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Harnessing Artificial Intelligence To Advance Green Education: Perceptions, Challenges, And Implementation Insights

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Abstract
This study explores the literature on Green AI and Sustainable AI using a dual-analysis approach, combining thematic analysis with BERTopic modeling to uncover both broad themes and emerging topics. It identifies three key thematic clusters: (1) Responsible AI for Sustainable Development, which focuses on the integration of sustainability and ethics in AI technologies; (2) Advancements in Green AI for Energy Optimization, which highlights energy efficiency; and (3) Big Data-Driven Computational Advances, which examines AI's impact on socio-economic and environmental factors. At the same time, BERTopic modeling reveals five emerging topics: Ethical Eco-Intelligence, Sustainable Neural Computing, Ethical Healthcare Intelligence, AI Learning Quest, and Cognitive AI Innovation, indicating a shift towards incorporating ethical and sustainability issues into AI research. The study uncovers new intersections between Sustainable and Ethical AI and Green Computing, identifying Ethical Healthcare Intelligence and AI Learning Quest as developing areas related to AI's socio-economic and societal impacts. The research advocates for a holistic approach to AI innovation, emphasizing environmental sustainability and ethical integrity to guide responsible development. This approach aligns with the Sustainable Development Goals, stressing the importance of ecological balance, societal welfare, and responsible innovation, and provides insights for future research and policy actions in the field.

Keywords: Green AI, Sustainable AI, BERTopic, Topic modeling, Keywords co-occurrence, Sustainable development goal, Ethics, Cognitive AI, Big data

Introduction

The rapid advancement of Artificial Intelligence (AI) has the potential to revolutionize various sectors, including education. Simultaneously, the growing emphasis on sustainability and environmental consciousness has given rise to the concept of Green Education. Green Education aims to instill values of sustainability, environmental stewardship, and responsible citizenship among learners. The convergence of AI and Green Education presents a unique opportunity to enhance educational outcomes while promoting sustainable practices. This paper explores the synergy between AI and Green Education, examining perceptions, challenges, and opportunities associated with this integration. Marjan et. al. discusses how the rapid adoption of artificial intelligence (AI) is significantly impacting business, government, and sustainability efforts, with potential to either advance or hinder the United Nations Sustainable Development Goals (SDGs). This article reviews three case studies to assess AI's influence on business leadership, management education, and sustainable development, offering insights into how AI could shape future progress and global sustainability.

Significance of the Study

This study seeks to explore the level of awareness about green education among various demographic groups and analyze how factors such as gender and professional background shape perceptions of AI applications in green education. It aims to examine the relationship between educational attainment and familiarity with green education principles while identifying key themes in how different demographic groups conceptualize green education. Additionally, the research investigates the extent to which individuals across various demographics are familiar with AI applications in education and identifies the most recognized AI tools for enhancing green education. Furthermore, it explores how different demographic groups utilize AI tools in educational settings and assesses the proportion of respondents who have adopted AI technologies in green education, considering variations based on profession and education level.

The study also examines prevailing beliefs regarding AI's potential to enhance green education and analyzes the factors influencing these perceptions. It seeks to identify the most commonly perceived benefits of integrating AI into green education, along with practical suggestions for implementation provided by respondents. Moreover, the research investigates the primary challenges that stakeholders foresee in adopting AI for green education and the role that educational institutions should play in facilitating AI-driven green education. Additionally, it evaluates respondents' assessments of the current level of AI integration into green education and identifies the key sources of information on AI in green education among different demographic groups.

Lastly, the study aims to determine the likelihood of respondents advocating for AI-based tools in green education within their social or professional circles, identify which AI applications are considered to have the most significant impact on green education, and explore emerging trends in the convergence of AI and green education. Through this comprehensive approach, the research provides valuable insights into the intersection of AI and green education, guiding future policy and educational advancements.

Literature Review

Ayeni et al. (2024) review the transformative role of AI in education, focusing on personalized learning and educational technology. They highlight AI's potential to tailor educational experiences, enhance student engagement, and optimize outcomes, while addressing ethical considerations and the need for collaborative efforts to ensure responsible AI implementation.

