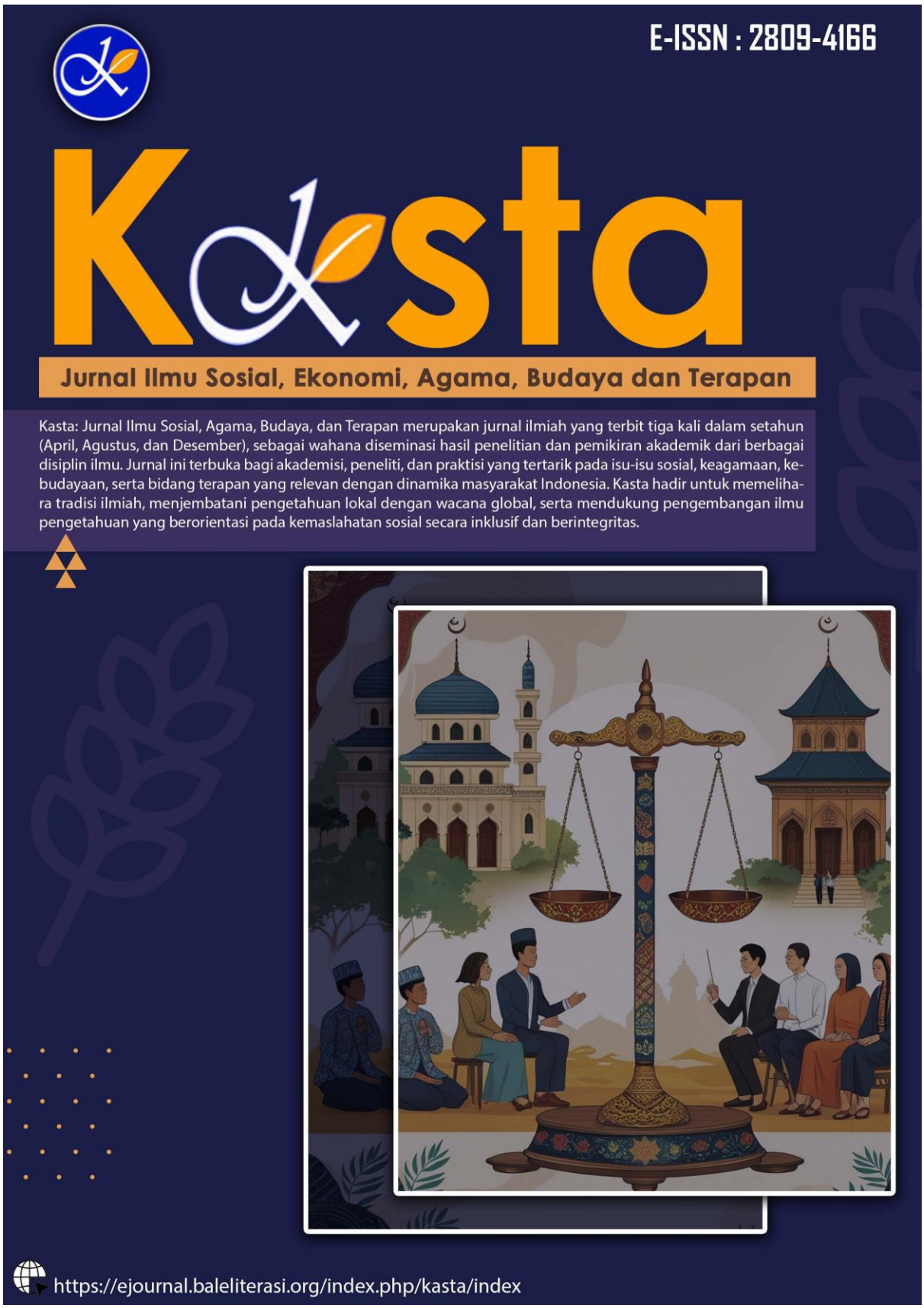
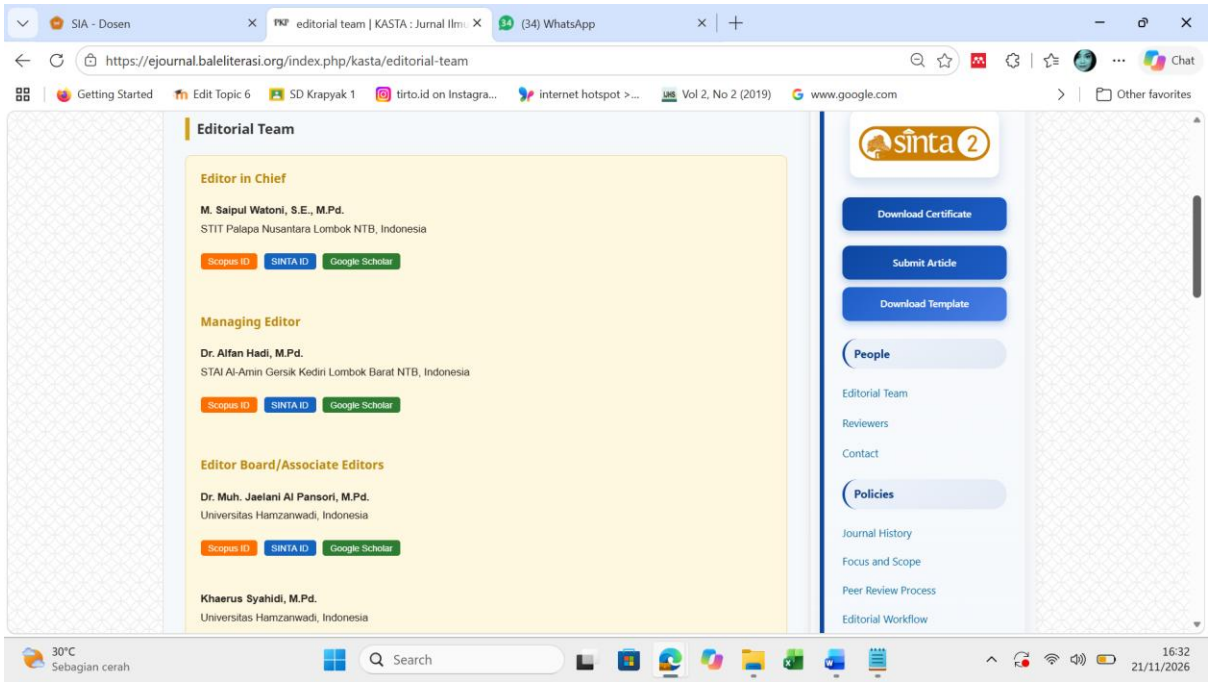
COVER JURNAL KASTA

