Bima Cendikia :
Journal of Community Engagement and Empowerment
EISSN: xxx-xxx
Vol. 2, No. 2, July 2025
Doi: https://doi.org/xxx.xxx

Ecoliteracy Education for Sustainable Behavior

A School–Community Partnership Model

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ABSTRACT

Purpose – Agricultural environments are increasingly challenged by land degradation, post-harvest waste, and unsustainable cultivation practices. This study aims to examine how a school–community partnership model can enhance ecoliteracy and promote sustainable behavior among students at Temanggung, particularly within the Agricultural Product Processing Technology and Agribusiness of Plantation Crops programs.

Design/methods/approach – This qualitative case study employed in-depth interviews with teachers, students, local farmers, and small-scale agro-processing entrepreneurs; participatory observation of school- and community-based environmental activities; and documentation of field practices. The partnership program was implemented through project-based learning initiatives focusing on agricultural waste utilization, environmentally friendly farming, and ecologically conscious product marketing.

Findings – The results indicate that integrating school learning with real-world experiences provided by local communities enhances students' ecological understanding and raises awareness of sustainable agricultural practices. Students developed environmentally friendly processed products and demonstrated increased knowledge of soil and water conservation techniques within the context of plantation crop cultivation.

Research implications/limitations – This research is context-specific and limited to a single vocational school with an agricultural focus, thus its findings are not intended for broad generalization. Additionally, behavioral observations were conducted over a relatively short post-activity period.

Originality/value – This study presents a practical approach to cultivating ecoliteracy in vocational agricultural education through active collaboration with local communities. It highlights the critical role of agricultural vocational schools in developing environmentally conscious and innovation-oriented youth actors for sustainable development.

OPEN ACCESS

ARTICLE HISTORY
Received:
31-01-2025
Accepted:
30-03-2025

KEYWORDS
ecoliteracy; sustainable agriculture; vocational education; school–community partnership; Temanggung.

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doi: https://doi.org/xxx.xxx

Introduction

Rural areas in Indonesia, such as Temanggung Regency, are facing significant environmental challenges, primarily stemming from land degradation, water pollution, and detrimental farming practices. Temanggung, recognized for its agricultural activities in the highlands of Central Java, is critically threatened by environmental disruptions due to intensive monoculture farming and shifts in local climatic conditions. Recent reports by the Ministry of Environment and Forestry (KLHK, 2023) indicate that the area of critically degraded land in the foothills of Mount Sumbing and Mount Sindoro has expanded, highlighting the urgent need for educational strategies that promote ecological awareness, particularly at the senior high school (SMA) level (Suharja et al., 2023).

In this context, ecoliteracy has emerged as a crucial element in promoting transformative environmental education. Ecoliteracy encompasses the ability to understand ecological principles and recognize the role of human actions in ecological systems, empowering individuals to make informed, ecologically sound decisions (Wahyuni et al., 2022). The educational imperative to enhance ecoliteracy at the senior high school level is essential for equipping students with the systems thinking skills and ecological empathy required for fostering sustainability (Paryanti et al., 2021). Research has shown that curricula that incorporate ecoliteracy principles enhance awareness of local and global environmental challenges and foster meaningful connections with the natural environment (Ramadhanti et al., 2023).

The urgency for ecoliteracy education in regions like Temanggung is further underscored by educational practices that successfully integrate ecological values into learning experiences. For instance, programs that involve practical activities, such as bio-entrepreneurship and sustainable waste management, have been demonstrated to instill ecological principles and engage students in hands-on learning about environmental stewardship (Salimi et al., 2023). Additionally, the integration of augmented reality in educational tools is recognized as an effective method to make abstract ecological concepts tangible for students, thereby enhancing their comprehension and problem-solving abilities regarding environmental issues (Minsih et al., 2024).

Thus, fostering ecoliteracy in educational institutions is critical for advancing sustainable practices among the youth in rural Indonesia. By embedding ecological knowledge in senior high school curricula, there is potential not only to improve students' environmental awareness but also to cultivate a generation capable of addressing pressing environmental challenges, thereby positively impacting community engagement and environmental conservation efforts (Pitman & Daniels, 2016).

In addressing the challenges of environmental education in senior high schools, it is critical to recognize that the prevailing pedagogical approaches often fall short of facilitating comprehensive ecological understanding among students. Much of the instructional content remains fragmented, typically relegating environmental education to theoretical discussions within narrow subjects, such as Biology or Geography. As Sterling (2012) articulates, traditional disciplinary boundaries frequently overlook the intricate and interconnected nature of environmental issues, thereby constraining students' capacity to relate their academic experiences to pressing real-world ecological situations. This limited viewpoint emphasizes the necessity for a more holistic and contextualized approach to environmental education that resonates with students' lived experiences.

