



Environmental Awareness of Biology Education Students Through Social Media: Addressing Local Issues

Defita Permata Sari^{1*}, Harlis Febriana¹, Ica Wandari Anisia¹, Dawam Suprayogi²

¹State Islamic University of Sulthan Thaha Saifuddin Jambi, Jambi, Indonesia

²University of Jambi, Jambi, Indonesia

*Email: defitapermata02@uinjambi.ac.id

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Abstract

Environmental degradation caused by illegal mining, deforestation, forest fires, and poor waste management, represents not only an environmental crisis but also a critical educational issue. These conditions indicate a low level of environmental awareness, emphasizing the urgency of cultivating ecological responsibility among prospective teachers. As future educators, they play a strategic role in integrating environmental values into learning processes to promote sustainable attitudes and behaviors among students. This study aims to assess the environmental awareness profile of biology education students, using social media to contextualize local ecological issues. A quantitative descriptive design was applied to 78 purposively selected students who had completed the conservation biology course. Data were collected using a validated 35 item questionnaire based on the New Ecological Paradigm (NEP) scale, covering five dimensions: limits to growth, anti-anthropocentrism, fragility of nature's balance, rejection of exceptionalism, and possibility of an ecocrisis. Results show that overall environmental awareness was in the good category, with the highest scores in fragility of nature's balance and possibility of ecocrisis, and the lowest in rejection of exceptionalism. This study concludes that biology education students demonstrated a good level of environmental awareness across the five dimensions of the NEP. These findings indicate that prospective biology teachers possess a relatively strong ecological perspective, which may support their future role in promoting environmental responsibility in schools. Future environmental education initiatives may benefit from integrating social media as a contextual platform for presenting local environmental issues and strengthening students' engagement with ecological challenges.

Keywords: biology education; environmental awareness; local ecology; NEP scale; social media

INTRODUCTION

Sustainable development is increasingly threatened by rapid ecosystem degradation worldwide, particularly in ecologically fragile and resource rich regions such as Jambi, Indonesia, where environmental challenges, especially illegal gold mining and mercury contamination, intersect with educational responsibilities (Guswahyuni, 2018; Susanti *et al.*, 2018; Ridwansyah *et al.*, 2020). Persistent issues such as illegal coal and gold mining (locally known as PETI or *Pertambangan Tanpa Izin*), recurring peatland fires, extensive forest loss exceeding 73% over the past five decades, and inadequate waste management systems highlight not only environmental vulnerability but also limitations in environmental awareness among communities (Kehutanan, 2020; Rahayu *et al.*, 2021; Sari & Alega, 2024). These conditions underscore the strategic role of education, especially teacher education programs in preparing prospective educators to develop students environmental awareness and foster pro environmental attitudes through learning processes.

University students play a critical role in sustainable transitions, particularly within science education contexts, because their professional identity and future societal influence are closely linked to their level of environmental awareness, which encompasses ecological knowledge, attitudes, and behavioral intentions toward environmental protection. Empirical evidence from open access studies shows that higher education significantly shapes students' sustainability perspectives and pro environmental orientations through structured learning experiences and campus engagement (Ardoin & Heimlich, 2021; Pratiwi *et al.*, 2023; Wibowo *et al.*, 2024). Furthermore, research consistently reports that university based environmental education strengthens students' environmental literacy by integrating cognitive understanding with value formation and behavioral readiness, positioning them as key actors in promoting sustainable development within their communities (Monroe *et al.*, 2023; Miterianifa & Mawarni, 2024; Punzalan, 2024). However, awareness remains uneven.

