Sustainable Policy Approaches in Environmental Ethics Education: A Narrative Review of Active Learning and Digital Innovation

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ABSTRACT

Environmental ethics education has become increasingly important in response to climate change, environmental degradation, biodiversity loss, and the growing need for sustainable development. Higher education institutions are now expected not only to deliver environmental knowledge but also to cultivate ethical awareness, responsible behaviour, and sustainable decision-making among students. This narrative review examines the role of active learning methods and digital innovation in environmental ethics education, with particular emphasis on sustainable policy implications for higher education institutions. The review synthesises previous literature on active learning, instructional design, technology-enhanced learning, and environmental ethics education. It highlights the use of innovative digital tools such as applications, gamification, virtual learning environments, and collaborative technologies in improving students' understanding of environmental values, ethics, and professional practices. The review also explores the integration of conventional learning methods with digital approaches to create a more holistic and sustainable educational framework. The findings suggest that active learning methods, supported by technology, significantly improve student engagement, critical thinking, environmental awareness, and problem-solving skills. Furthermore, sustainable educational policies are necessary to support infrastructure, digital accessibility, curriculum integration, lecturer training, and long-term institutional commitment. This article proposes that environmental ethics education should be embedded within sustainable higher education policy frameworks to ensure the development of environmentally responsible graduates.

Keywords: environmental ethics, sustainability policy, active learning, digital innovation, environmental education, higher education

INTRODUCTION

The global environmental crisis, including climate change, pollution, deforestation, biodiversity loss, and unsustainable consumption, has intensified the need for environmental education in higher education institutions. Environmental education is no longer limited to scientific understanding of ecosystems and natural resources. Instead, it increasingly involves the ethical dimensions of human interactions with the environment, including values, responsibilities, professional conduct, and sustainable behaviour. Environmental ethics education plays a crucial role in shaping students' understanding of moral responsibility towards the environment. It encourages learners to critically reflect on environmental issues, recognise the consequences of human actions, and develop sustainable attitudes and behaviours. In higher education, environmental ethics is particularly important because university graduates are future policymakers, professionals, community leaders, and decision-makers.

In Malaysia, the Ministry of Higher Education has emphasised the importance of innovation, digitalisation, and quality teaching and learning through the Higher Education Strategic Plan 2023–2025. Universities are encouraged to integrate technology and innovative pedagogy into their curriculum to address the demands of Industrial Revolution 4.0 and sustainable development. This includes promoting active learning, digital literacy, and interdisciplinary education in environmental studies. Traditional teaching methods that rely solely on lectures and passive learning may no longer be sufficient to develop environmental awareness and ethical reasoning among students. Instead, contemporary environmental education requires student-centred learning approaches that promote participation, collaboration, critical thinking, and real-world problem solving.

Therefore, integrating active learning methods and digital innovation has become an important strategy for improving environmental ethics education. This article provides a narrative review of the literature on environmental ethics education, active learning, digital innovation, and sustainable policy. It also discusses the policy implications for higher education institutions seeking to strengthen sustainability education.

METHODOLOGY

This article adopts a narrative review methodology to synthesise the existing literature on environmental ethics education, active learning, and digital innovation in higher education. The review was conducted by searching four major academic databases: Scopus, Web of Science, ERIC (Education Resources Information Center), and Google Scholar. Search terms included combinations of the following keywords: "environmental ethics education", "active learning sustainability", "digital innovation higher education", "gamification environmental education", "virtual reality sustainability learning", and "sustainable education policy". The time frame prioritised literature published between 2014 and 2025, with seminal earlier works included where conceptually essential. Inclusion criteria required that sources: (1) be published in peer-reviewed journals, conference proceedings, or scholarly books; (2) address environmental education, ethics, active learning, or educational technology in higher education contexts; and (3) be written in English or Malay. Sources were excluded if they were opinion pieces without empirical or theoretical grounding, or if they addressed primary or secondary school settings exclusively without relevance to tertiary education. A total of approximately 40 sources were reviewed, and the most relevant were synthesised thematically to inform the discussion and policy recommendations presented in this article.

Environmental Ethics Education in Higher Education

Environmental ethics refers to the moral relationship between humans and the natural environment. It involves examining how humans should behave towards nature, animals, ecosystems, and future generations. Environmental ethics encourages respect for nature, sustainable use of resources, environmental justice, and responsible environmental behaviour.