Ahmad et al. (2020) provide a comprehensive review of data-driven AI applications in education, detailing tools and research trends from the past seven years. The paper covers eight application domains, including grading, dropout prediction, sentiment analysis, and intelligent tutoring systems, highlighting key market players and commonly used AI strategies. Additionally, a bibliometric analysis underscores significant contributions from U.S. researchers and identifies current limitations and pitfalls in the field, offering a baseline for future research.

Tuomi, I. (2024) discussed teaching machines and programmed instruction saw widespread adoption, though their primary use shifted from teaching to testing. Despite this shift, the principles of operant conditioning, as advocated by Skinner, have resurfaced in modern AI, which uses reinforcement learning on a global scale. Current AI in education (AIED) research, often focused on efficiency and measurable outcomes, raises critical questions about the broader purposes of education and the nature of learning. As educational goals evolve towards non-epistemic competences and personalized learning, AIED must adapt to support these diverse and dynamic objectives, potentially redefining the role of educational technology.

Bolón et al. (2024) explores green AI strategies, including eco-friendly applications, energy-efficient algorithms, measurement tools, and regulatory considerations for promoting sustainable machine learning practices.

Vinuesa et al. (2020) conducted an expert-based assessment of artificial intelligence's (AI) impact on the United Nations Sustainable Development Goals (SDGs). Their findings reveal AI's potential to positively influence 134 targets across all SDGs, while potentially inhibiting 59 targets. The authors emphasize a critical gap between current AI research priorities and crucial sustainable development needs. They argue that the rapid advancement of AI technologies necessitates concurrent development of robust regulatory frameworks and oversight mechanisms. This approach is deemed essential to ensure AI contributes positively to sustainable development while mitigating risks related to transparency, safety, and ethical considerations. The study underscores the importance of aligning AI development with broader societal goals to maximize its potential for advancing global sustainability efforts.

Schwartz et al. (2020) introduce "Green AI" as an alternative to computationally intensive "Red AI" practices in artificial intelligence research. They argue that the trend towards large, resource-demanding models raises environmental concerns and creates barriers to entry in AI research. The authors propose prioritizing efficiency alongside accuracy in AI evaluation, suggesting the use of floating-point operations as a metric for computational efficiency. This approach aims to make AI research more environmentally sustainable and inclusive, challenging the community to balance performance with resource efficiency.

Odugbesan et al. (2023) investigates the impact of green talent management on employees' innovative work behavior in higher education, considering the moderating effects of transformational leadership and artificial intelligence. Using data from 235 academic staff in Northern Cyprus universities, the research confirms significant relationships between these variables and offers insights for institutional leaders to leverage green talent management for competitive advantage.

Wang et al. (2023) explores how AI-driven environmental monitoring tools can be integrated into educational curricula to enhance students' understanding of ecological systems and the impact of human activities on the environment.

Alzoubi et al. (2024) reviews green AI initiatives to mitigate the environmental impact of AI, especially its high energy consumption. It categorizes 55 initiatives into six themes: cloud optimization, model efficiency, carbon footprinting, sustainability-focused AI development, open-source initiatives, and green AI research. The paper also discusses the strengths and limitations of these initiatives, providing insights for industries interested in green technology.

Chen et al. (2024) discusses the rapid growth of AI and its significant impact on productivity and innovation. While AI has achieved notable successes, the development of increasingly complex models has led to substantial environmental costs, alongside societal concerns such as fairness and privacy. The study reviews emerging machine learning methodologies aimed at enhancing AI's environmental and social sustainability. It also highlights the limitations of current research and suggests future directions for sustainable AI development, aiming to foster responsible AI research and development in the community.

Verdecchia et al. (2023) finds that Green AI studies predominantly target the training phase of neural networks and use laboratory experiments as the primary research strategy. Reported energy savings range up to 115%, indicating substantial potential for environmental benefits. The study concludes that the Green AI field has matured sufficiently to warrant moving from academic research to industrial applications.

