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Students' Understanding and Attitudes Toward Environmental Conservation Based on Local Wisdom: A Preliminary Survey for Ethnoconservation-Based Teaching Material Development

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Abstract: This study explores high school students' understanding and attitudes toward environmental conservation grounded in local wisdom as a preliminary step to developing ethnoconservation-based teaching materials. A descriptive quantitative survey was administered to students in coastal and non-coastal areas using a Google Form questionnaire with dichotomous (Yes/No) items. Analysis identified five domains of perception: the importance of integrating local cultural values into science learning, interest in cultural knowledge related to environmental preservation, ability to explain cultural roles in conservation, difficulties in linking ecological concepts with cultural practices, and perceived relevance of local wisdom in science learning. Most students support the integration of local wisdom into science education and express strong interest in learning cultural practices related to conservation. However, many still struggle to conceptually connect scientific concepts with cultural traditions. The study concludes that there is an urgent need for contextualized, culturally responsive teaching approaches that integrate scientific knowledge with local environmental practices to strengthen students' ecological literacy and multicultural awareness.

Keywords: Culturally responsive teaching; Environmental conservation; Local wisdom; Project-based learning; Science learning; Student perceptions

Introduction

Science education plays a strategic role in shaping both ecological literacy and multicultural awareness among younger generations, especially in the face of global challenges such as climate crises, environmental degradation, and increasing socio-cultural diversity. However, science instruction in Indonesian schools is still often dominated by abstract, decontextualized content, making it difficult for students to see how scientific knowledge applies to environmental conservation in their own communities (Sumarni et al., 2020; Suprapto et al., 2021). In practice, ecological literacy means that students can explain local environmental issues—such as waste, water quality, or mangrove protection—and consider how communities can respond, while multicultural awareness involves recognizing how different cultural groups understand and care for nature. When teaching stays at the level of definitions and formulas without local cases or field data, learners struggle to transfer ideas and their motivation drops. A more contextual alternative is to anchor units in place-based phenomena and invite community voices so that learners can connect science to the realities around them. A simple check of readiness is

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whether students can not only name concepts but also propose feasible actions for their own neighborhood.

A humanistic orientation to science education emphasizes connecting disciplinary ideas with learners' lived socio-cultural contexts; recent work argues that such orientations are foundational for meaningful and inclusive learning in plural societies (Klopfer & Aikenhead, 2022; Jones & Donaldson, 2022; Henderson & Tudball, 2016). Operationally, this approach treats culture as an asset: start from learners' languages, artifacts, stories, and practices, then connect these to disciplinary models. Teachers can use local examples as entry points, co-design tasks with students, and then formalize with scientific explanations. Engagement strengthens when tasks allow choice and voice and when students see their identities reflected in the problems they tackle; to avoid tokenism, cultural connections should be woven across a unit and paired with critical reflection on both the strengths and limits of local practices.

Beyond conceptual understanding, ecological literacy entails critical awareness of human–environment interactions and a disposition to act for sustainability. Reviews in environmental and science education highlight that effective programs interweave knowledge, skills, and action, and situate inquiry in issues that matter locally (Monroe et al., 2019; Evagorou et al., 2020). In Indonesia's Merdeka Curriculum, this alignment is explicitly encouraged through IPAS units that invite contextualization with community practices and local resources (Fitri et al., 2023). Practically, this means integrating three strands—conceptual knowledge; inquiry and reasoning skills; and action dispositions such as responsibility and efficacy—into cohesive projects. Investigations organized around locally meaningful issues (e.g., a school waste audit or simple water testing) help learners practice evidence use, argumentation, and decision-making under constraints. Within IPAS, project outputs—policy briefs for stakeholders, infographics, simple prototypes, or campaigns—can be aligned with targeted competencies in the CP/ATP.