Social media usage in Indonesia has experienced significant growth, with 167.0 million active users (60.4% of the population) recorded in early 2023 (Kuntjoro & Alvin, 2023; Annisa *et al.*, 2025; Tewu *et al.*, 2025). Regional digital behavior studies indicate that users in Southeast Asia, including Indonesia, spend approximately three hours daily on social platforms such as YouTube, TikTok, and Instagram (Nugraha *et al.*, 2024; Pratama, 2024). This figure reflects general patterns of digital media use rather than pedagogical utilization in educational contexts. Consequently, the potential of social media as a tool for contextualized environmental learning, particularly for place based ecological issues, remains underutilized. Previous studies have demonstrated the effectiveness of social media in increasing environmental awareness (Putra *et al.*, 2024; Ramadhan & Sevilla, 2024; Amjad *et al.*, 2026). However, these studies do not specifically examine pre service biology teachers operating in ecologically high risk regions.

The NEP scale provides a useful framework for examining the gap between environmental awareness and the socio ecological realities faced by pre service biology teachers in ecologically vulnerable regions of Jambi Province, where illegal gold mining remains widespread despite its detrimental impacts on river ecosystems, forests, and endemic species (Yulianti *et al.*, 2016; Susanti *et al.*, 2018). The persistence of illegal gold mining despite widespread awareness of its environmental impacts reflects a profound value conflict driven by economic dependency (Susanti *et al.*, 2018; Wibowo *et al.*, 2022). Moreover, the practice poses significant public health risks, particularly to children exposed to chronic mercury contamination (Guswahyuni, 2018; Meutia *et al.*, 2023). For pre-service biology teachers in these communities, the gap between ecological knowledge and livelihood driven behavior poses a key pedagogical challenge. The NEP scale serves as a diagnostic tool for how economic precarity shapes environmental attitudes, informing context responsive education in mining affected regions of Jambi (Azizah *et al.*, 2017; Martini, 2019; Amirullah *et al.*, 2024).

The NEP framework enables analysis of beliefs about human nature relations, ecological limits, and environmental risk perception relevant to future teachers' decision making (Berze *et al.*, 2022; Amirullah *et al.*, 2024; Marcineková *et al.*, 2024). Although widely used, its application in Indonesian teacher education, particularly in high risk ecological regions, remains limited highlighting the need for this study (Putra *et al.*, 2024; Martini, 2019; Ramadhan & Sevilla, 2024). Prior research on environmental attitudes and social media in higher education is often abstract and instructional, focusing on outcomes rather than how ecological worldviews form in contexts where environmental degradation intersects with economic dependence and cultural practices. Thus, social media as a space for negotiating environmental meaning remains underexplored. This study positions social media as a discursive arena where students engage with local issues such as illegal gold mining, forest fires, and waste mismanagement, shaping environmental awareness as a reflection of value conflicts between environmental ethics and livelihood practices. Accordingly, this study aims to assess the environmental awareness profile of biology education students, using social media to contextualize local ecological issues.

METHOD

This study employed a quantitative descriptive design to objectively portray the environmental awareness profile of biology education students at State Islamic University of Sulthan Thaha Saifuddin Jambi (Arikunto, 2016). This design was selected because it is specifically to describes phenomena as they naturally occur without manipulating variables or testing causal relationship (Creswell & Creswell, 2018). It enables systematic collection of quantifiable data through standardized instruments, facilitating statistical analysis to generate an accurate profile across key dimensions of environmental awareness, namely knowledge, attitudes, and pro environmental behavior. Furthermore, as Arikunto (2016) emphasized, descriptive research is particularly suitable for profiling a specific population within its natural context, which aligns precisely with this study's aim to document students environmental literacy. The population comprised all active students who had completed the conservation biology course. Using purposive sampling, 78 students were selected based on three criteria: (1) active enrollment, (2) course completion, and (3) regular social media use. Ethical consent was obtained prior to data collection.

The primary instrument was a 35 item Likert scale questionnaire adapted from the NEP framework developed by Dunlap *et al.*, (2000) and validated for use in the Indonesian contexts. The questionnaire measured students environmental awareness across five dimensions: limits to growth, anti anthropocentrism, fragility of natures balance, rejection of exemptionalism, and the possibility of an ecocrisis. Responses were rated on four point scale: strongly agree (4), agree (3), disagree (2), strongly disagree (1) with negatively worded items reverse scored. Reliability testing indicated high internal consistency, with a Cronbach's $\alpha = 0.87$ confirming the instruments suitability for descriptive quantitative analysis. Overall, the questionnaire provided a robust and reliable measure for assessing students' environmental awareness in this study.