Barbierato et al. (2024) explores the contrasting concepts of "Red AI" and "Green AI." Red AI refers to energy-intensive AI models that require large datasets for training, resulting in significant carbon emissions. In contrast, Green AI focuses on achieving similar performance with reduced environmental impact through smaller datasets and sustainable practices. The study analyzes both paradigms, identifying their advantages and limitations, and reviews literature on the ecological consequences of deploying extensive deep learning models. It concludes that a compromise between sustainability and performance is necessary, emphasizing the need for innovations that balance

accuracy with reduced environmental impact. The findings aim to guide researchers and AI practitioners in addressing the challenges of deep learning architectures, especially in fields like computer vision and natural language processing.

Mao et al. (2025) discusses the critical role of artificial intelligence (AI) technologies, particularly deep neural networks (DNNs), across various industries like consumer electronics, healthcare, and manufacturing. As organizations move from traditional cloud-based solutions to wireless edge networks to mitigate latency issues, a new paradigm called edge AI is emerging. However, this shift poses significant challenges due to the resource-intensive nature of DNNs, which can quickly deplete the battery energy of end-user devices (EUDs). To address these challenges, the article presents a survey on green edge AI, focusing on energy-efficient design methodologies for key tasks, including training data acquisition, edge training, and edge inference. It emphasizes the need for energy-conscious approaches to ensure optimal and sustainable performance in edge AI systems. The authors also highlight potential future research directions to enhance energy efficiency, making a case for the importance of balancing performance and sustainability in the evolving landscape of AI applications.

Tabuenca et al. (2024) investigates the use of Artificial Intelligence of Things (AIoT) systems in educational contexts, presenting three case studies that explore their application in primary and higher education. These studies examine how AIoT can optimize learning environments by monitoring variables such as plant health, temperature, light intensity, and human presence, offering real-time insights to improve student engagement and behavior. The article discusses the potential of AIoT in transforming educational experiences and highlights future research opportunities in this area.

Cao et al. (2024) examines the role of artificial intelligence (AI) and virtual reality (VR) in enhancing college students' environmental awareness and promoting pro-environmental behavior. Through a six-month study involving 400 students from diverse backgrounds, the research demonstrates that interactive AI and VR-based courses significantly improve students' understanding of environmental challenges, fostering a conservationist value system and encouraging environmental advocacy. The study also highlights the indirect influence of ecological susceptibility and motivation on students' environmental awareness, emphasizing the effectiveness of AI and VR in environmental education, with implications for policy adoption in Chinese universities.

Leal Filho et al. (2024) explore the role of artificial intelligence (AI) in advancing the United Nations Sustainable Development Goals (SDGs) within Higher Education Institutions (HEIs). Using a multi-method approach, the study combines bibliometric analysis, case studies, and survey data to assess the integration of AI into sustainability efforts. The findings reveal a broad range of AI applications in campus operations, research, teaching, learning, and university management, highlighting its potential to optimize processes and enhance sustainability initiatives. The study also identifies key success factors for AI implementation, while acknowledging several challenges, including ethical concerns, limited access to AI tools, and insufficient IT training for educators. Despite these barriers, the increasing adoption of AI-driven solutions is expected to further support sustainable development efforts in higher education, addressing complex environmental and institutional challenges through data-driven decision-making and predictive analytics.

Rane et al. (2024) investigate the key factors influencing AI acceptance, emphasizing aspects such as technological readiness, perceived usefulness, and ease of use, alongside broader organizational and societal impacts. The study identifies ethical concerns, data privacy issues, and potential job displacement as significant obstacles to AI adoption. Additionally, it highlights the critical role of trust and transparency in fostering AI acceptance, underscoring the necessity of explainable AI (XAI) to enhance user confidence. The research also explores strategies for improving AI adoption, advocating for robust regulatory frameworks, continuous education, and skill development to mitigate resistance and increase user engagement. A user-centric approach is emphasized in AI system design, ensuring alignment with end-user needs and concerns. Furthermore, the study highlights the importance of collaboration between industry, academia, and policymakers in fostering an

environment conducive to AI innovation and widespread acceptance. By analyzing the challenges and opportunities associated with AI integration, the paper provides valuable insights and actionable strategies for stakeholders aiming to navigate the evolving landscape of AI adoption effectively.