An ethnoconservation approach—bridging traditional conservation practices with ecological principles—offers one promising pathway. Scholarship on Traditional Ecological Knowledge (TEK) shows how community-embedded practices and social institutions support sustainable ecosystem management and provide powerful contexts for learning (Berkes et al., 2000). Studies in Indonesian settings likewise indicate that integrating local wisdom into science instruction can bolster character development, motivation, and learning outcomes (Suastra et al., 2017; Parmin et al., 2015). Ethnobotanical work around Mount Ungaran, Central Java, further illustrates how communities sustain biodiversity through culturally embedded plant knowledge and ecological management—offering concrete examples for conservation-oriented science lessons (Utami et al., 2019). As a classroom strategy, ethnoconservation invites students to analyze a nearby practice, surface its ecological logic, test claims against observations or simple datasets, and propose respectful adaptations where needed. Because TEK includes rules, seasonal calendars, and social sanctions, it renders abstract mechanisms—such as feedbacks and carrying capacity—concrete and discussable. This approach can affirm cultural identity while strengthening systems thinking and problem-solving, while also avoiding romanticization by asking when contexts have changed and how practices might be updated.

Baseline evidence still suggests that many learners struggle to connect ecological ideas with everyday decisions and pro-environmental action, underscoring the need for materials and pedagogy that make these links explicit (Sasea et al., 2023). Mapping students' initial perceptions and experiences regarding local wisdom is therefore essential as a design foundation for context-relevant materials and for strengthening both ecological literacy and intercultural awareness. Concretely, baseline mapping should elicit what students already believe, value, and do—from their experience with local practices to their confidence in taking environmental action. Practical tools include brief surveys (mixing Likert and open items), quick interviews, concept maps, photo-elicited discussions of neighborhood issues, and simple action logs. Such findings can guide the choice of examples, vocabulary, scaffolds, and project products; the same measures can then be revisited after instruction to monitor growth and refine subsequent modules.

Method

Research Design and Approach

This study constitutes the preliminary phase within a Research and Development (R&D) framework, adopting a descriptive quantitative approach through survey methodology. The primary aim is to explore students' understanding and attitudes toward environmental conservation grounded in local wisdom. These findings serve as a critical needs analysis to inform the contextual and culturally responsive development of ethnoconservation-based teaching materials.

Research Participants and Setting

Participants in this study were senior high school students from various schools situated in both coastal and non-coastal regions. A random sampling technique was employed to ensure diverse representation and to capture a general overview of students' ecological

perceptions and their views on integrating local wisdom into conservation education.

Research Instrument

Data collection utilized an online questionnaire developed via Google Forms, comprising closed-ended items with dichotomous (Yes/No) response options. The choice of Google Forms was based on its accessibility, efficiency in large-scale data collection, real-time data availability, and user-friendliness across digital platforms. The binary response format was intentionally selected to provide clarity for respondents, reduce ambiguity in decision-making, and facilitate straightforward data tabulation and analysis.

Data Collection and Analysis Procedures

The survey link was distributed electronically to selected respondents across various schools in the designated research area. Respondents were requested to complete the form within the scheduled time frame. The collected data were analyzed descriptively by calculating the percentage of affirmative (Yes) and negative (No) responses for each item. The descriptive statistics were then interpreted to identify dominant patterns and trends in student perceptions. These insights were subsequently used to inform the content development and contextual relevance of the teaching materials.

Utilization of Findings in the Development of Teaching Materials

The results of this preliminary survey hold substantial implications for the subsequent instructional design process. Specifically, the findings were employed to: (1) Identify core concepts and local cultural elements appropriate for integration into the teaching module; (2) Align pedagogical strategies with indigenous ecological knowledge systems; (3) Select appropriate instructional models—such as project-based learning or place-based education—suitable for promoting ecological literacy through local wisdom.

Result and Discussion

Results should be clear and concise. The discussion should explore the significance of the results of the work, not repeat them. A combined Results and Discussion section is often appropriate. Avoid extensive citations and discussion of published literature. The survey conducted among senior high school students from various schools revealed their perceptions and opinions regarding environmental conservation. The survey data were analyzed using descriptive quantitative methods by calculating the percentage of "Yes" and "No" responses for each item.