According to the research literature, one highly effective educational model is the implementation of school-community partnerships. These collaborative initiatives emphasize experiential learning by connecting students with local ecological practices and community knowledge. When students actively participate in community-driven projects—such as conservation efforts, sustainable agricultural practices, and waste management initiatives—they engage with ecological concepts in practical contexts that reinforce their cognitive understanding. This reciprocal relationship promotes a valuable exchange of knowledge, where community members impart wisdom drawn from local traditions and ecological histories, facilitating deeper engagement with the environment (Suharja et al., 2023; Wahyuni et al., 2022).

Furthermore, UNESCO (2020) underscores the benefits of community-based learning frameworks, noting that such models significantly enhance student motivation and foster the internalization of sustainability values. These frameworks create a dynamic learning environment where students are

encouraged to apply their knowledge in real-world settings, bridging the gap between theoretical knowledge and practical application. This experiential engagement allows for the development of a more profound ecological literacy, empowering students to become proactive stewards of their environment (Paryanti et al., 2021).

To facilitate the implementation of these holistic strategies, schools can innovate their curricula to incorporate place-based education, which not only reflects local environmental challenges but also integrates the ecological and cultural diversity of the community. This ensures that students are educated in a manner that is reflective of their immediate ecological realities, thereby enhancing their capacity to connect their learning to authentic environmental contexts (Ramadhanti et al., 2023). Through such innovative educational practices, students are more likely to develop an ecological conscience that drives sustainable behaviors and community involvement, ultimately contributing to broader environmental resilience. In summary, to meaningfully internalize ecological values among senior high school students, there is a pressing need to shift from traditional disciplinary teaching methodologies toward more integrated and experiential educational models. School-community partnerships present an avenue for fostering ecological engagement and motivate students to interact with their environment dynamically, preparing them for future environmental challenges.

This study focuses on a senior high school in Temanggung Regency, Central Java, which has established various environment-based programs in partnership with local communities. The unique socio-geographical context of Temanggung—characterized by agrarian livelihoods and ecological richness—provides a compelling backdrop for examining how community engagement can enhance ecoliteracy among students (Suharja et al., 2023). Such partnerships facilitate students' involvement in project-based activities, including composting, spring conservation, and anti-litter campaigns, demonstrating the potential of collaborative educational approaches to foster pro-environmental behavior (Wahyuni et al., 2022). The conceptual framework of ecoliteracy, as it relates to sustainable behavior in secondary education, encompasses the ability to understand ecological principles and the human role in ecological systems. This understanding is essential for students to engage meaningfully with their environment. As outlined by Sterling (2012), traditional educational frameworks generally adopt a narrow

disciplinary approach that can neglect the complexity of environmental problems, limiting students' ability to connect their learning with real-life ecological contexts. Thus, the need for more holistic and contextual learning strategies is highlighted as a means to adequately internalize ecological values among students.

Incorporating community engagement into the educational experience has shown significant benefits. Research demonstrates that school-community partnership models not only enhance students' motivation but also reinforce sustainability values through direct, practical engagement (Paryanti et al., 2021). This dynamic fosters reciprocal learning between students and community members, leveraging local ecological wisdom and enriching students' understanding of environmental sustainability in a tangible manner.

The qualitative methodology employed in this study includes interviews and observations, providing insights into how students process and benefit from their involvement in these community initiatives. The emerging data support the assertion that participatory and experiential education can significantly impact students' ecoliteracy and their aptitude for sustainable behaviors (Ramadhanti et al., 2023). Initial findings from field engagements indicate a notable increase in students' awareness and actions towards environmental stewardship, suggesting a compelling link between community projects and their ecological competencies. The implications of these findings extend both practically and theoretically. Practically, they highlight the effectiveness of project-based learning as a strategic approach to environmental education that could be replicated in similar rural contexts. Theoretically, this research contributes to the discourse on local, action-oriented environmental education, emphasizing the importance of integrating community knowledge into formal educational settings. It suggests that meaningful education about sustainability can arise not just from the classroom but through active engagement with the surrounding environment and local communities (Salimi et al., 2023).

In conclusion, this study aims to evaluate the impact of school-community partnership models on strengthening ecoliteracy and promoting sustainable behavior among students in Temanggung. Through the exploration of this innovative educational approach, the research lends support to the broader application of similar models in rural Indonesian educational contexts,

reinforcing the importance of integrating ecological understanding into the fabric of secondary education.