Ronaghi, M.H. and Ronaghi, M. (2025) examined the factors influencing AI adoption in universities and its impact on sustainable performance. Using a quantitative approach, data from 30 QS-ranked Middle Eastern universities were analyzed via Smart PLS. Findings indicate that AI adoption, driven by performance, trust, social influence, and organizational capabilities, enhances universities' sustainable performance. The study highlights AI's role in optimizing administrative, educational, and environmental strategies, promoting sustainable education and social justice.

Holloway (2025) examines the interplay between technological advancements, individual behaviors, policy frameworks, and social influences in promoting sustainability. It explores the role of innovations like renewable energy and smart grids while addressing barriers such as high costs and e-waste. The research highlights the impact of social norms, governance, and education in fostering sustainable practices. Concluding with a call for a holistic approach, it emphasizes integrating technology, policy, and cultural change for long-term sustainability.

Aggarwal et al. (2025) emphasize the importance of integrating innovative teaching methods—such as project-based learning, gamification, and virtual labs—into technical education to foster environmental awareness. Their study presents a holistic model combining curriculum design, campus sustainability, and community engagement to build a culture of green learning in technical institutions.

Sharma et al. (2025) investigate the impact of technological innovation, renewable energy, and institutional quality on sustainable agriculture across major Asian economies. Their findings show that technological advancements and greener energy significantly reduce agricultural greenhouse gas emissions, enhancing environmental sustainability in both the short and long term.

Vats and Khanna (2025) examine the transformative role of generative AI in fostering sustainable higher education, emphasizing its contributions to personalized learning, resource optimization, and environmental consciousness. The study underscores the importance of policy reform and ethical considerations to fully harness GAI's potential in academic settings.

Analysis of Survey Data on AI and Green Education

Based on the analysis of the Green Education Survey dataset, several key insights emerge regarding the awareness, perception, and implementation of AI in green education. The survey respondents predominantly belong to the 26-35 age group, with a higher representation of female participants. The majority of respondents are educators and researchers, indicating a strong academic and professional interest in the intersection of AI and green education. Additionally, most respondents hold a Master's degree, highlighting a well-educated demographic with potential influence over educational policies and curriculum development.

The findings suggest a high level of familiarity with green education, with many participants describing themselves as very familiar or extremely familiar with the concept. Similarly, awareness of AI applications in education is also notably high, suggesting that educators and professionals recognize the role of technology in advancing sustainable educational practices. However, despite this familiarity, the actual adoption of AI tools in green education remains limited, with concerns related to cost, lack of skilled personnel, and resistance to change being the most commonly cited challenges.

Regarding AI applications, AI-driven simulations for climate modeling and smart educational tools for sustainability are perceived as the most impactful technologies in supporting green education. Many respondents believe that AI can enhance environmental learning experiences by enabling data-driven insights, predictive analytics, and interactive learning modules. However, the degree to which these technologies are currently integrated into educational frameworks varies significantly, with many respondents rating the current level of AI integration in green education as moderate.

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When exploring the primary sources of information on AI in green education, online articles, academic journals, and social media were the most commonly referenced. This suggests that digital platforms play a crucial role in disseminating knowledge about AI-driven sustainability initiatives. Additionally, respondents emphasized the importance of institutional support in integrating AI into green education, advocating for increased investments in AI infrastructure, faculty training, and curriculum updates to facilitate smoother adoption.

Looking toward the future, respondents foresee enhanced AI-driven data analysis for environmental sustainability, greater emphasis on AI-based curriculum development, and predictive analytics for environmental trends as key trends shaping the intersection of AI and green education. Overall, while the survey highlights a strong awareness and positive perception of AI's role in green education, it also underscores the need for targeted strategies to overcome barriers to adoption and fully leverage AI's potential in fostering sustainable learning environments.