Environmental ethics education has become increasingly relevant in higher education because environmental problems are often linked to human values, attitudes, and behaviour. According to Moorthy and Akwen (2020), environmental ethics education promotes moral awareness and encourages individuals to develop environmentally responsible behaviour. Similarly, Khalif Muammar A. Harris (2022) argued that environmental degradation occurs partly because of the loss of ethical values and respect for the environment. Environmental ethics education in universities often includes topics such as sustainability, environmental justice, ecological responsibility, professional ethics, climate change, waste management, and conservation. These topics require students to not only understand theoretical concepts but also apply ethical reasoning in practical situations. Educational institutions play an important role in promoting sustainable values among students. Chen, Xiang, and Fan (2024) found that integrated environmental education can significantly enhance environmental awareness and encourage students to adopt sustainable practices. Similarly, Liu, Cheng, and Chen (2019) reported that environmental education supported by virtual reality technology improves environmental ethics and literacy.

Active Learning in Environmental Education

Active learning is a teaching approach that emphasises students' active involvement in the learning process. Unlike traditional lecture-based methods, active learning requires students to participate in discussions, case studies, group work, presentations, problem-solving activities, fieldwork, and reflective exercises. The active learning model is particularly suitable for environmental ethics education because it encourages students to engage with real-world environmental issues and reflect on ethical dilemmas. According to Cruickshank (1991), effective teaching involves helping students actively participate in the learning process. Rahman et al. (2014) also argued that active learning promotes deeper understanding, critical thinking, and student engagement.

Several active learning approaches are relevant to environmental ethics education:

1. Heutagogy: This approach focuses on self-determined learning, where students take responsibility for their own learning process. Students independently explore environmental issues, gather information, and reflect on ethical concerns.

2. Peeragogy: Peeragogy involves collaborative learning among peers. Students discuss environmental issues, share ideas, and support each other in developing ethical perspectives.

3. Cybergogy: Cybergogy refers to technology-supported collaborative learning in online or digital environments. It allows students to interact with digital content, participate in virtual discussions, and engage in online environmental projects.

Research indicates that active learning can improve students' environmental awareness, communication skills, and problem-solving abilities. In a study on environmental values and ethics education, active learning methods showed high effectiveness in improving understanding of environmental ethics, problem-solving skills, motivation, and interaction among students. Furthermore, active learning supports the development of cognitive, affective, and behavioural dimensions of learning. Students not only gain knowledge but also develop emotional attachment to environmental issues and adopt positive environmental behaviours.

Digital Innovation in Environmental Ethics Education

Digital innovation has transformed the way environmental education is delivered in higher education institutions. The use of digital tools such as online learning platforms, mobile applications, gamification, virtual reality, Padlet, YouTube, simulations, and educational software can make learning more interactive and engaging.

Technology-enhanced learning environments allow students to access information, collaborate with peers, conduct research, and engage with environmental issues beyond the classroom. Muilenburg and Berge (2019) found that technology-enhanced learning significantly improves student engagement by creating interactive and collaborative experiences. One important example of digital innovation in environmental ethics education is the EthicWise application by Hezzrin et al. (2025). EthicWise was developed as a teaching and assessment tool for students taking courses related to environmental values, ethics, and professional practice. The application was designed to assist students in conducting environmental case studies in the field by using digital surveys and structured assessment tools.

EthicWise emphasises three main components: values, ethics, and professional practice. Students evaluate environmental case studies using Likert-scale assessments embedded in the application. The application also supports reflection, data collection, environmental decision-making, and intervention planning. In this way, EthicWise helps students connect theoretical concepts with real-life environmental situations. Previous studies have shown that EthicWise is effective in improving students' understanding of environmental ethics and professional practices. Research involving university students found that EthicWise recorded a high overall effectiveness score, with students reporting better understanding of environmental values and ethics, improved problem-solving skills, positive behavioural influence, increased motivation, and stronger interaction with peers and lecturers.

The highest mean score reported in the EthicWise study was related to students' understanding of environmental values, ethics, and professional practices, indicating that digital applications can significantly strengthen ethical awareness in environmental education. Students also reported that EthicWise was particularly useful during fieldwork because it provided guidance for interviews, surveys, and data collection. In addition, qualitative findings from previous studies indicated that students appreciated EthicWise because it simplified the process of conducting environmental case studies. However, challenges such as weak internet connectivity and limited digital access were also identified. Students suggested additional features such as gamification, chat rooms, and stronger collaborative tools to improve future versions of the application.