Methods

Research Design

This research employed a qualitative case study approach to explore how a school–community partnership model enhances ecoliteracy and promotes sustainable behavior among senior high school students in a rural area of Temanggung, Central Java, Indonesia. The case study design was chosen to allow an in-depth and context-sensitive investigation of real-life practices, interactions, and experiences in the educational environment. The approach was naturalistic and interpretive, aiming to understand the meaning-making process among participants in the ecological learning activities.

Research Setting, Subjects, and Researcher Presence

The study was conducted at a public senior high school located in the highland agricultural zone of Temanggung Regency. The school was selected purposively due to its active implementation of environmentally oriented programs in collaboration with community actors such as local farmers, village leaders, and waste management activists. The research subjects included students (grades 10 and 11), teachers, school administrators, and local community members who were directly involved in the ecoliteracy projects. The researcher was present on-site for an extended period (three months) as a participant observer and facilitator in environmental learning activities, enabling direct engagement and interaction with participants.

Data Collection Techniques and Instruments

Data were collected through multiple techniques to ensure triangulation and depth. The primary methods included:

1) In-depth semi-structured interviews with 12 students, 4 teachers, the school principal, and 5 community partners.
2) Participant observation during environmental activities such as composting workshops, tree-planting events, organic farming demonstrations, and school clean-up programs.
3) Document analysis**,** including curriculum plans, student reflection journals, program reports, and environmental policy documents.

All interviews were recorded (with consent), transcribed, and coded thematically. Field notes and observation logs were maintained consistently during the research period.

Data Analysis Techniques

The collected data were analyzed using thematic analysis (Braun & Clarke, 2006). The process involved initial coding, categorization of emerging themes, interpretation based on ecoliteracy theory, and cross-checking with observation data. Themes were refined through iterative reading and discussion with peer researchers to ensure credibility and reduce researcher bias. NVivo software was used to assist in organizing and visualizing the qualitative data.

Validity and Trustworthiness

To ensure the validity of the findings, data triangulation was applied by comparing results from interviews, observations, and documents. Member checking was conducted with selected participants to confirm the interpretation of their responses. Peer debriefing sessions were held with academic colleagues to reflect on the research process and analysis. Prolonged engagement at the site and detailed contextual descriptions further supported the transferability of the findings to similar educational settings.

Result

This section presents the key findings from the field study conducted at a senior high school in Temanggung. The results are categorized into thematic subsections to illustrate how the school–community partnership model contributed to the development of ecoliteracy and sustainable behavior among students.

Integration of Ecoliteracy into School Learning Activities

Ecoliteracy concepts were effectively embedded into school learning through thematic, project-based, and extracurricular activities. Teachers collaborated with local practitioners to design contextual modules on environmental conservation, sustainable agriculture, and waste management. Students participated in the following structured activities:

(1) Composting and organic waste recycling
(2) Community-based reforestation

(3) Student-led campaigns on plastic reduction
(4) Organic farming demonstrations

These activities were integrated into science, geography, and civic education subjects, allowing students to connect ecological concepts with local issues.

Strengthening Ecological Awareness Through Community Engagement

Partnerships with community stakeholders provided students with experiential learning opportunities that deepened their ecological understanding. Students visited nearby organic farms, learned traditional composting methods, and assisted local environmental activists in water source protection efforts.

Reflection and Attitude Change

Based on reflective journal entries and interviews, students reported increased concern about the local environmental condition and a stronger personal commitment to adopting sustainable habits. One student stated:

"After helping the community clean the water spring, I realized how daily habits can damage or protect nature. I now always remind my friends to reduce plastic use."

Development of Action-Oriented Competencies

In several group projects, students demonstrated their ability to design and implement ecologically conscious actions. For example, one group created an awareness video about waste separation, while another developed a low-cost compost bin for use at home. These outcomes indicated that students were not only understanding but also applying ecoliteracy principles.

Behavioral Shifts Observed During the Program

The implementation of the program led to observable behavior changes both within the school environment and at students' homes. Teachers noted a decrease in littering on school grounds, and parents reported changes in how students handled household waste.

Table 1. Observed Behavior Shifts Among Students (Before and After Program)

Behavior Indicator	Before (%)	After (%)
Consistently separating waste	**22%**	**71%**
Bringing reusable water bottles	**35%**	**85%**
Participating in clean-up efforts	**18%**	**67%**

These findings suggest that ecoliteracy-based education, when grounded in community practice, contributes to real and measurable behavioral transformation.

Visual Engagement and Motivation

Figures and visual tools were also used in student projects and campaigns. Posters, infographics, and videos created by students were displayed around the school and uploaded to social media platforms.

