based on the data in Table 2.

Table 2. Environmental Literacy Categories

No	Value Ranges	Categories
1	0 – 20	Low
2	21 – 40	Medium
3	41 – 60	High

(Source: Hariyadi et al., 2021).

RESULTS AND DISCUSSION

Environmental literacy comprises several components related to knowledge, attitudes, and skills. According to (Erdogan et al., 2009; Karimzadegan & Meiboudia (2012), literacy has six members: ecological knowledge, socio-political knowledge, environmental issue knowledge, cognitive, affective, and environmental responsibility. Stevenson et al. (2013) and Hollweg et al. (2011) identified four components of environmental literacy: knowledge, attitude, environmental skills, and environmental behaviours. But, in this research, the profile analysis will focus on environmental knowledge. Indeed, there are various versions of literacy components in different studies. Environmental knowledge is a component that exists in all of these versions.

Everyone should possess environmental knowledge to promote sustainable development goals (SDGs). In addition, as future teachers, environmental education should not only be limited to geography lessons but can be integrated into various subjects. Therefore, prospective

teachers should have good knowledge and a caring attitude towards the environment.

Students involved in this survey are students in study programs at STKIP Pesisir Selatan. The knowledge profile of environmental issues for students of the mathematics education study program is shown in Figure 1.

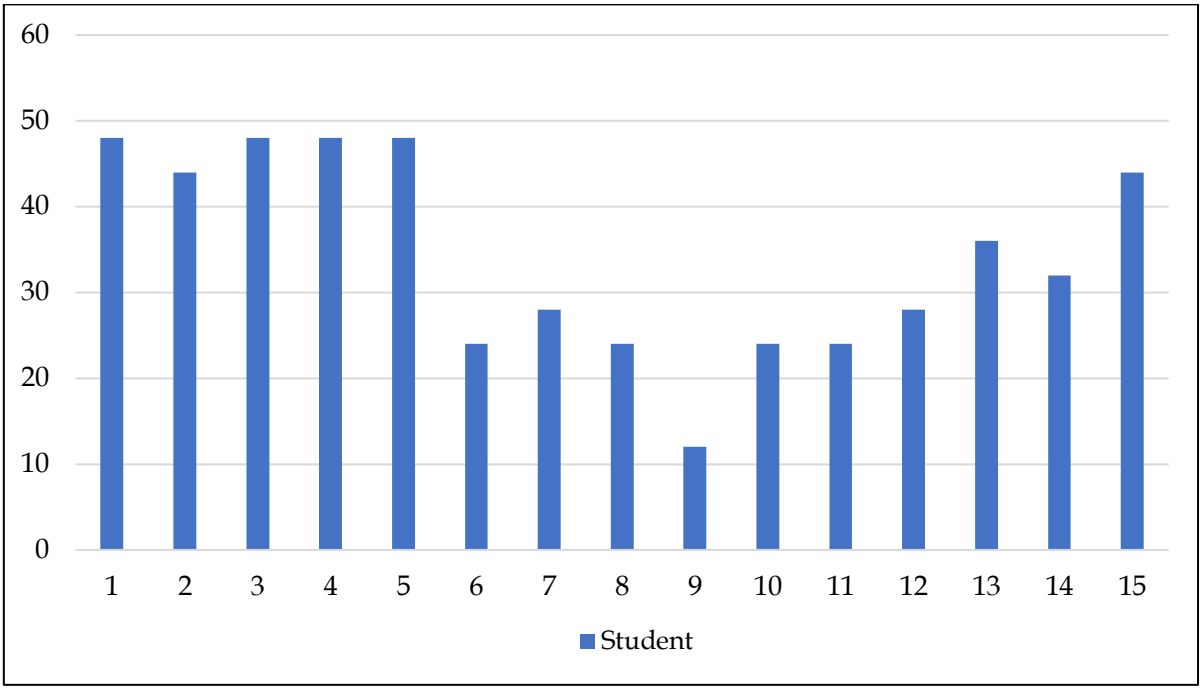

Figure 1: Profile of Environmental Knowledge among Mathematics Students

Based on Figure 1, it can be observed that among the mathematics students, a portion of students possess a high level of environmental knowledge. In contrast, a small percentage still has low ability. Mathematics students' average environmental knowledge score is 34.13, which is moderate. The obtained standard deviation is 11.79.

The following profile to be analyzed is the profile of geography education students. The knowledge of environmental issues among geography education students is presented in Figure 2.