To contextualize the quantitative findings, observation and documentation were conducted to identify and describe local environmental issues in Jambi Province, including PETI, forest and land fires, and waste management practices. Field notes and photographic documentation were used to record observable environmental conditions and community activities related to these issues. These data were not analyzed as qualitative research findings, but served as supporting contextual information to ensure that the measurement of students' environmental awareness was grounded in actual socio ecological conditions relevant to the study context. Data analysis techniques in this study consist of the following. The validity score was calculated using a percentage score formula (NP) by dividing the obtained score (R) by the maximum ideal score (SM) and multiplying the result by 100% (Sudijono, 2018). The resulting scores were then interpreted based on the environmental awareness assessment criteria adapted from (Riduwan, 2009), where scores of 88%–100% indicated very good environmental awareness, scores of 72%–87% indicated good environmental awareness, and scores of 46%–71% indicated fair environmental awareness.

RESULT AND DISCUSSION

Findings indicate that biology education students (2021-2022 intakes) who completed the conservation biology course exhibit environmental awareness profiles rated good to very good across all components. The highest averages occurred in fragility of nature's balance (91.80%; very good) and possibility of an ecocrisis (89.97%; very good), while the lowest was in rejection of exceptionalism (78.24%; good). This pattern confirms strong student recognition of ecosystem vulnerability and ecological risks, yet incomplete rejection of human exceptionalism (the notion that humans are exempt from natural laws or entitled to unlimited resource exploitation). The result data can be seen in Figure 1.

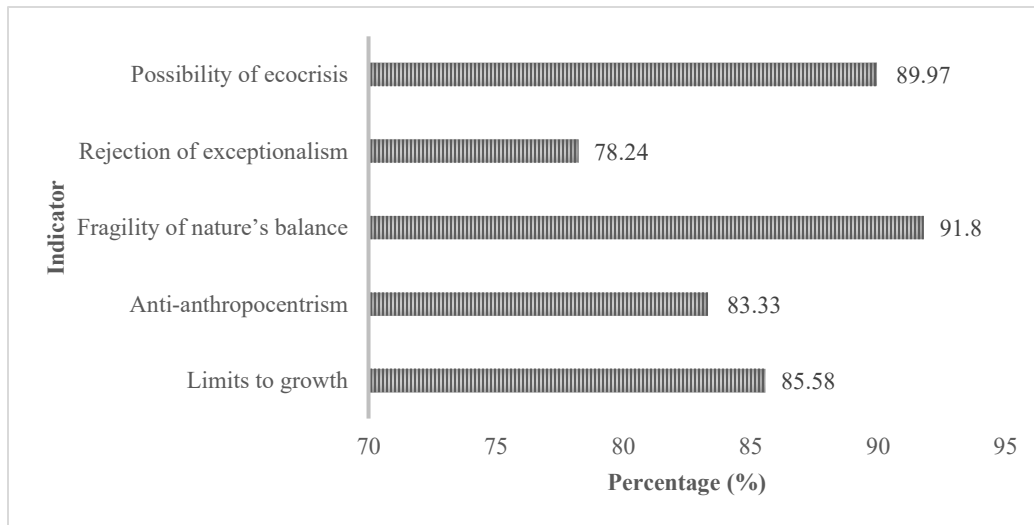


Figure 1. Mean percentage scores across NEP components

Figure 1 shows differences in the average percentage scores across the components of environmental awareness. Among these, the fragility of nature's balance component obtained the highest score (91.80%), categorized as very good. This result indicates that biology education students possess a strong awareness that natural systems are inherently fragile and can be easily disrupted by human activities. It suggests that students recognize the sensitivity of ecological equilibrium, in which even minor disturbances may trigger cascading effects across interconnected environmental components. This elevated awareness reflects students' understanding that ecosystems are highly responsive to anthropogenic pressures, such as habitat fragmentation, resource extraction, and environmental pollution. Minor environmental changes can generate systemic consequences due to the interconnected nature of ecological processes (Lumber *et al.*, 2017; Ives *et al.*, 2018). Such findings indicate that students are able to interpret environmental problems within a systems perspective rather than viewing them as isolated events.