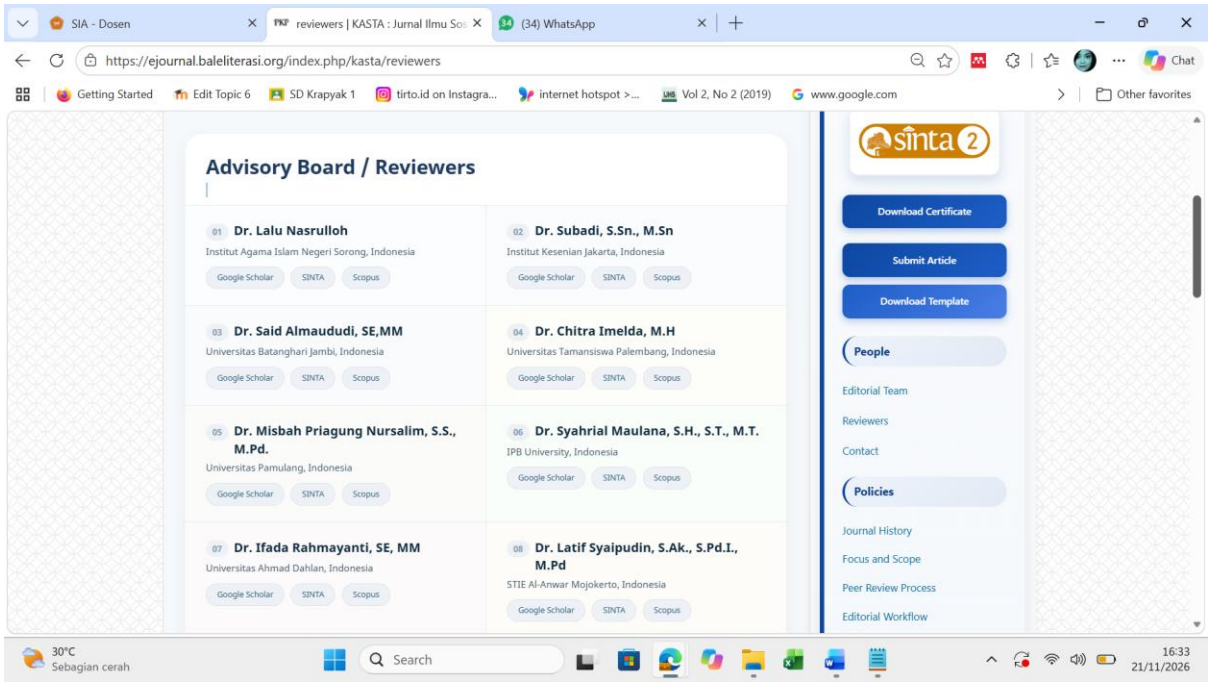
Link: https://ejournal.baleliterasi.org/index.php/JEs