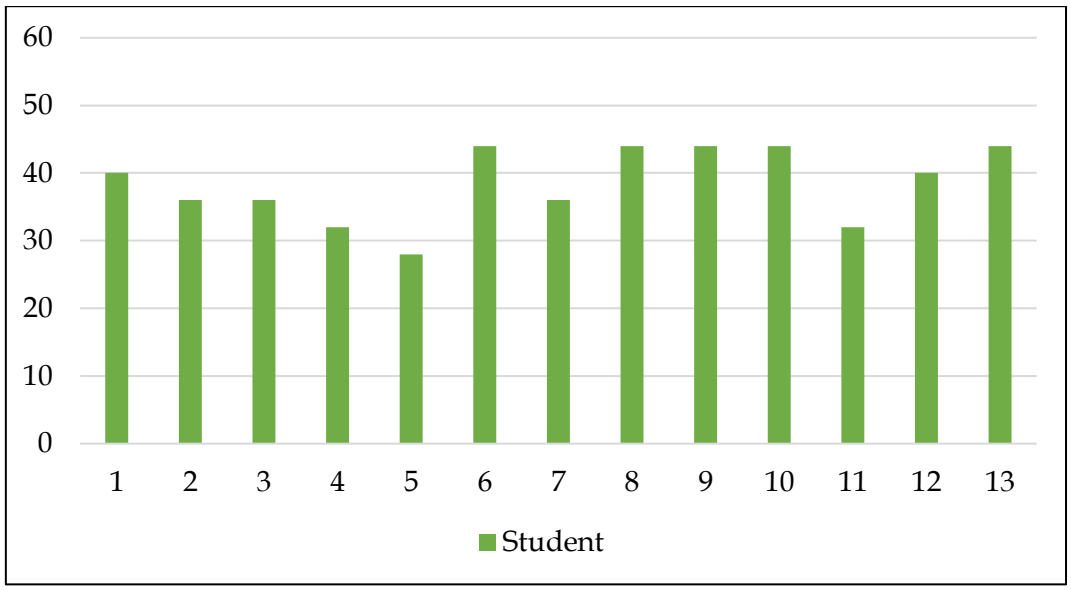

Figure 2. Profile of Environmental Knowledge among Geography Students

The environmental knowledge of geography students is categorized as 38.64, which falls under the "moderate" category. The standard deviation is 5.55. The environmental knowledge of mathematics education and geography students is in the "moderate" category. However, geography students' standard deviation is more minor than mathematics students. The data distribution of geography students is not as wide as that of mathematics students, indicating that the grades of geography students are not too far from the mean value. Unlike mathematics education, some geography students have excellent knowledge while others have minimal knowledge.

The following profile to be analyzed is the environmental knowledge profile of technology and Informatics Education program students. There was a total of 22 informatics students who participated in the study. Among these 22 students, two students had excellent knowledge of environmental issues, two students had good knowledge, eight students had moderate knowledge, and 10 students had minimal knowledge. The graph representing students' environmental knowledge in the technology and Informatics Education program is shown in Figure 3.

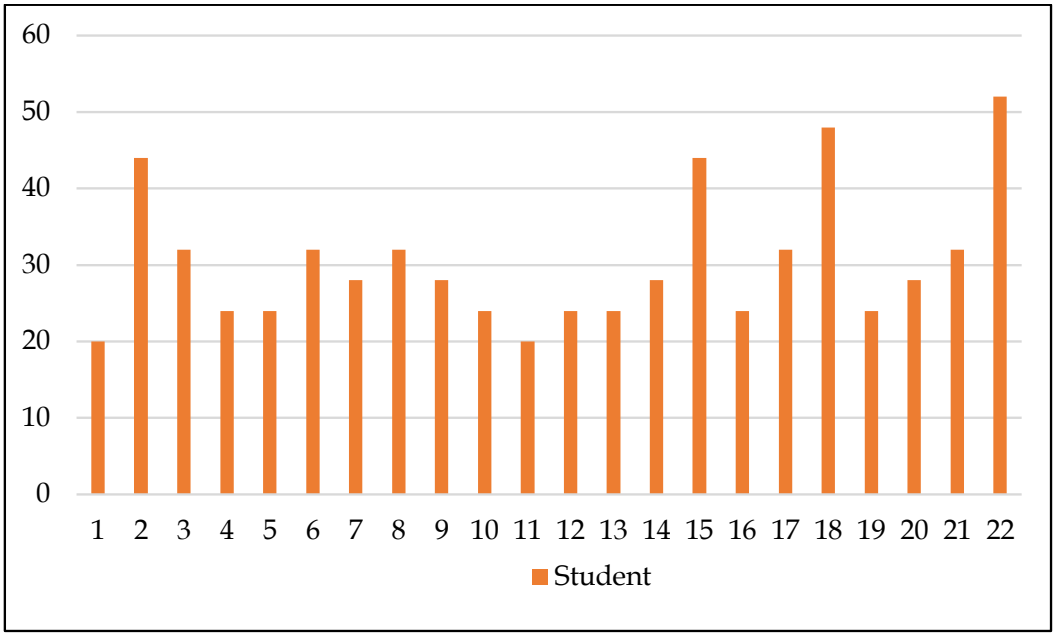

Figure 3. Environmental Knowledge of Students in the Technology and Informatics Education Program

