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Dimensions of Ecoliteracy Attitudes in Islamic Elementary Teacher Education: The Construction of Islamic Theo-Ecology, Socio-Ecology, Bio-Ecology, and Cosmo-Ecology

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ABSTRACT

This study examines and analyzes the profile of ecoliteracy attitudes among students in the Islamic Elementary Teacher Education (PGMI) Program from an Islamic perspective, laying the groundwork for the development of Islamic science education. Utilizing a mixed methods approach with a convergent triangulation design, the research involved 74 questionnaire respondents and 12 interview participants at IAIN Sultan Amai Gorontalo. Data were collected using Likert-scale questionnaires and semi-structured interviews, which were then analyzed both quantitatively and qualitatively. The findings reveal that students' ecoliteracy attitudes predominantly manifest in the affective and conative aspects, while the cognitive aspect remains underdeveloped, particularly within the cosmo-ecology dimension. The four primary dimensions examined, namely theo-ecology, socio-ecology, bio-ecology, and cosmo-ecology demonstrate that while spiritual values and moral responsibility toward the environment have developed emotionally and behaviorally, they lack deep conceptual understanding. These results underscore the need to reinforce the cognitive dimension in Islamic science education through the development of an integrative curriculum grounded in *ayat kauniyah* (divine signs in nature), Islamic ecoliteracy-based modules, and pedagogical training for lecturers. This research makes both conceptual and practical contributions to advancing environmental education based on Islamic values, particularly in shaping prospective teachers who possess comprehensive ecological awareness grounded in tawhid (the oneness of God).

Keywords: Ecoliteracy, Islamic Science Education, PGMI, Islamic Ecology, Environmental Literacy, Islam-Science Integration

INTRODUCTION

Global environmental degradation has become one of the most pressing challenges confronting humanity in the 21st century. Issues such as global warming, excessive deforestation, air and water pollution, and the collapse of biodiversity not only threaten ecological balance but also the survival of future generations. The United Nations' Agenda 2030 identifies education as a strategic means to address sustainability challenges (UNESCO, 2021). It emphasizes the necessity of fostering values, skills, and attitudes that enable individuals to contribute

to sustainable development. Within this framework, environmental education must transcend the delivery of factual content and evolve into a transformative process that nurtures ecological awareness, ethical responsibility, and sustainable action (Tilbury et al., 2005; Sterling, 2010). In this context, religious-based education, particularly in Islamic settings, holds untapped potential for promoting a spiritual and moral foundation for ecological stewardship. Islamic educational institutions are therefore well-positioned to integrate environmental literacy with theological doctrines such as *tawhid* (oneness of God), *khilafah* (stewardship), and *'adl* (justice).

In the Indonesian context, the Islamic Elementary Teacher Education (PGMI) program plays a central role in preparing future educators who will shape young learners' ecological consciousness. PGMI students are expected not only to master pedagogical and scientific content but also to embody and transmit Islamic values in their everyday teaching practice. As future teachers at the foundational level, their ecoliteracy attitudes are critical for cultivating a generation capable of navigating environmental complexities with moral and intellectual competence. Despite its importance, empirical exploration of ecoliteracy attitudes among PGMI students remains limited, particularly within the framework of Islamic education. This gap raises critical questions regarding how Islamic teacher education programs integrate environmental literacy, whether they effectively bridge scientific and theological perspectives, and how these are reflected in the attitudes of pre-service teachers.

Ecoliteracy, as conceptualized initially by Capra (2005), refers to the understanding of the principles governing natural systems and the ability to apply them in the design of human communities. In educational terms, it involves cognitive comprehension, affective sensitivity, and conative readiness to act in favor of the environment (McBride et al., 2013). When situated within Islamic educational frameworks, ecoliteracy acquires additional dimensions rooted in scriptural interpretation, moral reasoning, and spiritual engagement (Izzi Dien, 2000; Foltz, 2003). The Qur'an frequently invites believers to observe and reflect upon natural phenomena as signs (*ayat*) of divine wisdom, encouraging a contemplative and ethical orientation toward nature (Saniotis, 2012). Thus, Islamic ecoliteracy is not merely about environmental concern but constitutes a theological imperative grounded in the unity of creation and the sacred duty of humans as stewards of the Earth (Khalid & O'Brien, 1992).