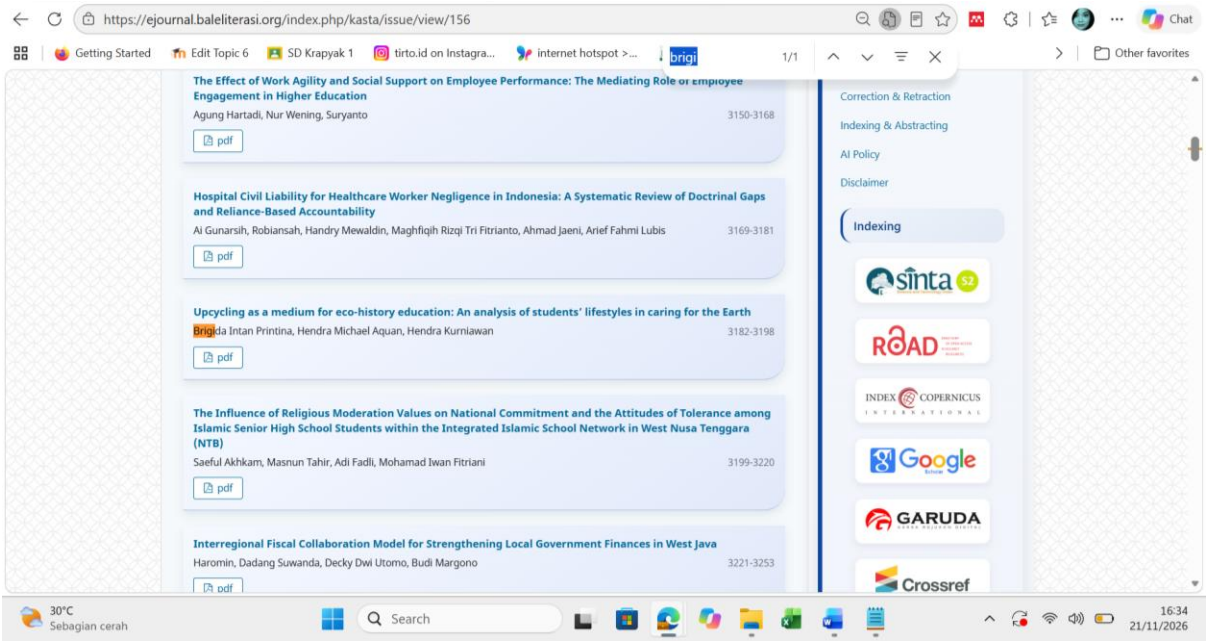
EDITORIAL TEAM



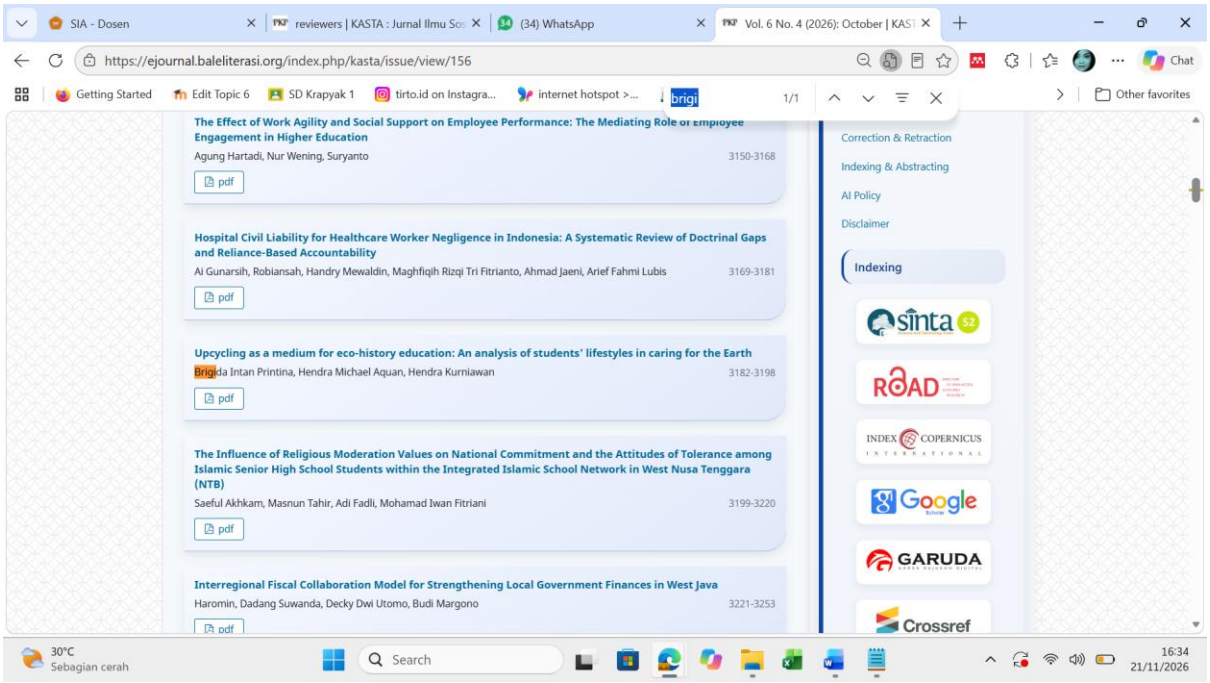
REVIEWER



ARCHIVES/ DAFTAR ISI



SINTA 2



BALE LITERASI
Kasta
Jurnal Ilmu Sosial, Ekonomi, Agama, Budaya, dan Terapan
https://ejournal.baleliterasi.org/index.php/kasta
e-ISSN 2809-4166

Upcycling as a medium for eco-history education: An analysis of students' lifestyles in caring for the Earth

[1]Brigida Intan Printina, [2]Hendra Michael Aquan, [3]Hendra Kurniawan
[1,2,3]Universitas Sanata Dharma
* Corresponding Author. Email: intanbrigida@usd.ac.id

Article Info
Received: June 22, 2026
Revised: September 2, 2026
Accepted: September 17, 2026

Keywords:
Eco-history; Upcycling; Sustainable Lifestyle; Vocational Education; Ecological Literacy.

Abstract
This study examines the role of upcycling as an eco-history-based learning medium in fostering ecological awareness and sustainable lifestyles among vocational high school students. Employing a descriptive qualitative design, data were collected at SMK Negeri 5 Yogyakarta through document analysis, participatory observation, open-ended surveys, and in-depth interviews involving students and history teachers, with source triangulation applied to strengthen the credibility of the findings. The results reveal that conventional history instruction remains largely anthropocentric and memorization-based, limiting its relevance to contemporary ecological issues. Introducing eco-history through upcycling-based learning media offered a transformative pedagogical approach that linked historical narratives with real-world environmental challenges: students who transformed waste materials into historical learning media not only deepened their understanding of historical concepts but also exhibited more environmentally responsible behavior. The study further identifies a discernible shift from "awareness without action" toward active ecological engagement, reflecting a process of ecological conversion that fosters ecological literacy, creativity, and intergenerational responsibility. Integrating ethical frameworks such as Laudato Si' and the Universal Apostolic Preferences strengthened the moral dimension of this environmental education approach. The study concludes that upcycling-based eco-history learning constitutes an innovative and effective model for bridging historical knowledge and sustainable practice, contributing to the advancement of sustainability education by demonstrating how history learning can serve as a medium for cultivating environmentally responsible behavior in vocational contexts.

INTRODUCTION

The Special Region of Yogyakarta is currently facing significant pressure due to the continuous increase in solid waste generation. Each day, the region produces approximately 300–360 tons of waste, with more than 50% consisting of organic materials and around 45% non-organic waste. Limited waste management capacity has resulted in the accumulation of waste in various locations and has even raised concerns regarding the potential closure of the Piyungan Final Disposal Site (TPA), which

has exceeded its operational capacity. Data from the National Waste Management Information System indicate that the province generates more than 702,140 tons of waste annually, reflecting inadequate public awareness and suboptimal waste management practices (Alazaiza et al., 2024; Maulana et al., 2025; Zahrah et al., 2024). This condition not only contributes to environmental degradation but also affects the quality of life of urban communities.

Although environmental awareness has increased over recent decades, it has not been fully translated into sustainable lifestyle practices, as evidenced by the persistent gap between knowledge, attitudes, and actual behavior (Alharbi et al., 2025; Boermans et al., 2024; Nichifor et al., 2025). This gap suggests a disconnect between environmental knowledge and everyday behavior. In the context of education, this indicates the need for more contextual, reflective, and practice-oriented learning approaches.

Findings from a Focus Group Discussion (FGD) on the evaluation of the History Education curriculum revealed that history learning in vocational high schools *(Sekolah Menengah Kejuruan, SMK)*, particularly in phases E and F, remains largely focused on conventional narratives emphasizing political, economic, and social aspects, with limited integration of environmental history perspectives. In fact, vocational students are at a developmental stage that requires learning experiences closely connected to their daily realities, including issues related to waste, consumer lifestyles, and environmental sustainability within their school and community environments.

One of the partner schools in this study, SMK Negeri 5 Yogyakarta, produces project-based waste such as fabric and wood residues, which still possess potential value through an upcycling approach. These materials can be utilized as contextual learning media aligned with the characteristics of vocational education. Previous studies have shown that the use of waste and recycled materials as instructional media can enhance students' conceptual understanding, creativity, and learning motivation, while also encouraging teachers to design more innovative and contextual learning experiences (Alayar et al., 2025; Karakuyu & Karafil, 2026; McSweeney et al., 2025). However, most existing studies tend to emphasize pedagogical and technical aspects of environmental education, with limited attention to integrating broader conceptual perspectives such as eco-history or environmental history, indicating a significant research gap in the field (Aikens et al., 2018; Shen et al., 2025). Therefore, a significant research gap exists in integrating waste utilization with a historical-ecological approach in education.