To further elaborate these findings, Table 1 presents the relationship between each NEP component, local environmental issues in Jambi, and students' interpretations.

Tabel 1. Students' ecological perspectives across NEP dimensions in the context of environmental issues

NEP Dimension	Local environmental issue in Jambi	Interpretation
Fragility of nature's balance	Deforestation, forest fires	Students demonstrate a strong awareness that ecosystems are vulnerable to human disturbances and environmental changes that may disrupt ecological balance
Possibility of ecocrisis	Mercury pollution from illegal gold mining	Students recognize that unsustainable human activities can lead to environmental crises and understand the cause and effect relationships between human actions and ecological consequences
Limits to growth	Overexploitation of natural resources	Students understand that natural resources are finite and must be managed sustainably, although this understanding still requires reinforcement through consistent environmental practices
Anti anthropocentrism	Human dependence on natural resources	Students tend to view humans as part of an interconnected ecological system, although human centered perspectives still emerge in certain situations
Rejection of exceptionalism	PETI as livelihood strategy	Students have not fully rejected the belief that human activities can overcome environmental limitations, indicating that their ecological worldview is still developing

Overall, Table 1 indicates that students' environmental awareness is strongly contextualized through local environmental issues, suggesting that theoretical NEP dimensions are effectively linked with real world ecological problems. Students showed a good understanding of ecological vulnerability, environmental crises, and resource limitations, particularly when these concepts were connected to environmental issues they encounter in their local context. Nevertheless, responses related to human exceptionalism indicate that some students still believe that human activities can overcome environmental constraints. These findings suggest that students possess a generally positive ecological worldview, although further educational interventions are needed to strengthen their understanding of ecological limits and sustainable resource management.

The high score in this component indicates that the conservation biology course has effectively enhanced students' ecological literacy and understanding of human environment relationships. This finding is consistent with previous studies showing that environmental education integration in science learning strengthens ecological awareness and sustainability literacy (Punzalan, 2024; Wibowo *et al.*, 2024). Furthermore, this finding is consistent with earlier research reporting that students in science disciplines tend to exhibit higher environmental awareness due to sustained exposure to ecological issues through formal instruction and inquiry-based learning (Hamidah *et al.*, 2024; Husamah *et al.*, 2024). Such learning experiences facilitate students' ability to analyze environmental problems systematically and understand the relationship between human activities and ecological consequences. Conceptually, the present study indicates that students' awareness has progressed beyond cognitive understanding toward the internalization of ecological values, reflecting the development of pro-environmental perspectives and attitudes.

Similarly, the possibility of an ecocrisis component shows a very high score (89.97%; categorized as very good), indicating that students can connect human activities with environmental degradation and potential ecological crises. This finding reflects well developed ecological literacy, enabling students to understand the interconnected nature of environmental problems and their broader ecological consequences. From an epistemological perspective, this result supports previous studies showing that the integration of environmental education within science learning enhances systems thinking, environmental risk perception, and the ability to anticipate future ecological impacts (Ardoin & Heimlich, 2021; Wibowo *et al.*, 2022; Monroe *et al.*, 2023). It is also consistent with research indicating that students in science disciplines tend to develop higher ecological awareness through sustained exposure to environmental issues in inquiry-based learning, problem-based instruction, and contextual environmental case studies (Hamidah *et al.*, 2024; Husamah *et al.*, 2024). Together, these findings reinforce the role of environmental education in strengthening ecological literacy and environmental reasoning capacities.