This study seeks to explore the multidimensional structure of ecoliteracy attitudes among PGMI students through an integrated framework that combines Islamic theology and environmental education. It analyzes three major components, cognitive (knowledge and understanding), affective (emotional engagement), and conative (behavioral intention) across four domains of ecological relationships: theo-ecology (human-God), socio-ecology (human-human), bio-ecology (human-other living beings), and cosmo-ecology (human-universe). Employing a mixed-methods approach, this research aims to provide a nuanced and contextualized understanding of how Islamic educational values intersect with ecological awareness and how these dimensions can be integrated to support a sustainable and spiritually grounded science education.

MATERIALS & METHODS

This study employed a descriptive approach using a mixed methods design, integrating quantitative and qualitative methodologies simultaneously. The research adopted a convergent triangulation model, in which quantitative and qualitative data were collected simultaneously, analyzed independently, and then compared to achieve a comprehensive and in-depth understanding. The research population consisted of students from the PGMI program at IAIN Sultan Amai Gorontalo who had completed the Basic Science Concepts

course. Purposive sampling was used to select students who had undertaken the course and were actively involved in both academic and social activities. A total of 74 students participated in the questionnaire survey, while 12 participants were selected for in-depth interviews, chosen representatively based on their ecoliteracy attitude scores. The research instruments consisted of: (1) a 5-point Likert scale questionnaire designed to measure three attitudinal components (cognitive, affective, and conative) across four ecoliteracy dimensions (theo-, socio-, bio-, and cosmo-ecology); and (2) a semi-structured interview guide developed to explore students' experiences, perceptions, and adherence to Islamic ecological values more comprehensively.

Instrument validation was conducted by three specialists, including science education, Islamic education, and research methodology. A pilot test of the questionnaire was conducted to assess its reliability, while the validity of the qualitative data was ensured through triangulation techniques that involved multiple sources, methods, and theoretical perspectives. Data analysis was performed in three stages: (1) quantitative analysis of questionnaire data using descriptive statistics, with a focus on score distribution for each attitude component across the dimensions; (2) qualitative analysis to identify patterns in the interpretation of ecoliteracy values from an Islamic perspective; and (3) integrative analysis through theoretical triangulation, linking empirical findings with the Islamic ecoliteracy framework, encompassing perspectives of *tawhid*, social responsibility, ecological balance, and cosmic awareness (Azwar, 2010; Gerungan, 2004). This methodological approach aimed to provide a holistic depiction of PGMI students' ecoliteracy tendencies, as well as the challenges and opportunities associated with integrating Islamic values into science education.

RESULT

Based on quantitative data from the questionnaire and qualitative data from in-depth interviews, the findings reveal that the ecoliteracy attitude profiles of PGMI students exhibit uneven development across the cognitive, affective, and conative components within the four Islamic ecological domains: theo-ecology, socio-ecology, bio-ecology, and cosmo-ecology. Quantitative analysis showed that the average scores for the affective (4.21) and conative (4.08) components were higher than those of the cognitive component (3.52). This pattern was consistent across all ecological dimensions examined. The theo-ecology dimension recorded the highest average in the conative aspect, whereas the cosmo-ecology dimension exhibited the lowest average score in the cognitive aspect.