The eco-history approach is particularly relevant as it positions nature as an integral component of human historical processes, enabling a more comprehensive

and reflective understanding of contemporary ecological crises within the context of the Anthropocene (Holmes et al., 2020; Jorgensen et al., 2020; McNeill, 2019). Through upcycling activities, students not only acquire cognitive knowledge about sustainability but also internalize ecological values, which are reflected in their daily behaviors, as experiential and practice-based learning fosters the transition from knowledge to value-driven action (Khajuria, 2025; Tan & Yeoh, 2025; Zhu, 2026). Ecological crises, in this sense, represent not only environmental degradation but also a rupture in the relationship between humans and nature, rooted in the long-standing conceptual separation between the two, as emphasized in Anthropocene scholarship (Conversi, 2025; Fredriksen, 2025; Patterson, 2024).

In line with this perspective, educational approaches grounded in reflection and action, such as those reflected in the Universal Apostolic Preferences, emphasize the importance of enabling learners to critically interpret their lived realities and "read the signs of the times," fostering contextual and transformative learning (Ocampo & Gozum, 2025; Sánchez-Camacho & Villegas Moreno, 2024; Settimio et al., 2025). In this context, upcycling-based eco-history learning media can function as a pedagogical instrument that integrates historical awareness, ethical reflection, and ecological action. Therefore, this study aims to analyze the use of upcycling as an eco-history-based learning medium in fostering students' ecological awareness and sustainable lifestyles, offering a conceptual integration of environmental history and circular-economy practice that has not been systematically addressed in vocational education research. This research is expected to contribute theoretically to the development of environmental history education and practically to the creation of contextual, reflective, and sustainable learning innovations.

METHODS

This study employed a descriptive qualitative research design integrating document analysis, participatory observation, and in-depth interviews to explore the socio-cultural dimensions of environmental issues within an educational context. A source triangulation strategy was applied to enhance the validity and credibility of the findings (Creswell & Poth, 2018; Sterling, 2010). Participants comprised students and history teachers at SMK Negeri 5 Yogyakarta, selected through purposive sampling; the survey and interview phase involved fourteen students (coded S1–S14, see Table 2) together with the teachers responsible for the History Education curriculum, whose needs are summarized under codes G1–G4. This study was conducted over a period of eight months, encompassing document analysis, participatory observation, questionnaire administration, and in-depth interviews, followed by data triangulation and thematic analysis. The initial phase involved

document analysis of historical records, local archives, environmental ethics literature, and student reflection portfolios to construct an eco-history narrative relevant to contemporary ecological challenges. These documents served as an objective data foundation for examining how human nature relationships have been historically constructed. In addition, key normative texts, including *Laudato Si'* (Pope Francis' encyclical on integral ecology) and the Universal Apostolic Preferences (UAP 4), were analyzed using a hermeneutic-critical approach to identify core concepts such as integral ecology, ecological conversion, and intergenerational responsibility (Nefilinda & Siwi, 2022). The results of this analysis informed the development of environmental spirituality indicators, which subsequently guided the design of upcycling-based history learning media.

Following the document analysis, participatory observation was conducted systematically to capture the socio-cultural dynamics and student interactions during the transformation of eco-history narratives into upcycling practices. Students' upcycling products, primarily derived from fabric and wood waste, were also analyzed as visual documents representing their critical reflections on environmental history. This approach enabled the researcher to examine how abstract historical narratives were translated into tangible ecological actions.

To further explore students' perceptions and lived experiences, open-ended surveys and semi-structured interviews were conducted. The survey aimed to map students' initial perceptions of environmental issues, sustainable lifestyles, and the use of waste-based physical media in history learning, as understanding learners' baseline awareness is essential for designing effective environmental education interventions (Al Husban, 2025; Chen et al., 2025; Jamaludin et al., 2026). Subsequently, in-depth interviews were carried out with selected participants to investigate their personal experiences, visual-tactile engagement, and the symbolic meanings they constructed through interaction with upcycling media. This method allowed for the exploration of affective and reflective dimensions of learning that are often overlooked in conventional evaluative approaches, as traditional assessment tends to prioritize cognitive outcomes while neglecting students' emotional engagement and reflective experiences (Kuo et al., 2024; McGuire, 2025; Yang et al., 2024).

The research instruments comprised three complementary tools developed by the research team on the basis of the study's conceptual framework. The document-analysis guide directed the identification of environmental-history themes and normative concepts (e.g., integral ecology, ecological conversion) from historical records, school archives, and student reflection portfolios. The open-ended survey

instrument was organized around three domains—students' environmental knowledge, everyday sustainable-lifestyle practices, and perceptions of waste-based learning media—and was administered to all fourteen student participants (S1–S14). The semi-structured interview guide consisted of probing questions addressing students' lived experience of upcycling, the symbolic meaning they attributed to reused materials, and their reflective engagement with eco-history narratives. Prior to data collection, all instruments were reviewed internally by the research team for clarity, relevance, and alignment with the research questions.

Data obtained from these multiple sources were analyzed through triangulation, enabling cross-validation between historical textual data (documents), observable behaviors (observation), and participants' expressed awareness (interviews). This integrative analysis provided a comprehensive understanding of how eco-history is operationalized in practice from multiple data perspectives. Within the methodological boundaries of historical inquiry, this study does not aim to reconstruct past events chronologically.

The analysis followed a systematic thematic-analysis procedure. First, all data—including interview transcripts, survey responses, observation field notes, and analyzed documents—were transcribed and read repeatedly for familiarization. Second, initial codes were generated inductively from recurring words, phrases, and actions related to environmental awareness, upcycling practice, and historical understanding. Third, codes with related meanings were grouped into categories (e.g., "awareness without action," "creative engagement," "ecological conversion"), which were then refined into broader themes through constant comparison across data sources. Finally, the resulting themes were cross-checked against the triangulated data (documents, observations, and interviews) to strengthen consistency and credibility, and were interpreted in relation to the eco-history and ecological-conversion frameworks guiding this study.

Instead, it positions history as a reflective space of values (*eco-history*), connecting past experiences, present realities, and future orientations through upcycling-based learning media. The environmental history themes incorporated into the learning process include: (1) human–nature relations in the prehistoric era; (2) early agriculture and environmental change; (3) ancient civilizations and environmental management; (4) traditional Indonesian societies and ecological practices; (5) the Industrial Revolution and environmental crises; (6) environmental conditions in Indonesia during the colonial period; (7) global environmental issues in the post-independence era and contemporary Indonesia; and (8) environmental history and youth responsibility.