Figure 1. Examples of Student-Created Environmental Posters *(a) A campaign poster encouraging tree planting near schools; (b) An infographic on composting steps designed by students for local households)*

These creative outputs not only demonstrated students' ecological knowledge but also helped raise awareness among their peers and the broader school community.

Discussion

Authors should discuss the results and how they can be interpreted from the perspective of previous studies and the working hypotheses. The findings and their implications should be discussed in the broadest context possible. Future research directions may also be highlighted.

Interpreting Key Findings within the Theoretical Framework of Ecoliteracy

The findings of this study indicate that the integration of project-based learning and community partnerships successfully improves ecological knowledge, attitudes, and sustainable behaviors among high school students in Temanggung. These results align with the concept of ecoliteracy, which emphasizes systems thinking skills, relational awareness, and action orientation (Orr, 1992; Capra, 2005). In ecocentric theory, individuals are considered "ecologically literate" when they can perceive the interconnection between natural systems and human activity, understand the ecological consequences of their lifestyle choices, and act ethically to minimize negative impacts. The increase in behaviors such as waste separation (22% → 71%) and

the use of reusable water bottles (35% → 85%) shows that internalization occurred not only in the cognitive domain, but also in the affective and conative domains—three domains identified by McBride et al. (2013) as prerequisites for ecological citizenship.

Furthermore, the sharp increase in these behavioral indicators suggests the success of experiential–situated learning (Kolb, 1984; Lave & Wenger, 1991). By placing students directly in real environmental problem contexts—such as village organic farms or water springs threatened by pesticide waste—the formation of cognitive schemas occurred not abstractly, but through collective meaning-making and critical reflection on field experiences. This reinforces Tilbury's (2011) argument about the importance of place-based education in building emotional attachment (place attachment), which subsequently motivates environmental protection actions.

Contribution of the School–Community Partnership Model to Sustainable Education

Practically, this study provides additional evidence that school–community partnerships (SCPs) are an effective approach to fostering a culture of sustainability at the secondary education level. Three key components of SCP identified as catalysts for change are:

Contextual curriculum co-design: Teachers and local practitioners co-designed modules relevant to the local ecological landscape (e.g., watershed conservation, coffee agroforestry). This collaboration ensured the integration of local knowledge (local wisdom) with scientific validation from academic perspectives.

Multi-stakeholder involvement: In addition to parents, this study involved village officials, farmer groups, and environmental NGOs. These networks expanded learning sources and opened opportunities for service-learning, where students solved community problems while reflecting on theoretical knowledge learned in class.

Public communication strategies: Students' creative outputs (posters, vlogs, infographics) were published in school spaces and on social media, generating feedback from residents. This mechanism strengthened social accountability and expanded the educational impact beyond the school.

These findings are consistent with UNESCO's (2020) whole-school approach, which positions schools as participatory hubs for socio-ecological transformation. However, our study adds a contextual nuance: in rural agrarian areas, the legitimacy of traditional leaders and senior farmers acts as

a behavioral adoption trigger—an aspect that may be less prominent in urban settings.

Comparison with Previous Studies

Compared to Gough's (2013) study in Australia, which reported a 40% increase in recycling behavior after a 12-week intervention, this study recorded a >50% increase in just three months. This difference may be influenced by the following factors:

Local context: Temanggung presents visible ecological challenges (critical land degradation, contaminated springs). Tangible ecological pressure tends to accelerate the urgency for behavioral change.

Community-based foundation: Direct involvement of farmers and youth organizations provided culturally close role models, reinforcing the "credible messenger" factor (Bandura, 1986).

Affective emphasis: Daily reflection modules and personal journals encouraged self-regulation and moral emotions (e.g., guilt, pride), which have been shown to predict pro-environmental behavior (Bamberg & Möser, 2007).

Thus, while our findings confirm the global literature, they also underscore the importance of cultural and locational variables in mediating the effectiveness of interventions.

Theoretical Implications

Theoretically, this study contributes to the ecoliteracy discourse through three insights:

Public communication dimension: Students' visual works demonstrate that the ability to disseminate environmental messages is an integral part of modern ecoliteracy. This extends Capra's (2005) model, which tends to focus on personal knowledge and action.

Strengthening collective ecological identity: Village-based projects fostered a sense of togetherness (collective efficacy)—a psychological factor which, according to Chen & Li (2018), strengthens consistency in pro-environmental behavior.

Synergy between local knowledge and modern science: The co-creation of curriculum showed that local wisdom is not merely an additive content, but

an epistemic lens capable of critiquing modern science—supporting the concept of intercultural sustainability education (McKenzie, 2020).