Conceptually, this finding suggests that students' awareness of potential ecocrisis has progressed beyond cognitive understanding toward the internalization of ecological values and responsibility. Previous studies indicate that engagement with environmental issues can foster emotional attachment to nature, strengthening pro-environmental identity and behavioral intentions (Ives *et al.*, 2018; Chawla, 2020). Such affective integration represents a critical stage in environmental literacy development because it transforms knowledge into value-based environmental commitment. This shift reflects the development of anticipatory ecological thinking, enabling students to recognize potential environmental crises and supporting long-term sustainability awareness. Therefore, the high score reflects an integrated ecological perspective that combines knowledge, values, and environmental responsibility.

For the limits to growth component (85.58%; categorized as good), the findings indicate that students demonstrate a solid understanding of the finite carrying capacity of natural systems and the risks associated with excessive resource exploitation. This score shows that students are able to recognize that environmental quality and long term sustainability are closely related to patterns of human consumption, energy use, and waste generation. However, the good category also suggests that this awareness remains largely at the conceptual level and still requires reinforcement so that it can be consistently translated into everyday pro environmental behavior. Studies in environmental education over the past decade consistently report that students often possess adequate cognitive knowledge about sustainability limits but experience

difficulties in transforming this knowledge into behavioral commitment without contextual and experiential learning support (Ardoin & Bowers, 2020; Wibowo *et al.*, 2022; Husamah *et al.*, 2024).

From an epistemological perspective, these findings align with recent research showing that higher education plays a central role in shaping environmental character, yet conceptual understanding alone is insufficient to produce observable behavioral change. Contemporary studies emphasize that applied learning approaches such as project based sustainability activities, problem based environmental cases, and community oriented ecological engagement significantly strengthen the connection between knowledge and action (Husamah *et al.*, 2024; Rahmawati *et al.*, 2025; Setioningrum *et al.*, 2025). This confirms earlier theoretical arguments that awareness of ecological limits develops progressively from cognitive recognition toward value internalization, and ultimately toward behavioral manifestation. Therefore, the good rating in this component reflects a transitional stage of ecological literacy in which students have developed adequate understanding of environmental limits but still require pedagogical reinforcement to support consistent sustainable decision making in daily life.

The anti-anthropocentrism component, which reached 83.33% (good category), indicates that most students have adopted an ecological worldview that recognizes humans as part of an interdependent environmental system rather than as its dominant controller. Previous studies show that anti-anthropocentric attitudes are associated with stronger connectedness to nature, ecological concern, and pro-environmental behavior (Otto & Pensini, 2017; Martin *et al.*, 2020). Consistent with the NEP framework, this orientation represents a transition from human centered beliefs toward ecological interdependence and recognition of environmental limits (Janmaimool & Khajohnmanee, 2019; Cruz & Manata, 2020). Environmental knowledge further supports this shift by strengthening awareness of the links between human activities and environmental consequences, fostering environmental responsibility that integrates cognitive understanding and affective commitment (Janmaimool & Khajohnmanee, 2019; Murzyn *et al.*, 2025). Therefore, the high score reflects successful internalization of ecological values as both cognitive and affective environmental learning outcomes.

However, the presence of mixed positive and negative response patterns suggests that anthropocentric thinking has not been completely eliminated and may still emerge in specific situations. Epistemically, this indicates that environmental attitudes are shaped by interactions among knowledge, social experience, and contextual pressures rather than solely by rational considerations (Janmaimool & Khajohnmanee, 2019; Murzyn *et al.*, 2025). This finding is consistent with environmental psychology perspectives showing that individuals can simultaneously hold pro environmental values while prioritizing human centered interests when faced with practical trade offs. Such conditions reflect the attitude behavior gap, where contextual demands, habits, and social expectations may override environmental commitments (Dong *et al.*, 2021; Bentler *et al.*, 2023). Therefore, the persistence of anthropocentric reasoning reflects the complexity of translating ecological values into real life behavior rather than low ecological awareness.