Furthermore, a needs analysis was conducted by synthesizing data from document analysis, surveys, and interviews. This stage aimed to identify the gap between students' environmental knowledge and their actual lifestyle practices. The findings were used to determine the most effective features of upcycling-based learning media as a "value bridge" a medium that not only delivers historical content but also stimulates ecological awareness, environmental empathy, and ethical reflection. In this regard, learning media are positioned not merely as instructional tools but as instruments for transforming students' ecological consciousness.

RESULT

Analysis of Ecological Crisis and Students' Lifestyles

Based on survey findings conducted at SMK Negeri 5 Yogyakarta, a significant gap was identified between students' environmental awareness and their everyday practices. Although the majority of students demonstrate a basic understanding of the concept of "caring for the Earth", primarily reflected in actions such as avoiding littering and conserving water, they continue to face practical challenges in waste management.

One of the most frequently encountered environmental issues reported by students, both in school and at home, is the prevalence of single-use plastic waste. While some students have engaged in upcycling activities, such as transforming plastic bottles into pencil holders or plant pots, these practices tend to be sporadic and often motivated by school assignments rather than being embedded as a consistent lifestyle. Nevertheless, environmental issues have begun to stimulate reflective awareness among students. Several respondents indicated that exposure to plastic pollution has encouraged them to reconsider their daily consumption habits. This suggests that, although sustainable behavior has not yet been fully internalized, there is an emerging critical awareness that may serve as a foundation for developing more environmentally responsible lifestyles.

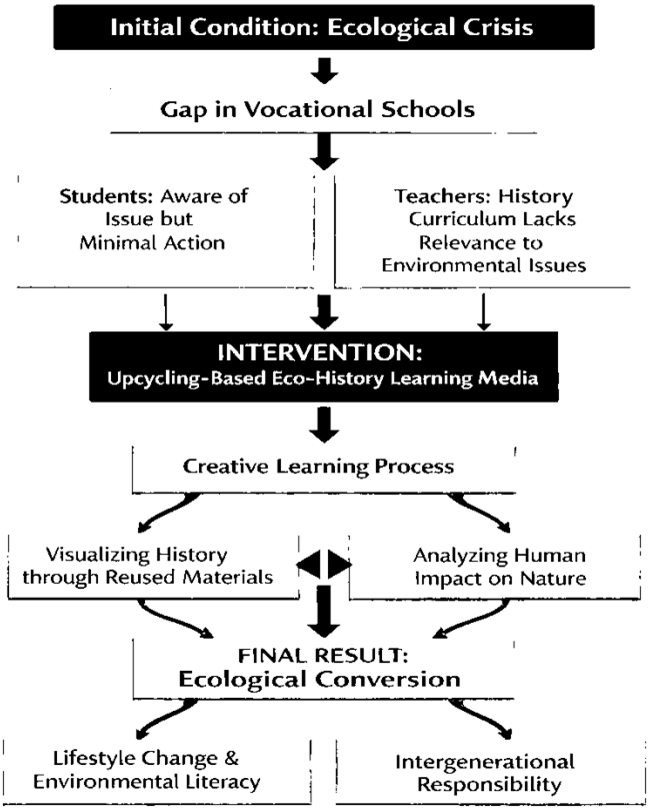


Figure 1. Ecological crisis intervention flowchart

The Position of Eco-History in Current History Learning

Document analysis and teachers' responses indicate that environmental history (*eco-history*) has not yet been systematically integrated into the vocational high school (SMK) curriculum. One of the primary constraints lies in the curriculum structure, where teachers noted that the relevance of historical learning to contemporary issues, particularly sustainability, remains insufficiently emphasized. As a result, students often struggle to establish meaningful connections between past historical events and present-day environmental challenges.

This fragmented integration is reflected in instructional practices where environmental perspectives appear only in limited topics. For instance, discussions on human-nature interactions are occasionally introduced in specific historical contexts, such as the impact of the Cultivation System (*Cultuurstelsel*) on forest exploitation and soil erosion during the colonial period. However, these instances remain partial and do not constitute a coherent eco-historical framework within the curriculum.

At the pedagogical level, teachers expressed the need for more contextual, creative, and practice-based learning media to address students' disengagement with conventional memorization-based methods. This highlights a significant gap between traditional history instruction and the demands of contemporary, sustainability-

oriented education. The contrast between traditional history learning and an eco-history approach integrated with upcycling can be summarized as follows:

Table 1. Traditional vs. Eco-History–Upcycling Learning

Dimension	Traditional History Learning	Eco-History + Upcycling Approach
Content Focus	Memorization of figures, dates, and political events	Dialectical relationship between humans and nature
Learning Media	Textbooks and lectures (often monotonous)	Creative media from waste materials (interactive and contextual)
Student Role	Passive recipients of information	Creative actors and environmental problem-solvers
Learning Outcomes	Cognitive historical knowledge	Ecological conversion and lifestyle transformation

Upcycling as a Pedagogical Bridge for Ecological Conversion

This study identifies upcycling not merely as a waste-management technique but also as a transformative pedagogical tool. Students demonstrated high levels of enthusiasm toward the use of recycled materials as learning media, perceiving it as making history more "alive" and personally meaningful. The use of discarded materials, such as cardboard and plastic, to construct historical dioramas or artifact replicas enables students to visualize the past while simultaneously engaging in environmentally responsible practices. Beyond cognitive engagement, this approach fosters ecological literacy and a sense of intergenerational responsibility. Students begin to recognize that historical progress often entails environmental consequences, which in turn cultivates an awareness of their responsibility to protect the environment for future generations. This reflective process indicates that upcycling-based eco-history learning can function as an effective bridge between historical understanding and sustainable lifestyle formation.