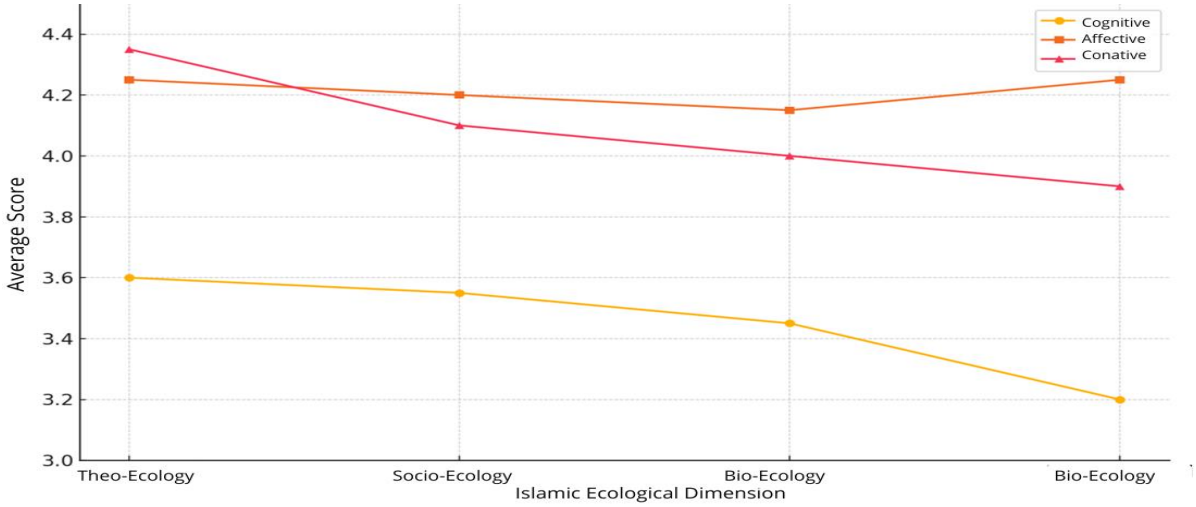

Figure 1. Average scores of PGMI students' ecoliteracy attitudes by dimension

The diagram in Figure 1 presents the distribution of average ecoliteracy attitude scores across the three attitude components, namely cognitive, affective, and conative, within the four Islamic ecological dimensions: theo-ecology, socio-ecology, bio-ecology, and cosmo-ecology. The predominance of affective and conative aspects is evident, with average scores for both aspects exceeding 4.00 across all dimensions. This indicates that students demonstrate a high level of empathy (affective) and a strong willingness to take action (conative) concerning environmental issues. The highest score was recorded in the conative component of the theo-ecology dimension (4.35), indicating that students' motivation to act is heavily influenced by Islamic spiritual values, particularly the belief in nature as God's creation (*tawhid*).

In contrast, the cognitive aspect appeared weaker, with consistently lower scores, especially within the cosmo-ecology dimension (3.20). This reflects that students have a limited conceptual grasp of the macro-level relationship between the universe and Islamic ecological principles. The gap between the cognitive component and the other two components suggests that while students are emotionally and behaviorally inclined toward environmental concerns, their scientific and conceptual understanding of Islamic ecoliteracy principles remains underdeveloped. The consistent score distribution across dimensions implies that this imbalance is structural rather than limited to a specific domain. The bio-ecological and socio-ecological dimensions demonstrated relatively balanced development among the three components, but still followed the general pattern, with affective and conative scores exceeding cognitive ones. Pedagogically, this disparity underscores the need to redesign the science education curriculum in PGMI to reinforce the cognitive dimension. This can be achieved through the integration of conceptual content, the use of *ayat kauniyah*, and the application of interdisciplinary approaches that connect the natural sciences with Islamic values. Enhancing the cognitive aspect is essential to ensure that ecoliteracy attitudes are not merely emotional reactions, but are grounded in a deep, sustainable, and critically developed understanding, internalized in both teaching practices and everyday life.

Further analysis indicates that, in the theo-ecological dimension, most respondents demonstrated spiritual awareness of the environment as God's creation. They associated environmentally responsible behavior with worship and their duty as *khalifah* (stewards) on Earth. However, interview findings revealed that many students had not yet clearly grasped the relationship between the concept of *tawhid* and environmental stewardship. In the socio-ecology dimension, students displayed social sensitivity to the environmental impact on fellow human beings. They actively participated in campus and community cleanliness initiatives and expressed empathy for disaster victims. Nevertheless, their understanding of the collective and structural causes of environmental damage remained limited. The bio-ecology dimension revealed strong tendencies toward conservation practices, such as nurturing plants and avoiding the destruction of animal habitats. Qualitative data from interviews further revealed that most students were emotionally engaged and highly motivated to take action on environmental issues. However, this enthusiasm was not balanced by a deep understanding of Islamic ecological concepts. This suggests that many of their actions were not yet grounded in a theological understanding of biodiversity as a manifestation of divine mercy. In the cosmo-ecology dimension, students expressed admiration for natural phenomena but lacked deeper conceptual links between cosmic order and the Islamic concept of *tawhid rububiyyah*.