The results were categorized into five main perception domains: (1) perceptions of the importance of integrating local cultural values into science education, (2) interest in learning about local culture related to environmental preservation, (3) ability to explain the role of local culture in environmental conservation, (4) difficulties in connecting ecological concepts with local cultural practices, and (5) views on the relevance of indigenous knowledge in science learning. The findings for each category are presented below.

Perceptions of the Need to Integrate Local Cultural Values into Science Learning

Perceptions regarding the importance of integrating local cultural values into science learning were measured using the survey statement: "I believe science learning should incorporate local cultural/wisdom values." The survey results indicated that the majority of students support the integration of local cultural values into science education. The distribution of respondents' answers is presented in Figure 1.

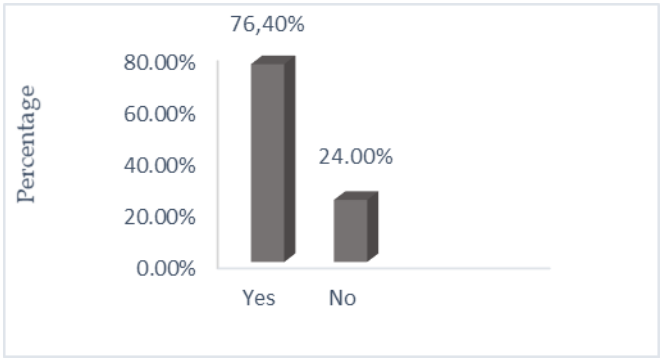

Figure 1. Student responses: "science learning should include local cultural values"

Of the total 178 respondents, 136 (76.4%) answered “Yes,” while 42 (23.6%) answered “No.” These results indicate broad support for connecting science with local wisdom to bridge scientific concepts and everyday realities, especially for environmental issues and conservation (Verawati & Wahyudi, 2024).

The high proportion of “Yes” responses underscores the instructional need to contextualize science through community-relevant practices so students see that science is intertwined with cultural and social life. Approaches that are culturally responsive/sustaining have been shown to strengthen engagement and understanding—particularly when linked to sustainability issues—rather than treating culture as an add-on (Smith et al., 2022).

Conversely, the 42 (23.6%) who answered “No” suggest that a subset of students still does not perceive the relevance of local cultural values to science

learning—likely reflecting lecture/textbook-heavy experiences with few concrete examples. Strengthening design with projects and field tasks that make the culture–science–conservation link explicit addresses this gap (see also Sumarni et al., 2020 on the need to connect cultural knowledge and STEM). Overall, these findings are consistent with synthesis studies showing that integrating local or indigenous knowledge makes science learning more contextual and meaningful while directly linked to sustainability issues (Zidny et al., 2020). and with bibliometric evidence of a rising trend in ecopedagogy and science–conservation linkages in Scopus-indexed literature (Yuliani et al., 2024). To design engaging learning experiences, a context-based science education approach is recommended because it enhances relevance and the transfer of understanding (Gilbert et al., 2011).

Willingness to Learn About Local Culture Related to Environmental Conservation

Students' perceptions of their willingness to learn about environmentally friendly practices based on local culture were measured through the survey statement: "I want to learn how local cultures protect the environment." The survey results show that the majority of students expressed a very strong interest in learning about local wisdom related to environmental conservation. The distribution of respondents' answers is shown in Figure 2 below.

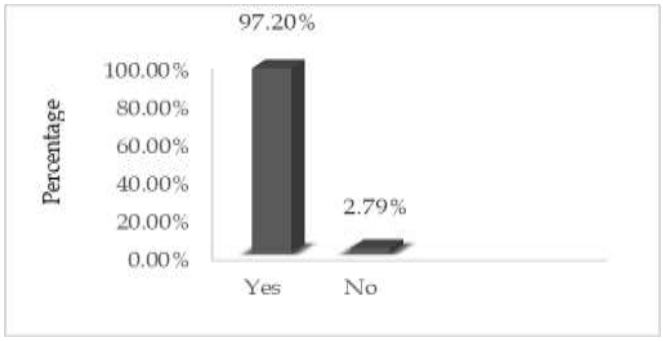

Figure 2. Student responses: "I want to learn how local culture helps protect the environment"