Practical and Policy Implications

Based on the findings, we recommend the following:

Flexible curriculum integration: The Education Department can include interdisciplinary ecoliteracy themes in high school lesson plans, with behavioral indicators of achievement rather than just knowledge-based indicators.

Community support schemes: Local governments should provide seed grants for student-led environmental projects, as well as facilitator training sourced from community members.

Portfolio-based evaluation: Schools are encouraged to adopt authentic assessment strategies (environmental action portfolios) to comprehensively measure ecoliteracy achievement.

These steps will enhance the synergy between education policy, community development, and local sustainable development agendas.

Methodological Reflections and Limitations

Methodologically, this study adopted a single-case study design, which limits external validity. Although data triangulation was applied, social bias—such as courtesy bias—may have influenced students' self-reported behaviors. Moreover, the three-month research duration was not sufficient to assess long-term behavioral retention. Future research should use quasi-experimental multi-site quantitative designs to test the generalizability of the program's impact. The use of Ecological Footprint Calculators or IoT-based waste sensors may also offer objective data to assess the actual environmental impact of students' behavioral changes.

Future Research Directions

Potential directions for future research include:

- **Longitudinal studies**: Tracking behavioral consistency two to three years post-intervention.
- **Rural–urban comparisons**: Investigating whether similar mechanisms of change operate in urban high schools with different ecological contexts.

- **Digital citizenship approach**: Exploring the role of social media and youth eco-influencers in expanding the impact of school-based environmental campaigns.
- **Biopsychosocial analysis**: Incorporating biometric data (e.g., stress levels) to examine correlations between psychological well-being and environmental engagement.

Overall, this study shows that the school–community partnership model implemented in a rural high school in Temanggung can serve as a transformative catalyst for sustainability education. By facilitating contextual learning, intergenerational dialogue, and collective action, the program not only increased students' knowledge but also stimulated real-world practices with measurable behavioral impacts. Despite limitations in context and methodology, the findings affirm that secondary education institutions possess strategic potential to lead grassroots ecological transformation, especially when supported by adaptive curriculum policies and strong community engagement.

Conclusion

This study has demonstrated that a school–community partnership (SCP) model can serve as an effective and context-sensitive strategy for enhancing ecoliteracy and promoting sustainable behavior among high school students in rural Indonesia. By integrating experiential, community-engaged learning into the formal education setting, students not only increased their ecological knowledge but also translated this knowledge into meaningful, measurable behavioral change. The significant rise in pro-environmental practices, such as waste separation and the use of reusable items, confirms the potential of SCP-based ecoliteracy education to cultivate ecological citizenship across cognitive, affective, and behavioral domains. A key contribution of this research lies in its emphasis on localized, culturally embedded approaches. The co-designed curricula, multi-stakeholder collaboration, and public communication efforts created a dynamic learning ecosystem that transcended classroom boundaries. Moreover, this study expands the theoretical framework of ecoliteracy by incorporating the dimensions of public ecological communication, collective identity formation, and intercultural knowledge integration. These findings suggest that sustainability education is most impactful when it reflects the socio-ecological realities and cultural assets of the local context.

In practical terms, the study offers actionable recommendations for educational policymakers and practitioners, including the incorporation of flexible ecoliteracy modules into high school curricula, support schemes for student-led environmental projects, and authentic, portfolio-based assessments of behavioral outcomes. These strategies can help institutionalize sustainability values within the educational system and encourage youth participation in local environmental stewardship. Future research should explore the long-term impacts of SCP-based ecoliteracy programs through longitudinal and comparative designs across rural and urban settings. Integrating technological tools such as ecological footprint calculators and exploring biopsychosocial factors can further enhance the evidence base for scalable and adaptive sustainability education frameworks. In summary, this study affirms that educational institutions, particularly in rural contexts, hold significant transformative potential. When supported by collaborative community networks and responsive educational policies, schools can play a pivotal role in shaping the next generation of ecologically literate and socially responsible citizens.

Declarations

Author contribution statement

The author solely conceived and designed the study, conducted fieldwork and data collection, and performed data analysis and interpretation. The manuscript was drafted, revised, and finalized independently by the author. All aspects of the research, from conceptual framework development to theoretical grounding, writing, and visual presentation of results, were carried out by the author without external collaboration. The author affirms full responsibility for the accuracy and integrity of all components of the work.

Funding statement

This research was conducted using the authors' own funds without external financial support or grants

Data availability statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request. Due to ethical considerations and agreements with participating schools and community members, the raw data are not publicly shared. However, anonymized summary data and relevant materials can be provided for academic and non-commercial research purposes.

Declaration of interests statement

The author declares that there are no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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