The use of EthicWise demonstrates how digital innovation can support sustainable education policy by promoting digital literacy, ethical awareness, and data-driven decision-making in environmental education. Universities can adopt similar innovations to strengthen teaching and learning practices related to sustainability

and environmental responsibility. Digital innovation has transformed the way environmental education is delivered in higher education institutions. The use of digital tools such as online learning platforms, mobile applications, gamification, virtual reality, Padlet, YouTube, simulations, and educational software can make learning more interactive and engaging. Beyond EthicWise, two other categories of digital tools deserve specific attention in this literature. First, virtual reality (VR) simulations have emerged as a powerful medium for environmental ethics education. VR environments immerse students in simulated ecological scenarios—such as experiencing deforestation, coral bleaching, or urban pollution—creating embodied, first-person encounters with environmental degradation that text-based learning cannot replicate. Liu, Cheng, and Chen (2019) demonstrated that VR-supported environmental education significantly improved students' environmental ethics scores and ecological literacy compared to conventional instruction. Similarly, Capecchi et al. (2025) reported that augmented reality combined with artificial intelligence enhanced students' engagement and conceptual understanding in sustainability-related subjects. These findings suggest that immersive technologies activate affective responses alongside cognitive learning, which is particularly important in ethics education where attitudes and values are central outcomes. Second, gamified decision-making platforms represent a growing area of innovation. These platforms present students with environmental dilemmas—such as resource allocation, land-use conflicts, or carbon budgeting—structured as interactive games with consequence-driven feedback loops. The gamification mechanics of points, leaderboards, narrative branching, and real-time outcomes have been found to heighten intrinsic motivation and deepen engagement with complex ethical trade-offs (Deterding et al., 2011). Platforms such as university-developed serious games for environmental management have demonstrated effectiveness in building students' systems thinking and ethical reasoning skills. Taken together, EthicWise, VR simulations, and gamified platforms illustrate that the digital landscape for environmental ethics education is diverse, and institutional adoption strategies should account for this variety rather than relying on any single tool.

The use of gamification in environmental education has also gained attention. Deterding et al. (2011) argued that gamification can increase motivation, engagement, and academic performance. Similarly, Jonassen (2021) emphasised that technology-supported problem-solving environments can improve students' critical thinking and decision-making skills. However, the integration of digital technology in environmental education also presents challenges. One major issue is unequal access to digital infrastructure, especially in rural areas or institutions with limited technological resources. Students may face difficulties related to internet connectivity, device availability, and digital literacy. Therefore, universities must ensure that digital innovation is supported by adequate infrastructure, training, and institutional policies. Without strong policy support, the potential benefits of digital environmental education may not be fully realised.

Sustainable Policy Implications for Higher Education

Sustainable policy is essential for ensuring that environmental ethics education remains relevant, inclusive, and effective. Sustainable educational policies refer to long-term strategies, regulations, and institutional commitments that support environmental education, digital innovation, and active learning. Several policy implications can be identified from the literature: To improve actionability, these implications are organised below into short-term (0–2 years), medium-term (3–5 years), and long-term (5+ years) priorities, with responsible actors identified for each.

1. Curriculum Integration

Environmental ethics and sustainability should be integrated across different disciplines rather than being limited to environmental science programmes. Students from business, engineering, social sciences, law, education, and health sciences should also be exposed to sustainability education. Interdisciplinary curriculum design can help students understand that environmental issues are connected to social, economic, and political factors. Universities should therefore include sustainability learning outcomes in their academic programmes.

2. Digital Infrastructure and Accessibility

Governments and universities must invest in digital infrastructure to support technology-enhanced environmental education. This includes internet connectivity, digital devices, software, virtual learning

platforms, and technical support. Educational inequality may occur if students from rural or low-income backgrounds do not have access to technology. Therefore, sustainable policy should focus on equitable access to digital learning resources.

3. Lecturer Training and Professional Development

Lecturers play an important role in implementing active learning and digital innovation. However, some lecturers may lack the skills and confidence to use new technologies in teaching. Professional development programmes should therefore be provided to help lecturers develop competencies in instructional design, educational technology, sustainability education, and digital pedagogy.

4. Institutional Support for Innovation

Universities should provide financial support, grants, recognition, and incentives for lecturers who develop innovative teaching methods, applications, and sustainability projects. Institutional support can encourage educators to experiment with active learning, gamification, and digital tools in environmental education. This support is essential for sustaining innovation over time.