Of the total 178 respondents, 173 (97.2%) answered "Yes," while only 5 (2.79%) answered "No." This indicates that almost all students show very high interest in learning about the role of local culture in environmental conservation, reflecting growing awareness of the value of local-wisdom-based knowledge for environmental preservation. These findings suggest that integrating cultural practices into science classes aligns with learners' needs and interests and can cultivate a sense of environmental ownership. Empirical work on local-wisdom-based biology learning models shows positive effects on outcomes and supports contextualized instruction (Ramdiah et al., 2020), while localized implementations in Indonesia report literacy and motivation gains (Verawati & Wahyudi, 2024).

The small "No" group likely reflects limited exposure to local conservation practices inside or beyond school. Project-based learning, field studies, and authentic community actions can provide that exposure and sustain pro-environmental concern—consistent with culturally responsive sustaining approaches. Overall, the very high interest levels align with evidence that science learning based on local wisdom enhances students' character, motivation, and attachment to environmental issues (Suastra et al., 2017). A recent national-level systematic literature review likewise confirms that integrating local potentials into science learning strengthens cultural awareness and the perceived relevance of learning (Kamila et al., 2024). Addressing the remaining gap requires practical, locally grounded designs—case studies, community-linked conservation projects, and field observations—that connect ecological mechanisms with cultural practices. Studies in Indonesia indicate that embedding cultural values within science learning through a Culturally Responsive Transformative Teaching approach increases student engagement and conceptual grasp (Rahmawati et al., 2023).

Ability to Explain the Role of Local Culture in Environmental Conservation

Students' perceptions of their ability to explain the role of local culture as part of environmental conservation strategies were measured through the survey statement: "I can explain how local culture can be part of an environmental conservation strategy." The survey results indicate that the majority of respondents have a reasonably good initial understanding of the role of local culture in environmental conservation. The distribution of respondents' answers is shown in Figure 3 below:

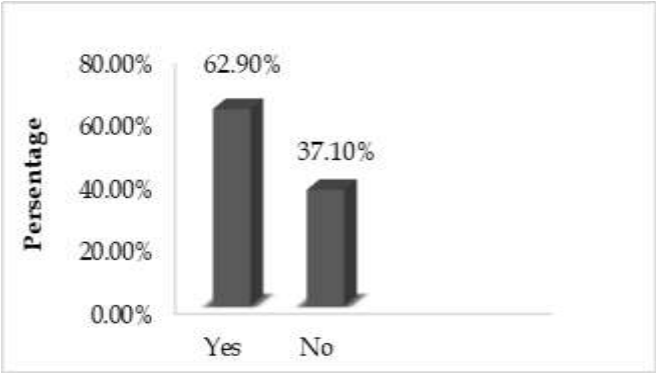

Figure 3. Student Responses: "I Can explain how local culture supports environmental conservation"

Out of a total of 178 respondents, 112 (62.9 %) answered "Yes," while 66 (37.1 %) answered "No." These results show that although the majority of students are capable of understanding the link between local culture and environmental conservation strategies, around one-third of respondents still cannot adequately explain this relationship. The 37.1 % "No" responses point to a conceptual gap in how local wisdom can be integrated into environmental preservation efforts. This situation is in line with the findings of Lestari et al. (2024), who argue that research on science education grounded in local cultural and environmental contexts remains limited and that many learning programmes fail to bridge scientific knowledge and students' everyday cultural experience. Abas et al. (2022) highlight that indigenous local wisdom plays a critical role in nature conservation but is still seldom integrated into formal science/education curricula, thereby contributing to the low understanding among students of the connection between ecological concepts and conservation practices based on local wisdom.