Further evidence suggests that pro environmental attitudes are more likely to translate into behavior when individuals possess sufficient psychological resources, such as autonomy, self efficacy, and perceived behavioral control (Dong *et al.*, 2021; Bentler *et al.*, 2023). Without these conditions, individuals may experience inconsistencies between environmental values and actual practices, often leading to rationalization rather than behavioral change (Bentler *et al.*, 2023; Murzyn *et al.*, 2025). Studies also show that environmental knowledge and concern alone are insufficient to sustain pro environmental behavior because decision making remains influenced by contextual pressures, social norms, and habitual routines (Dong *et al.*, 2021; Murzyn *et al.*, 2025). This indicates that anti-anthropocentric attitudes require cognitive understanding, affective internalization, and behavioral reinforcement. Therefore, environmental responsibility should be viewed as a multidimensional construct integrating knowledge, values, and psychological readiness, highlighting the need for environmental education to promote ecological understanding and meaningful environmental action (Dong *et al.*, 2021; Bentler *et al.*, 2023; Murzyn *et al.*, 2025).

The lowest rejection of exceptionalism score (78.24%; categorized as good) indicates that students have not fully rejected the belief that humans possess special privileges over nature. This finding suggests that anthropocentric assumptions remain embedded at the epistemic level, particularly when individuals

interpret environmental issues through socio economic realities. Interview data support this pattern, showing that practices such as familial dependence on PETI activities are often justified as necessary survival strategies in contexts of limited employment opportunities. Such conditions illustrate that environmental attitudes are shaped not only by ecological knowledge but also by lived experiences, structural constraints, and pragmatic considerations. From an epistemological perspective, this demonstrates that environmental understanding is constructed through the interaction between cognitive awareness and socio economic contexts rather than through abstract ecological reasoning alone (Guswahyuni, 2018; Rahmi *et al.*, 2023).

This condition implies that strengthening rejection of human exceptionalism requires educational approaches that move beyond knowledge transmission toward deeper reflective learning. Students need opportunities to develop critical thinking and ethical reasoning skills that enable them to evaluate environmental dilemmas within real world contexts, particularly those rooted in local socio economic challenges. When learners are encouraged to critically examine the tension between environmental sustainability and livelihood demands, they are more likely to internalize ecological values as moral commitments rather than merely conceptual knowledge. Therefore, environmental instruction should integrate contextual problem based learning, ethical reflection, and locally relevant case discussions so that students can construct more coherent ecological worldviews and translate them into consistent environmental responsibility (Nasution & Siregar, 2024; Rahmi *et al.*, 2023).

Overall, the results show that biology education students have developed relatively strong environmental awareness across all NEP components, particularly in ecological fragility, ecocrisis understanding, and human environment interdependence. These findings suggest that the conservation biology course has strengthened ecological literacy through scientific knowledge, environmental case analysis, and systems thinking, enabling students to interpret environmental problems holistically while internalizing ecological values. However, moderate scores in the limits to growth and rejection of exceptionalism components indicate the need to further bridge the gap between environmental knowledge and consistent pro environmental behavior. Integrating social media as a learning support tool is relevant, as it can extend environmental learning beyond the classroom through campaigns, discussions, and knowledge sharing. Therefore, combining conservation biology instruction with strategic social media use has the potential to enhance affective engagement, behavioral reinforcement, and pro environmental commitments in real world contexts.

CONCLUSION

Biology education students demonstrate environmental awareness profiles ranging from good to very good, with the strongest orientation reflected in their understanding of the fragility of nature's balance. This awareness is evident not only in their conceptual knowledge but also in their emotional engagement with local environmental issues, particularly those encountered through discussions of real cases on social media platforms. These findings indicate that the conservation biology course, supported by peer interaction and contextual learning experiences, has contributed significantly to the development of students' ecological literacy and value internalization. This study highlights the importance of integrating local wisdom and ethnobotanical knowledge into biology curricula as a strategy to strengthen environmental awareness while preserving culturally rooted ecological perspectives. In addition, the strategic use of social media can serve as an effective tool for expanding environmental literacy beyond classroom boundaries, especially for prospective educators. The findings can contribute to national sustainability goals by fostering a generation of educators who are capable of promoting proactive and responsible environmental stewardship.

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