Based on the theoretical triangulation analysis, four empirical findings were identified.:

The presence of a *tawhidic worldview* (a worldview based on the Islamic concept of

tawhid) sis the foundation of ecological spirituality. Students' strong conative and affective responses in the theo-ecology dimension reflect their internalization of *tawhid* in environmental consciousness. Despite their faith-driven actions, the moderate cognitive scores suggest a limited understanding of the theological and scientific foundations behind these actions (Al-Attas, 1980).

The emergence of social responsibility as collective ecological awareness. High scores in the socio-ecology dimension indicate students' perception of environmental care as part of *amar ma'ruf nahi munkar* (enjoining what is good and forbidding what is wrong). However, limited scientific knowledge in this area necessitates educational models that emphasize project-based and community-centered learning.

A sense of ecological balance rooted in Islamic teachings on *mīzān* (balance) and *khilāfah*. Students exhibited relatively balanced development of all attitude components in the bio-ecology dimension, signifying stronger exposure to these Islamic ecological narratives.

Neglected cosmic awareness due to low cognitive scores in the cosmo-ecology dimension. Although affective and behavioral responses toward nature were high, the limited connection to Qur'anic concepts such as*tafakkur fi al-kawn* (contemplation of the cosmos) indicates theneed to integrate Islamic cosmology more fully into science education.

These findings are further detailed in Table 1, which triangulates the empirical results with Islamic ecoliteracy theory to formulate academic and pedagogical implications.

Table 1. Triangulation of Empirical Findings and Theoretical Framework of Islamic Ecoliteracy

Islamic Ecological Dimension	**Empirical Findings**	**Islamic Theoretical Framework**	**Academic Implications**
Theo-Ecology (*Human–God Relationship*)	Highest conative score; students act to protect the environment, motivated by faith	Nature as a sign (*ayah*) of God; humans as *khalifah*; *tawhid* as the foundation of ecological responsibility	Strengthening the cognitive dimension through *ayat kauniyah*-based learning and thematic Qur'anic interpretation in Islamic science curricula
Socio-Ecology (*Human–Human Relationship*)	High affective and conative scores; students perceive environmental care as part of *amar ma'ruf nahi munkar*	*Mas'uliyyah jama'iyyah* (collective responsibility); prohibition of *fasād* (corruption) in the Qur'an	Implementation of social-ecological project-based learning to reinforce cognitive and collaborative competencies
Bio-Ecology (*Human–Other Creatures Relationship*)	Relatively balanced development across affective, conative, and cognitive aspects; students understand the importance of coexisting with living beings	Principle of *mīzān* and *khilāfah* in maintaining harmony between humans and other creatures	Integration of ecological narratives and contextual scientific experiments based on Islamic values in science instruction
Cosmo-Ecology (*Human–Universe Relationship*)	Lowest cognitive scores; students demonstrate affective and conative engagemen with nature but lack theological understanding of the macrocosm	*Tafakkur fi al-kawn* (cosmic contemplation) as intellectual worship; importance of reflecting on the order of the universe	Integration of Islamic cosmology with astronomy and earth sciences to foster cosmic awareness in science education

Triangulated findings indicate that PGMI students' ecoliteracy is strong in the affective and conative components but remains weak in the cognitive dimension, especially regarding an in-depth understanding of *tawhid* (monotheism) and Islamic cosmology. These ssuggest that Islamic science education should focus on strengthening conceptual understanding through the integration of Islamic values and