The results of this survey underscore the need for a more practical, local wisdom-based learning approach—such as case studies, culturally rooted conservation projects, or field observations that connect ecological concepts with cultural practices. Such approaches not only offer more meaningful and contextual learning experiences but also allow students to perceive the direct relevance of science to their daily lives. Verawati et al. (2024) emphasize that project-based learning strategies infused with local cultural values can enhance student engagement, foster a sense of environmental ownership, and strengthen contextual ecological understanding. Furthermore, students' involvement in culturally based activities promotes the internalization of environmental conservation values, reinforces their ecological identity, and cultivates critical awareness of sustainability issues.

This form of learning serves as a bridge between scientific knowledge and the local values embedded in community life, thereby creating a more inclusive, relevant, and transformative educational experience.

About one-third of respondents were not yet able to adequately explain the connection between local culture and environmental conservation. This gap is consistent with analyses emphasizing the challenges of linking ecological concepts to everyday practices and the importance of place-based design to foster conceptual meaning-making (Lanouette, 2022). Analyses of science learning problems based on local wisdom in Indonesia also highlight obstacles related to strategy, assessment, and learning resources that hinder the optimal integration of concept–practice relationships (Hikmawati et al., 2021).

Difficulties in Connecting Ecological Concepts with Local Cultural Practices

Students' perceptions of the difficulty in connecting ecological concepts with local cultural practices were measured through the survey statement: "I find it difficult to connect the ecological knowledge I have learned with the cultural practices around me."

The survey results revealed variations in students' understanding and a gap in linking ecological concepts with the context of local culture. The distribution of respondents' answers is shown in Figure 4.

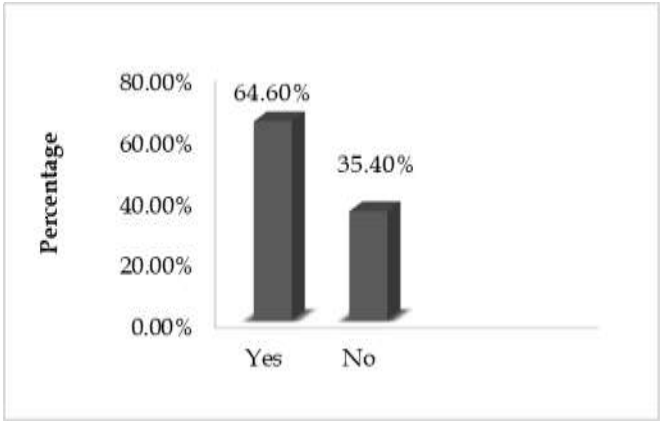

Figure 4. Student Responses: "I find it hard to relate ecological knowledge to local cultural practices"

Out of a total of 178 respondents, 115 (64.6%) answered "Yes," while 63 (35.4%) answered "No." These results indicate that although a majority can see how ecological concepts connect with local cultural practices, a substantial minority still struggle to make that link. This pattern is consistent with critiques that school science often remains abstract and insufficiently contextualized with local cultural–environmental phenomena (Sumarni et al., 2020). It also resonates with evidence that integrating local wisdom into science learning—especially in ecology—can enhance environmental awareness and scientific communication by providing concrete, culturally grounded examples of conservation practices (Yasir et al., 2020).

Pedagogically, the findings underscore the need for more tangible, context-rich experiences—culturally rooted projects, field studies, and collaboration with local knowledge holders—that explicitly connect ecological mechanisms with community practices. Project-based learning models infused with local cultural content have been shown to boost engagement, deepen ecological understanding, and foster environmental care through direct interaction with cultural and conservation practices (Verawati & Wahyudi, 2024) highlighted that implementing project-based learning models infused with local cultural content can enhance student engagement, enrich

ecological understanding, and foster a sense of environmental care through direct interaction with cultural and conservation practices in the community. Evidence from local-wisdom-based designs likewise shows improvements in student engagement and understanding (Ramdiah et al., 2020).

At the systems level, these challenges align with curriculum–policy analyses that call for mainstreaming local wisdom/ethnoscience so integration becomes systematic rather than ad hoc (Suprapto et al., 2021). Complementary systematic reviews of Scopus-indexed articles in JPII further stress that the success of environmental education depends on the continuous development of models, methods, and learning tools (Husamah et al., 2022).