Table 2. Teachers' Needs versus Students' Responses

Code	Aspect	Raw Data Findings	Interpretation	Level of Alignment
G1 ↔ S1–S4	Content Relevance	Teachers require "relevant" materials (e.g., issues of environmental exploitation in the colonial period)	Students show interest when learning is connected to real-life issues, such as plastic waste	High
G2 ↔ S5–S8	Practice-Based Learning	Teachers prefer practice-oriented learning approaches	Students report feeling "engaged" and "enjoyment"	Very High

			during hands-on activities (upcycling)	
G3 ↔ S9–S11	Non-Monotonous Methods	Teachers seek non-monotonous instructional methods	Students demonstrate active participation and enthusiasm during creative learning activities	Very High
G4 ↔ S12–S14	Environmental Relevance	Teachers aim to connect history with environmental issues	Students begin to "rethink their lifestyles" following the learning process	High (Transformational)

Implementation Potential and Institutional Support

The feasibility of implementing upcycling-based eco-history learning media depends on several key factors. First, in terms of competency development, teachers believe that this approach is capable of fostering both cognitive and practical competencies. At the cognitive level, students are encouraged to analyze the relationship between humans and nature from a historical perspective. At the same time, the approach promotes practical skills through creative, action-oriented activities such as upcycling, enabling students to translate knowledge into tangible environmental practices.

Second, regarding institutional needs, schools require adequate support to ensure the sustainability of the program. This includes the provision of appropriate facilities, easier access to reusable or waste materials, and institutional recognition of students' creative work. Such support is essential for embedding the approach into routine educational practices rather than treating it as a one-time activity.

Third, from a moral and philosophical foundation, the analysis of Laudato Si' and the Universal Apostolic Preferences (UAP) provides a strong ethical framework for environmental education. Within this perspective, environmental stewardship is positioned as a moral calling and a concrete expression of "ecological conversion," understood as a transformation of both lifestyle and consciousness. These findings suggest that the successful implementation of upcycling-based eco-history education requires not only pedagogical innovation but also institutional commitment and a solid ethical foundation.

DISCUSSION

Interpretation of Findings

The findings of this study demonstrate that the integration of environmental issues into history education at vocational high schools constitutes a fundamental pedagogical transformation rather than a mere expansion of instructional content. This transformation is particularly significant within the context of vocational education, where learning is expected to be contextual, practice-oriented, and directly connected to real-world challenges. The study reveals that conventional history instruction, which emphasizes the memorization of events, figures, and political narratives, tends to limit students' ability to develop historical thinking and relate past events to contemporary environmental issues. This limitation highlights the need for a paradigm shift toward more integrative and reflective approaches, such as eco-history, which situate human–environment interactions at the center of historical inquiry (Champalet et al., 2025; Geshere et al., 2025).

However, the study also reveals a persistent gap between students' environmental awareness and their actual practices. This phenomenon reflects the widely recognized attitude–behavior (or value–action) gap in sustainability education, where increased knowledge and positive attitudes do not necessarily translate into consistent pro-environmental behavior (de Matos et al., 2025; Mendes et al., 2025; Pilch & Laurisz, 2026). Before the intervention, students demonstrated a basic understanding of environmental responsibility but lacked consistent engagement in sustainable practices. This gap highlights the limitations of purely cognitive approaches to environmental education and underscores the importance of experiential and action-oriented learning.

In this context, the introduction of upcycling as a pedagogical medium plays a crucial role in bridging this gap. Upcycling refers to the process of transforming waste materials into products of higher value or quality, thereby contributing to both creative innovation and environmental sustainability within circular economy practices (Galila et al., 2024; Wijekoon et al., 2025). The findings of this study extend this concept by demonstrating that upcycling can function as a transformative educational tool. Through hands-on activities, such as creating historical dioramas or artifacts from discarded materials, students actively engage in the learning process. This engagement reflects the principles of experiential learning, which emphasize that knowledge is constructed through direct experience, reflection, and application, as learners actively transform experiences into meaningful understanding (Hernández-de-Menéndez et al., 2023; Kolb & Kolb, 2022; Morris, 2020).

Moreover, the use of upcycling media enables students to simultaneously engage with historical content and environmental practice. This dual engagement represents a significant pedagogical innovation, as it integrates cognitive, affective, and behavioral dimensions of learning. Students are not only required to understand historical narratives but also to translate these narratives into tangible forms that reflect environmental responsibility. As a result, learning becomes more meaningful, contextual, and personally relevant. This finding supports recent studies highlighting the effectiveness of creative and innovative learning media in enhancing students' motivation and conceptual understanding, particularly when learning activities are designed to be engaging and contextually relevant (Rahmawati & Kurniawan, 2024; Zhang & Chen, 2025).

Beyond its pedagogical benefits, the integration of eco-history and upcycling also contributes to the development of ecological literacy. UNESCO (2017) defines ecological literacy as the ability to understand environmental systems and to act responsibly toward them. In this study, students demonstrated a shift in perception, particularly in how they view waste materials. Items that were previously considered useless were reinterpreted as valuable resources, indicating a transformation in their cognitive and affective orientation toward the environment. This shift is critical, as it reflects the internalization of sustainability values rather than mere compliance with environmental norms.

Comparison with Previous Studies

From a theoretical perspective, these findings align with recent scholarship in environmental history and Anthropocene studies, which positions environmental factors as integral to historical processes rather than as peripheral elements (Hannaford, 2024; Mordechai & Haldon, 2024). Rather than treating nature as a passive backdrop, as in conventional anthropocentric historiography, the eco-history approach adopted here repositions it as a co-actor in historical change. In this study, teachers identified the Cultivation System (Cultuurstelsel) as a concrete entry point for exploring environmental exploitation, a finding consistent with prior work showing that environmental history fosters critical awareness by linking past human activities with present ecological crises (McGregor & Evans, 2026; Sieberkrob & Reusch, 2025; Sund & Ohman, 2026).

Furthermore, the findings resonate strongly with the concept of "ecological conversion" articulated in *Laudato Si'*, which emphasizes the need for a profound transformation in both mindset and lifestyle, as reinforced by recent studies highlighting the importance of value-based and transformative approaches in

sustainability education (Sánchez-Camacho & Villegas Moreno, 2024; Settimio et al., 2025). Ecological conversion involves not only awareness of environmental issues but also a commitment to behavioral change and ethical responsibility. In this study, students began to reflect on their consumption habits and expressed a willingness to adopt more sustainable practices. This transformation suggests that learning experiences grounded in eco-history and upcycling can facilitate deeper moral and ethical engagement with environmental issues.