The data analysis results indicate the average score and standard deviation for the knowledge of environmental issues among technology and Informatics Education program students. The average score for understanding environmental issues among technology and Informatics Education students is 30.36, which falls under the "moderate" category, and the standard deviation is 8.96. This high standard deviation suggests a significant variation in the data regarding the student's knowledge of environmental issues. It means that while some students possess a high level of expertise, others have a significantly low level of understanding, resulting in a wide range of scores that deviate from the average value.

Knowledge of the environment consists of three sub-indicators: 1) knowledge about the environment and the surrounding conditions, 2) knowledge about environmental pollution, and 3) knowledge about environmental problem-solving. The scores obtained for each sub-indicator can be seen in Table 3.

Table 3. Percentage of Environmental Knowledge Sub-Indicators

No	Environmental Literacy Sub Indicator	Mathematics		Geography		Technology & Informatics	
		True	False	True	False	True	False
1	Knowledge about the environment and local environmental issues	56.19%	43.81%	71.43%	28.57%	55.84%	44.16%
2	Knowledge about environmental pollution	66.67%	33.33%	69.23%	30.77%	54.54%	45.45%
3	Problem-solving skills related to environmental issues	46.67%	53.33%	46.15%	53.85%	37.50%	62.50%

Source: Research Results, 2023

Students majoring in mathematics education obtained the highest score in the sub-indicator of knowledge about environmental pollution, while students majoring in geography and technology and Informatics education received the highest score in the sub-indicator of knowledge about the environment and the surrounding conditions. However, students from all three majors—mathematics education, geography, and technology & informatics—obtained the lowest score in the sub-indicator of problem-solving related to environmental issues. Nonetheless, compared to the other two programs, students majoring in mathematics education had the highest score in problem-solving related to environmental problems.

Based on the information regarding the knowledge aspect from the three mentioned study programs, it can be concluded that the highest mean score is obtained by the Geography Education program, followed by the Mathematics Education program, and the lowest is the Informatics Education program. However, all three programs have the same level of environmental literacy knowledge category, which is moderate. Regarding the standard deviation information, it is found that Geography Education has the lowest standard deviation compared to the other two programs. This means that the data distribution among Geography Education students is less varied. Figure 2 shows that the individual values of the students generally fall close to the mean value. A more minor standard deviation indicates less variation in the data and a closer proximity between the data points.

Unlike the Geography Education program, the Mathematics Education and Technology and Informatics education programs show more variation in data distribution. In the case of the Mathematics Education program, looking at Figure 1, it is evident that there are significantly high and significantly low values. Similarly, the data distribution of the technology and informatics education students, as seen in Figure 3, still exhibits considerable variation, although not as wide-ranging as the Mathematics Education students. This implies the presence of notable values or a more comprehensive range of scores among the students, indicating differences in their knowledge of environmental issues.

The environmental literacy of geography education students has a minor standard deviation, indicating that students' values in that program are not significantly different. This suggests consistency in the level of environmental literacy among geography education students. On the other hand, students in mathematics education and technology & informatics education programs have a higher standard deviation, indicating more significant variation in their science literacy scores. This means there is a substantial difference in science literacy among students in these two programs.

On the other hand, students in the Mathematics Education and Technology & Technology and Informatics education programs have a higher standard deviation, indicating a more significant variation in their science literacy scores. This means substantial differences in science literacy among students in these two programs.

In general, the environmental knowledge of prospective teachers at STKIP Pesisir Selatan is categorized as moderate. This finding is supported by the statement of (Goulgouti et al., 2019), which revealed that studies related to international surveys indicate that future teachers have moderate or low environmental knowledge but have a high environmental attitude. Based on their empirical research, (Saribas et al., 2014) also found that the prospective teachers who participated in their study did not have adequate environmental knowledge. Although this study only focuses on environmental knowledge, it is essential to note that environmental knowledge can be used to address existing environmental issues. Taking action for the environment sometimes requires accurate information about environmental theories.