Perspectives on the Relevance of Local Wisdom in Science Learning

Perceptions of the relevance of local wisdom in science learning were measured through the survey statement: "I consider the integration of local culture in environmental conservation as an important part of science learning." Student survey results for this statement show that the majority of respondents perceive the integration of local wisdom as very important to make science learning more contextual and meaningful. The distribution of respondents' answers is shown in Figure 5.

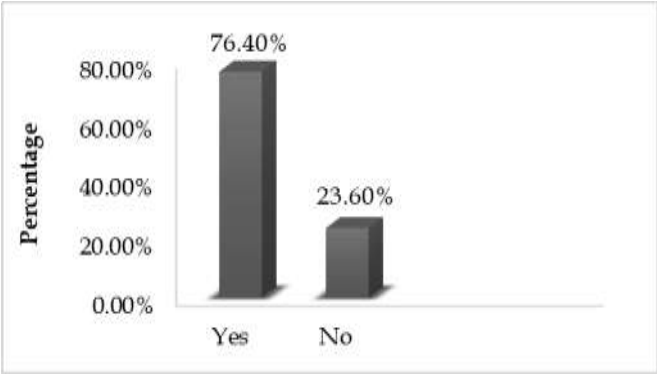

Figure 5. Student Responses: "Integrating local culture into science learning is important for environmental conservation"

Out of 178 respondents, 136 (76.4%) answered "Yes," while 42 (23.6%) answered "No." These results indicate broad support for integrating local cultural values into science learning. The pattern underscores the need to make instruction more contextual by linking scientific concepts to socio-cultural practices familiar in students' daily lives—consistent with Kasi et al. (2024), who found that integrating local science into formal education both preserves local wisdom and yields more meaningful, relevant learning that strengthens students' sense of connection and environmental responsibility.

The high "Yes" rate suggests students want learning experiences that are meaningful, relevant, and grounded in their local environments. Conversely, the 24.0% "No" responses signal a group that has not yet recognized the science–culture connection. This aligns with Rahmawati et al. (2023), who argue that conventional science instruction often overlooks local cultural contexts, making it hard for learners to relate school science to everyday socio-cultural realities. Addressing this gap calls for project-based learning and field observations emphasizing real-life, culture-based conservation practices, as highlighted by Lestari et al.(2024).

Overall, the majority view that integrating local wisdom is essential for contextualizing science is supported by cross-study evidence showing that bringing indigenous knowledge into classrooms enriches perspectives, increases relevance, and links learning with community sustainability actions (Zidny et al., 2020). At the level of material development, needs analyses also point to the importance of local-wisdom-based e-modules/learning tools to ensure consistent and sustainable implementation (Yuliana et al., 2023).

Conclusion

These findings underscore the need for more contextual, meaningful, and culturally responsive science instruction. Integrating scientific concepts with local wisdom can enhance students' ecological literacy, strengthen their sense of cultural identity, and promote environmentally responsible behavior. In practical terms, the development of ethnoconservation-based teaching materials becomes highly relevant for improving science learning. Such materials should: (1) identify essential ecological content aligned with appropriate local cultural contexts; (2) emphasize cultural values and traditional environmental practices in learning activities; and (3) utilize approaches such as project-based learning, field studies, and real-life conservation actions to connect students directly with their environment. Overall, these insights provide a strong foundation for designing innovative and transformative science learning modules that bridge scientific knowledge with culturally embedded conservation practices. The integration of local wisdom into science education can contribute not only to improved conceptual understanding but also to broader goals of environmental stewardship and multicultural awareness.

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Author Contributions

Conceptualization, Sudirman and Woro Sumarni; methodology, Sudirman; software, Sudirman; validation, Sudirman, Woro Sumarni, and Margareta Rahayuningsih; formal analysis, Sudirman; investigation, Sudirman; resources, Sudirman; data curation, Sudirman; writing—original draft preparation, Sudirman; writing—review and editing, Margareta Rahayuningsih and Woro Sumarni; visualization, Sudirman; supervision, Woro Sumarni; project administration, Sudirman. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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