scientific principles. In terms of ecological balance (bioecology), students demonstrate a sufficient understanding of the relationships among living beings and the connection between the principles of *mīzān* and *khilāfah* in maintaining the harmony of nature. Science learning should integrate ecological narratives and contextual experiments grounded in Islamic values to reinforce this understanding. In contrast, for cosmic awareness (cosmoecology), students' cognitive scores are the lowest, indicating that they have yet to grasp the connection between the macrocosm and Islamic values. The concept of *tafakkur fi al-kawn* (cosmic contemplation) as a form of worship and reflection on the order of the universe should be integrated into science education through the incorporation of Islamic astronomy and geosciences, enabling the comprehensive development. In order to address this imbalance, a social-ecological, project-based learning model is urgently needed to strengthen the cognitive dimension alongside collaborative practice. This model is expected to encourage students to engage in critical and reflective exploration of the relationship between humans and nature, as well as to integrate *ayat kauniyah*with scientific phenomena through contextual fieldwork and community service projects grounded in Islamic values. Thus, Islamic science education in PGMI can produce graduates who harmonize knowledge, morality, and practical actions in preserving the environment.

DISCUSSION

The findings reveal a notable imbalance in the development of the three ecoliteracy components among PGMI students. Specifically, the affective and conative dimensions are significantly more developed than the cognitive dimension. This pattern reflects broader trends in religious and values-based education, where emotional and behavioral exhortations often take precedence over deep conceptual understanding (Stevenson et al., 2013). Although students demonstrate a strong emotional identification with ecological values and a readiness to engage in pro-environmental behavior, their conceptual grasp of ecological systems and the associated theological underpinnings remain limited. This gap can compromise the depth and sustainability of their ecological engagement. As Ajzen (2020) argued in the Theory of Planned Behavior, enduring behavioral change is most effectively achieved when cognitive, affective, and conative elements are aligned and mutually reinforcing.

Several factors may account for this underdevelopment in cognitive abilities. First, the science curriculum within PGMI programs often emphasizes normative religious values without sufficiently integrating ecological science. Students may be encouraged to act responsibly toward nature as part of their religious duty, yet they often lack an adequate understanding of ecological principles, environmental systems, or the interdependence of living organisms (Nasir, 2024). Second, the absence of pedagogical strategies that link Islamic texts with ecological phenomena limits opportunities for critical reflection. Concepts such as *mīzān* (balance), *fasād* (corruption), and *khilāfah* (stewardship), although rich in ecological relevance, are rarely explored through interdisciplinary learning models that bridge theology and science (Sardar, 1985). Third, instructional materials rarely incorporate *ayat kauniyah*as thematic anchors for science lessons, resulting in fragmented knowledge acquisition and poor integration of faith and reason.

Addressing these issues requires a paradigm shift toward transdisciplinary, values-based, and context-sensitive science education. Islamic ecoliteracy should not be limited to ethical exhortation but must encompass scientific literacy, theological depth, and pedagogical innovation. Project-based and service-learning approaches, for instance, can immerse students in real-world environmental problems while encouraging reflection on Islamic ethical frameworks

(Kricsfalusy et al., 2018). Reflective engagement with the Qur'an through *tafsir maudhu'i* (thematic exegesis) can help students connect scientific phenomena with spiritual meanings. Furthermore, exposure to contemporary ecological literature alongside classical Islamic texts can cultivate a critical consciousness that is both spiritually grounded and scientifically informed.

The importance of cosmo-ecology, identified as the most underdeveloped domain in this study, deserves particular consideration. Although students were fascinated by cosmic phenomena, they struggled to articulate the theological significance of cosmic order or to relate it to the concept of *tawhid rububiyyah* (divine lordship). This finding highlights the importance of pedagogical approaches that foster cosmological contemplation, such as integrating astronomy and geosciences with spiritual reflection (Orr, 1994; McBride et al., 2013). Qur'anic verses such as Q.S. Ali Imran: 190–191, which encourage reflection on the creation of the heavens and the earth, provide a powerful foundation for fostering this kind of cosmological ecoliteracy.

In conclusion, this discussion underscores the crucial need to revitalize Islamic science education in PGMI through an integrative and transformative framework. Aligning theological commitments with scientific understanding is essential not only for cultivating environmental responsibility but also for preparing educators who can embody and transmit a holistic, ethical, and intellectually rigorous ecological worldview.