5. Collaboration with Government and Industry

Higher education institutions should collaborate with government agencies, industries, schools, and local communities to strengthen environmental ethics education. Partnerships can provide students with opportunities for fieldwork, community engagement, environmental campaigns, and sustainability projects. Such collaborations also ensure that educational practices are aligned with national sustainability goals and labour market needs.

6. Policy Alignment with Sustainable Development Goals

Universities should align their teaching and learning strategies with the United Nations Sustainable Development Goals (SDGs), particularly Goal 4 (Quality Education), Goal 12 (Responsible Consumption and Production), Goal 13 (Climate Action), and Goal 15 (Life on Land).

Embedding SDGs into environmental ethics education can help students understand the global relevance of sustainability and encourage them to become responsible citizens.

Critical Challenges and Limitations

While active learning and digital innovation offer considerable promise for environmental ethics education, a balanced assessment must acknowledge three critical challenges that the existing literature has not fully resolved.First, the digital divide remains a persistent equity concern. Access to devices, stable broadband connectivity, and digital literacy skills is unevenly distributed across socioeconomic groups, geographic regions, and institutional types in Malaysia and globally. Students from rural communities, indigenous populations, or low-income households may be systematically disadvantaged when environmental ethics programmes rely heavily on technology-mediated platforms. This risk is compounded in fieldwork contexts, where weak mobile coverage further restricts application usability, as noted in feedback on the EthicWise platform itself. Zahra et al. (2024) similarly highlighted that technology-enhanced environmental education can deepen existing inequalities if access barriers are not proactively addressed. Universities and policymakers must therefore ensure that digital tools are accompanied by offline alternatives and targeted device-lending or connectivity subsidy programmes.

Second, student data privacy raises significant ethical and legal concerns that are often overlooked in educational technology discourse. Digital platforms used in environmental ethics education including assessment applications, gamified tools, and VR environments collect behavioural, attitudinal, and locational data from students. Without robust data governance frameworks, this information may be stored, shared, or commercialised in ways that students are unaware of or have not meaningfully consented to. Malaysian higher education institutions are subject to the Personal Data Protection Act 2010, yet compliance in the context of educational

applications is inconsistently monitored. It is therefore important that institutions conduct privacy impact assessments before deploying digital tools, adopt transparent data retention policies, and ensure students are informed about how their data are used.

Third, there is a real risk of superficial engagement with technology that produces only surface-level learning outcomes. When digital tools are adopted primarily for novelty or institutional prestige rather than grounded pedagogical rationale, students may interact with environmental content in a performative rather than genuinely reflective manner. Gamification, for instance, can reduce complex ethical dilemmas to point-scoring exercises if the game mechanics are not carefully designed to reward moral reasoning rather than speed or competitiveness. Similarly, VR experiences of environmental destruction may generate emotional reactions without cultivating the deeper value shifts necessary for behaviour change. Educators must therefore apply instructional design principles rigorously when selecting and deploying digital tools, ensuring that technology serves as a scaffold for critical ethical thinking rather than a substitute for it.

CONCLUSION

Environmental ethics education is essential for developing environmentally responsible graduates who are capable of addressing complex sustainability challenges. This narrative review highlights that active learning methods and digital innovation significantly improve students' understanding of environmental values, ethics, and professional practices. The integration of conventional teaching methods with digital technologies creates a more engaging, interactive, and effective learning environment. However, successful implementation requires sustainable educational policies that support curriculum integration, digital infrastructure, lecturer training, institutional innovation, and collaboration. Higher education institutions must therefore move beyond traditional approaches and adopt sustainable policy frameworks that prioritise environmental ethics education. Such efforts are important not only for improving educational quality but also for preparing future generations to contribute towards a more sustainable and ethical society. At the same time, the critical challenges discussed in this review the digital divide, student data privacy, and the risk of superficial technology engagement remind us that digital tools are not inherently transformative; their effectiveness depends on intentional design, equitable access, and strong institutional governance. The key takeaway for policymakers is that embedding environmental ethics within higher education requires a coherent, phased policy strategy: in the short term, universities should revise curricula and secure digital infrastructure; in the medium term, sustained investment in lecturer capacity and innovation incentives is critical; and in the long term, cross-sector collaboration and alignment with national and international sustainability frameworks will determine whether environmental ethics education generates graduates who are not only knowledgeable, but genuinely committed to an ethical relationship with the natural world. For educators, the central message is that technology should serve pedagogy—not the reverse: the goal is cultivating ethical environmental citizens, and every digital tool adopted must be evaluated against that purpose.

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