The study also highlights the importance of intergenerational responsibility, particularly within the framework of the Universal Apostolic Preferences, which emphasize accompanying young people and fostering a shared commitment to caring for the future of our common home (Jesus, 2019; Sánchez-Camacho & Villegas Moreno, 2024; Settimio et al., 2025). The call to "care for our common home" underscores the ethical obligation to preserve the environment for future generations. Students involved in upcycling-based learning activities demonstrated an emerging awareness of this responsibility, recognizing that their actions have long-term implications for environmental sustainability. This finding is particularly relevant for vocational students, who are preparing to enter industries that significantly impact natural resources and environmental systems.

In line with environmental history perspectives, historical awareness of environmental change can serve as a critical foundation for more informed and responsible decision-making in the present, as it enables individuals to understand current ecological challenges as products of long-term human–environment interactions (Conversi, 2025; Fredriksen, 2025). By understanding that past human activities have contributed to current ecological crises, students are better equipped to evaluate the consequences of their actions. Similarly, recent studies suggest that sustainability-oriented education plays a significant role in shaping long-term behavioral patterns, as it fosters the internalization of environmental values and promotes consistent pro-environmental actions over time (Alharbi et al., 2025; Tan & Yeoh, 2025; Zhu, 2026). The present study contributes to this body of literature by demonstrating that the integration of eco-history and upcycling provides a practical and effective pathway for fostering sustainable lifestyles among vocational students.

Implications

The principal contribution of this study is to demonstrate that upcycling can function as a concrete pedagogical bridge between historical understanding and sustainable-lifestyle formation, offering vocational history education an empirically grounded alternative to purely cognitive, memorization-based instruction. In

addition, the findings suggest that institutional support plays a critical role in the successful implementation of this approach. Teachers emphasized the need for adequate resources, access to materials, and recognition of students' creative work. Without such support, innovative pedagogical approaches may remain limited in scope and sustainability. This observation aligns with broader educational research, which highlights the importance of systemic support in facilitating pedagogical innovation (Cohen & Cho, 2018). This study underscores the transformative potential of eco-history-based upcycling as an educational model. By integrating historical understanding with practical environmental action, this approach addresses both the perceived irrelevance of history education and the urgency of ecological challenges. It redefines the role of history education as not only a means of understanding the past but also as a tool for shaping ethical, responsible, and sustainable futures.

CONCLUSION

This study demonstrates that the integration of eco-history through upcycling-based learning media represents a meaningful pedagogical innovation in vocational history education. The findings reveal that this approach not only enhances students' understanding of historical content but also transforms their roles from passive recipients of knowledge into active agents capable of reflecting on and responding to contemporary environmental challenges. By situating environmental issues within historical narratives, students develop a deeper awareness of the interconnected relationship between past human activities and present ecological crises. Importantly, the upcycling-based eco-history model functions as an effective bridge between abstract historical knowledge and concrete environmental practice. Through experiential and creative engagement, students internalize ecological values and begin to translate awareness into action, reflecting the process of ecological conversion. This indicates that history education can extend beyond cognitive learning to foster ethical responsibility and sustainable lifestyles. Theoretically, this study contributes to the advancement of eco-history and sustainability education by demonstrating how historical learning can be operationalized as a transformative, action-oriented practice. Practically, it offers an innovative model for integrating environmental literacy into vocational curricula, highlighting the importance of institutional support to ensure long-term implementation and impact. Based on the findings of this study, it is recommended that history education practitioners begin to integrate ecocentric narratives through the utilization of school-generated waste as contextual upcycling-based learning media. Such an approach has the potential to transform history learning, often perceived as monotonous, into a more interactive,

engaging, and relevant process aligned with contemporary ecological challenges. Educational institutions are encouraged to support this initiative by providing collaborative spaces that foster interdisciplinary learning, as well as by recognizing and appreciating students' creative works in designing innovative historical media. These efforts are essential for promoting the implementation of a sustainable "green curriculum" that integrates environmental awareness into everyday learning practices. From a scholarly perspective, future research is recommended to expand the scope of investigation across different educational levels and to employ longitudinal designs to examine the consistency of "ecological conversion" behaviors over time. Furthermore, future studies may explore the integration of digital technologies, such as augmented reality, with physical upcycling media to enhance environmental literacy among Generation Z in a more comprehensive and immersive manner.

REFERENCES

Aikens, K., McKenzie, M., & Vaughter, P. (2018). Environmental and sustainability education policy research: A systematic review of methodological and thematic trends. *Environmental Education Research*.

Al Husban, W. (2025). The impact of integrating sustainable development goals on students' awareness and pro-environmental behavior. *Sustainability*.

Alayar, M., Alrashidi, N., Alrashaidi, E., & Alazmi, K. (2025). The role of alternative materials in enhancing creativity and sustainability in art education. *Social Sciences & Humanities Open*.

Alazaiza, M. Y. D., Alzghoul, T. M., Al Maskari, T., & Amr, S. A. (2024). Analyzing the evolution of research on student awareness of solid waste management in higher education institutions: A bibliometric perspective. *Sustainability*, *16*(13). https://doi.org/10.3390/su16135422

Alharbi, H. S., Alotaibi, B. H., Alotaibi, S. S., & Alqahtani, A. T. (2025). From knowledge to action: investigating sustainability awareness and behavior. *Sustainability*. https://doi.org/10.3390/su17135854

Boermans, D. D., Jagoda, A., Lemiski, D., & Wegener, J. (2024). Environmental awareness and sustainable behavior: A qualitative focus group study. *Journal of Environmental Management*.

Champalet, J., Keum, H., Knowles, S. G., Lee, S., & Park, H. (2025). Education for disaster justice: integrating environmental history. *Science and Education*.

Chen, C., Shahbaz, P., & Haq, S. (2025). Transforming students' green behavior through environmental education. *Frontiers in Psychology*.

https://doi.org/10.3389/fpsyg.2024.1499781

Cohen, A. S., & Cho, S.-J. (2018). Information Criteria. In *Handbook of Item Response Theory: Three Volume Set* (Vols. 1–3, pp. 363–376). CRC Press. https://doi.org/10.1201/9781315119144-51

Conversi, D. (2025). The Anthropocene and its contenders: Cross-disciplinary tools for a divided humanity. *Earth's Future*. https://doi.org/10.1029/2024EF004918

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches*. SAGE Publications.

de Matos, C. A., Luppi, L., & Veiga, R. T. (2025). Assessing the intention–behavior gap in pro-environmental behavior. *Journal of Cleaner Production*.