The profile of environmental literacy among students in the three programs of study examined indicates that all of them fall into the moderate category. This is different from the findings obtained by (Yusup, 2021), who researched future science teachers from biology, physics, and chemistry programs. The results showed that the students' environmental knowledge in those programs was good. This may be due to the possibility that future teachers are more familiar with ecological issues, contributing to their higher level of environmental knowledge.

Celades et al. (2021) assert that ecological immersion should be provided to enhance environmental knowledge. This approach can lead to heightened awareness and understanding, ultimately facilitating the development of a profound appreciation for the environment. Consequently, prospective teachers in various other study programs should also be offered environmental education to ensure they possess solid environmental knowledge. Durmuş & Kinaci (2021) state that future teachers outside the field of science education, such as social and language education, need to have a high ecological culture and environmental sensitivity.

Compared to the other two programs, students in the geography education program have a higher level of knowledge in ecology and pollution. On the other hand, regarding environmental problem-solving ability, the mathematics education program excels with 46.47%, followed by the geography education program with 46.15%. This may be attributed to the geography education program covering various topics related to ecology, pollution, and the environment. Meanwhile, the mathematics education program likely emphasizes problem-solving strategies more frequently. However, these possibilities need further investigation to confirm.

Table 3 shows that all three study programs have the lowest scores regarding Problem-solving skills related to environmental issues. This indicates that students' environmental knowledge in all three study programs is consistently higher than their ability to solve environmental problems. This should be a concern moving forward, considering that the essence of environmental literacy is not only having knowledge about the environment but also making decisions and providing solutions to environmental issues.

Research on the profile of environmental literacy among students, especially those from non-science programs, is rarely conducted. This study recommends conducting such research in other programs to understand the extent of students' environmental literacy and provide reflective material for universities to create innovations that produce graduates with environmental knowledge and pro-environmental attitudes. According to (Rowe, 2002), some educational institutions

still graduate students with minimal environmental knowledge and perceive that resources and pollution are not serious issues. However, the education sector is now starting to make improvements to create a sustainable environmental future.

Environmental knowledge and awareness influence an individual's attitudes and behaviour toward the environment (Kiryak et al., 2021). Environmental literacy is not only the responsibility of science teachers; future teachers from other academic disciplines must also be equipped with this competence. There are two reasons for this. First, as future teachers, they should serve as role models in their behaviour. Therefore, addressing this issue is not solely about the content of the curriculum but also about the essence of teachers as "behavioural models." Second, they are members of society who can act as agents of change for their environment. The lack of understanding of environmental literacy among these students can impact their behaviour toward the environment because what they know can influence what they do.

The research results from (Gheith, 2019) regarding the environmental literacy of prospective teachers at the University of Petra, Jordan, indicate a low level of environmental literacy among them. The population in this study included all students of the University of Petra in the education department, comprising 112 respondents. This finding is consistent with the discovery that the environmental knowledge of 214 prospective teachers from three universities in Israel (Kibbutzim College of Education, Oranim Academic College, and Beit Berl Academic College) remains low. The literature review conducted by (Álvarez-García et al., 2015) also emphasizes the low environmental competence of prospective teachers. This implies that prospective teachers do not yet possess adequate environmental knowledge to teach their students about understanding the environment and solving environmental problems in the future. These findings point to the necessity of a curriculum that supports prospective teachers in acquiring solid environmental knowledge.

Teachers' environmental literacy needs to be improved through curriculum modification and pedagogical approaches (Dada, 2018). Concepts related to the environment and how to teach them need to be considered for inclusion in university curricula. Future teachers must adopt an anthropocentric value system regarding the environment (Goulgouti et al., 2019; Masalimova et al., 2023). Colleges producing future teachers should make environmental education a mandatory module (Damoah & Omodan, 2023) because future teachers with adequate environmental literacy are likelier to implement environmental education (Tran et al., 2022). The curriculum in higher education, especially for future teachers, should integrate environmental education to ensure that they possess solid environmental literacy as teachers and as members of society. Therefore, this research recommends that educational institutions modify their curriculum to facilitate meaningful learning experiences for future teachers and enhance their environmental literacy skills.

CONCLUSION

This study presents the profile of environmental literacy among students majoring in Geography Education, Mathematics Education, and technology and informatics education programs. The findings indicate that students from all three programs have moderate environmental knowledge. However, Geography Education students were found to have higher proficiency in ecology and pollution than students from the other two programs. Additionally, the highest problem-solving skills in environmental issues were observed among Mathematics Education students, followed closely by Geography Education students. Nevertheless, the difference in problem-solving abilities between Mathematics Education and Geography Education programs is slight. Curriculum modifications are needed to ensure

educational institutions produce future teachers with solid environmental literacy.

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