CONCLUSION

The ecoliteracy attitudes of PGMI students demonstrate relatively strong in the affective and conative dimensions, but are insufficiently supported by a corresponding development in the cognitive aspect. This imbalance reflects a conceptual gap and a limited understanding of Islamic ecological principles. Although students exhibit positive feelings and behaviors toward the environment, they do not yet fully comprehend the theological, scientific, and philosophical foundations underlying these actions. These findings suggest that Islamic science education within PGMI requires a fundamental reconstruction, one that is not merely normative and moralistic in nature, but also capable of cultivating a solid intellectual and theological framework. Such an approach is crucial to ensure that the ecological attitudes fostered in students evolve into holistic and sustainable ecological awareness.

Based on these findings, several strategic recommendations are proposed for implementation in science education within PGMI programs. These include: reorienting the science curriculum through an integrative approach that bridges scientific knowledge and Islamic values; incorporating *ayat kauniyah* alongside modern scientific themes; developing Islamic ecoliteracy learning modules that explicitly connect theo-, socio-, bio-, and cosmo-ecological dimensions within an Islamic framework;; providing training on contextual learning approaches grounded in Islamic principles to facilitate the integration of ecoliteracy into instructional practices; and promoting student engagement in field activities, environmental observation, and community service projects infused with Islamic values to foster transformative learning experiences. Additionally, evaluation systems must include indicators that assess students' ecological understanding, not only in cognitive terms but also in relation to significance and practical action. Through these efforts, PGMI has the potential to become a pioneer in producing *madrasah* (Islamic school) teachers who are not only scientifically competent but also morally upright and spiritually aware in their environmental stewardship.

Declaration by Authors

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REFERENCES

1. Ajzen, I. The theory of planned behavior: Frequently asked questions. *Human Behavior and Emerging Technologies*, 2020; 2(4), 314–324. https://doi.org/10.1002/hbe2.195.
2. Al-Attas, M. N. *The concept of education in Islam*. 1980. Kuala Lumpur: Muslim Youth Movement of Malaysia.
3. Azwar, S. *Sikap manusia: Teori dan pengukurannya*. 2010; 2nd ed., Pustaka Pelajar.
4. Foltz, R. C. *Islam and ecology: A bestowed trust*. 2003; Harvard University Press.
5. Gerungan, W. A. *Psikologi sosial*. 2004. Bandung: Refika Aditama.
6. Khalid, F., & O'Brien, J. *Islam and ecology*. 1992; Cassell.
7. Kricsfalusy, V., George, C., & Reed, M. G. Integrating problem-and project-based learning opportunities: Assessing outcomes of a field course in environment and sustainability. *Environmental education research*. 2018; 24(4):593-610.
8. McBride, B. B., Brewer, C. A., Berkowitz, A. R., & Borrie, W. T. Environmental literacy, ecological literacy, ecoliteracy: What do we mean and how did we get here? *Ecosphere*. 2013; 4(5), 1–20. https://doi.org/10.1890/ES13-00075.1.
9. Nasir, M. F. A. Integrasi Nilai Islami Dalam Penerapan Kurikulum Merdeka Pada Pengajaran Ipa Sains Di Madrasah Ibidaiyyah. *Al-Mubtadi: Jurnal Pendidikan Guru Madrasah Ibtidaiyah*. 2024; 1(2):71-91.
10. Orr, D. W. *Earth in mind: On education, environment, and the human prospect*. 1994; Island Press.
11. Saniotis, A. Muslims and ecology: fostering Islamic environmental ethics. *Contemporary Islam*. 2012; 6(2), 155-171.
12. Sardar, Z. Arguments for Islamic science. *Aligarh: Centre for Studies on Science*. 1985.
13. Sterling, S. Transformative learning and sustainability: Sketching the conceptual ground. *Learning and Teaching in Higher Education*. 2010; 5, 17–33.
14. Stevenson, R. B., Brody, M., Dillon, J., & Wals, A. E. J. *International handbook of environmental education*. 2013; Routledge. https://doi.org/10.4324/9780203813331.
15. Tilbury, D., Keogh, A., Leighton, A., & Kent, J. C. *A national review of environmental education and its contribution to sustainability in Australia*. Australian Government Department of Environment. 2005.
16. UNESCO. *Education for sustainable development: A roadmap*. 2021; United Nations Educational, Scientific and Cultural Organization.

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