Fredriksen, A. (2025). Anthropocene ordinary: Emergent worlds with/in imaginaries of anthropogenic planetary crisis. *Progress in Human Geography*. https://doi.org/10.1177/03091325251348612

Galila, A., Kaseireldeil, S., & Abdalkhaliq, N. (2024). Enhancing sustainability and resource efficiency through upcycling. *Innovative Infrastructure Solutions*.

Geshere, G. L., Woyessa, D. D., & Tarekegne, W. M. (2025). Exploring history teachers' understanding of the goals of history teaching and historical thinking skills. *The Social Studies*.

Hannaford, M. J. (2024). Environmental historical geographies. *Geography Compass*.

Hernández-de-Menéndez, M., Escobar Díaz, C., & Morales-Menendez, R. (2023). Experiential learning in engineering education: A review. *Education Sciences*. https://doi.org/10.3390/educsci13010032

Holmes, K., Gaynor, A., & Morgan, R. (2020). Doing environmental history in urgent times. *History Australia*.

Jamaludin, A. A., Chin, S. Y., & Hasikin, K. (2026). Exploring university students' perception and acceptance of carbon-neutral lifestyle. *International Journal of Sustainability in Higher Education*.

Jesus, S. of. (2019). *Universal Apostolic Preferences 2019–2029*.

Jorgensen, D., Hou, S., Leal, C., & McNeill, J. R. (2020). Reflections: Environmental history in the era of COVID-19. *Environmental History*.

Karakuyu, A., & Karafil, B. (2026). Recycling-based STEM education for sustainability: Effects on students' creativity and design thinking. *Sustainability*.

Khajuria, A. (2025). Integrating circular economy education into education for sustainable development: A conceptual advancement. *Journal of Environmental Education*.

Kolb, A. Y., & Kolb, D. A. (2022). Experiential learning theory: Updated perspectives on learning cycles. *Experiential Learning and Teaching*.

Kuo, Y. K., Batool, S., Tahir, T., & Yu, J. (2024). Exploring the impact of emotionalized learning experiences on the affective domain. *Heliyon*.

Maulana, D., Nugroho, C., Wulan, R. R., & Habibi, F. (2025). Developing sustainable waste management in urban areas: Case study of municipal government policy strategies in Indonesia. *SAGE Open*. https://doi.org/10.1177/21582440251378799

McGregor, H. E., & Evans, R. S. (2026). Pedagogical approaches for climate justice orientations to teaching history and social studies. *History Education Research Journal*.

McGuire, M. (2025). Feedback, reflection and psychological safety: rethinking assessment for student well-being. *Assessment & Evaluation in Higher Education*.

McNeill, J. R. (2019). The Anthropocene and environmental history. *HALAC: Historia Ambiental Latinoamericana y Caribeña*.

McSweeney, K., Raisanen, R., & Kosunen, M. (2025). Testing a pedagogical model for design learning using reused materials. *Technology Education Journal*.

Mendes, T., Teixeira, H., Lopes, A. M., & Correia, A. (2025). From environmental knowledge to pro-environmental behaviors. *Journal of Technology Transfer*. https://doi.org/10.1007/s10961-024-10181-8

Mordechai, L., & Haldon, J. (2024). Resilience in environmental history discourse: Past, present, and future? *The American Historical Review*.

Morris, T. H. (2020). Experiential learning – a systematic review and revision of Kolb's model. *Educational Research Review*. https://doi.org/10.1016/j.edurev.2020.100379

Nefilinda, N., & Siwi, S. A. (2022). Reuse upcycling sebagai wujud peduli lingkungan warga sekolah. *PaKMas*, *2*(2), 434–442. https://doi.org/10.54259/pakmas.v2i2.1148

Nichifor, B., Zait, L., & Timiras, L. (2025). Drivers, barriers, and innovations in sustainable food consumption: A systematic literature review. *Sustainability*. https://doi.org/10.3390/su17052233

Ocampo, L. M. A. R., & Gozum, I. E. A. (2025). Catholic higher education interface with AI: diversions and intersections. *International Studies in Catholic Education*.

Patterson, J. (2024). Into the wild: Uncertain frontiers and sustainable human–nature interactions. *Frontiers in Sociology*. https://doi.org/10.3389/fsoc.2024.1325963

Pilch, K., & Laurisz, N. (2026). The attitude–behaviour gap in young adults' sustainable consumption. *Sustainability*.

Rahmawati, Y., & Kurniawan, D. (2024). Innovative teaching media and student engagement in sustainability education. *Education Sciences*.

Sánchez-Camacho, J., & Villegas Moreno, J. L. (2024). Foundations and implications of

integral ecology and sustainable development goals in Catholic university education. *Religions*.

Settimio, L., Surab, M., Dolista, J., Maturkanic, P., & Durkova, E. (2025). Human dignity and its role in shaping sustainable development within Catholic teaching. *Religions*.

Shen, Y. S., Wu, X., & Li, P. Y. (2025). Environmental education and sustainable development: Trends, gaps, and future directions. *Environmental Education Research*.

Sieberkrob, M., & Reusch, N. (2025). Climate crisis, the Anthropocene and the future: historical thinking in the German climate movement. *History Education Research Journal*.

Sterling, S. (2010). *Transformative learning and sustainability*.

Sund, L., & Ohman, J. (2026). Revisiting the political in environmental and sustainability education. *Environmental Education Research*.

Tan, Q. H., & Yeoh, B. (2025). Everyday circular literacy in households: Informal pedagogies in sustainability learning. *Cleaner and Responsible Consumption*.

UNESCO. (2017). *Education for sustainable development goals*.

Wijekoon, A., Ranaweera, A., & Martin, B. A. S. (2025). Upcycling: a systematic review and research agenda. *Journal of Management History*.

Yang, Y., Chan, C. K. K., Zhu, G., Tong, Y., & Sun, D. (2024). Reflective assessment using analytics and artifacts for scaffolding knowledge building competencies. *International Journal of Computer-Supported Collaborative Learning*.

Zahrah, Y., Yu, J., & Liu, X. (2024). How Indonesia's cities are grappling with plastic waste: An integrated approach towards sustainable plastic waste management. *Sustainability*, *16*(10). https://doi.org/10.3390/su16103921

Zhang, X., & Chen, L. (2025). The impact of creative instructional media on student motivation and conceptual learning. *Frontiers in Psychology*. https://doi.org/10.3389/fpsyg.2025.1682850

Zhu, Q. (2026). Upcycling Motivation Internalization: A Self-Determination Theory Perspective. *Circular Economy and Sustainability*. https://doi.org/10.1007/s43615-026-00902-6