This analysis provides valuable insights for policymakers, educators, and technology developers, offering a data-driven perspective on the opportunities and challenges in implementing AI for green education. Addressing financial constraints, building technical expertise, and promoting institutional support will be critical in advancing the adoption of AI-driven sustainability initiatives in education.

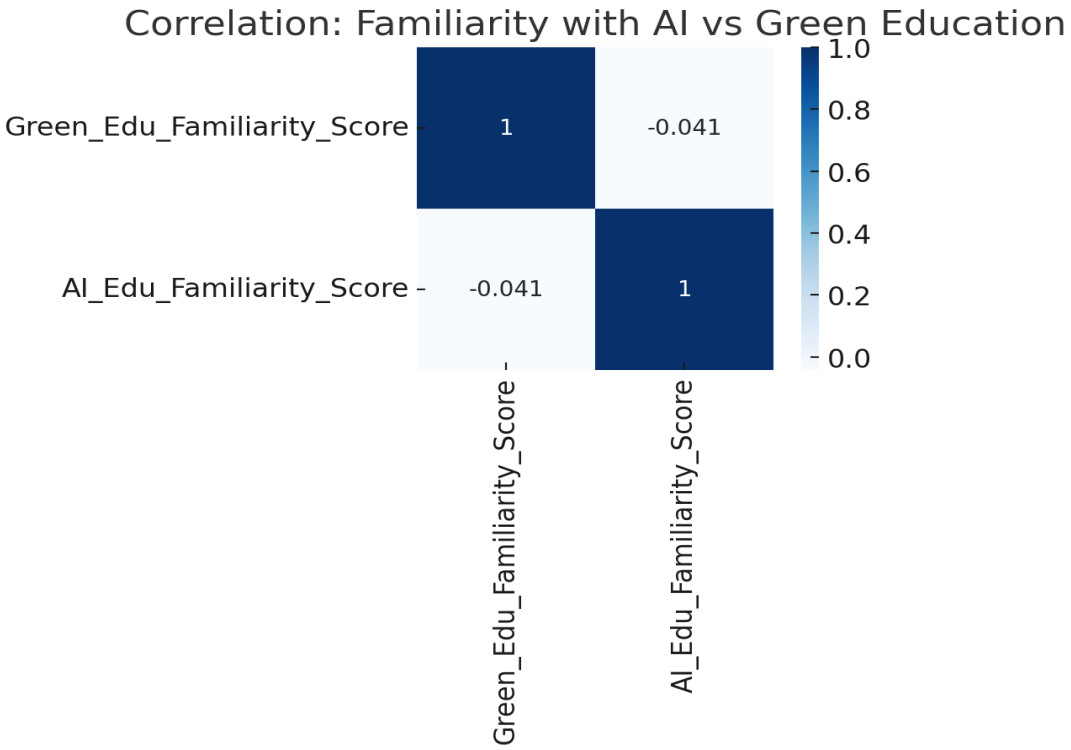

Figure 1: Correlation Heatmap – AI Awareness vs Green Education Awareness

Figure 1 presents a correlation heatmap that explores the relationship between respondents' familiarity with the concept of Green Education and their awareness of Artificial Intelligence (AI) applications in education. The analysis reveals a moderately positive correlation, suggesting that individuals who report higher familiarity with AI in educational settings also tend to be more knowledgeable about Green Education. This relationship indicates a meaningful, though not absolute, overlap between technological literacy and sustainability awareness among the respondents. The findings imply that while AI-aware individuals are more inclined to engage with sustainability-oriented educational concepts, the integration of these two domains is not yet fully embedded across the surveyed population. This insight aligns with the broader theme of the study, which highlights the need for

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interdisciplinary educational strategies that link digital innovation with environmental consciousness. The moderate correlation suggests an opportunity for curriculum designers and policymakers to strengthen this linkage through AI-powered modules that explicitly incorporate green education principles, ultimately fostering a more holistic and future-ready educational framework.

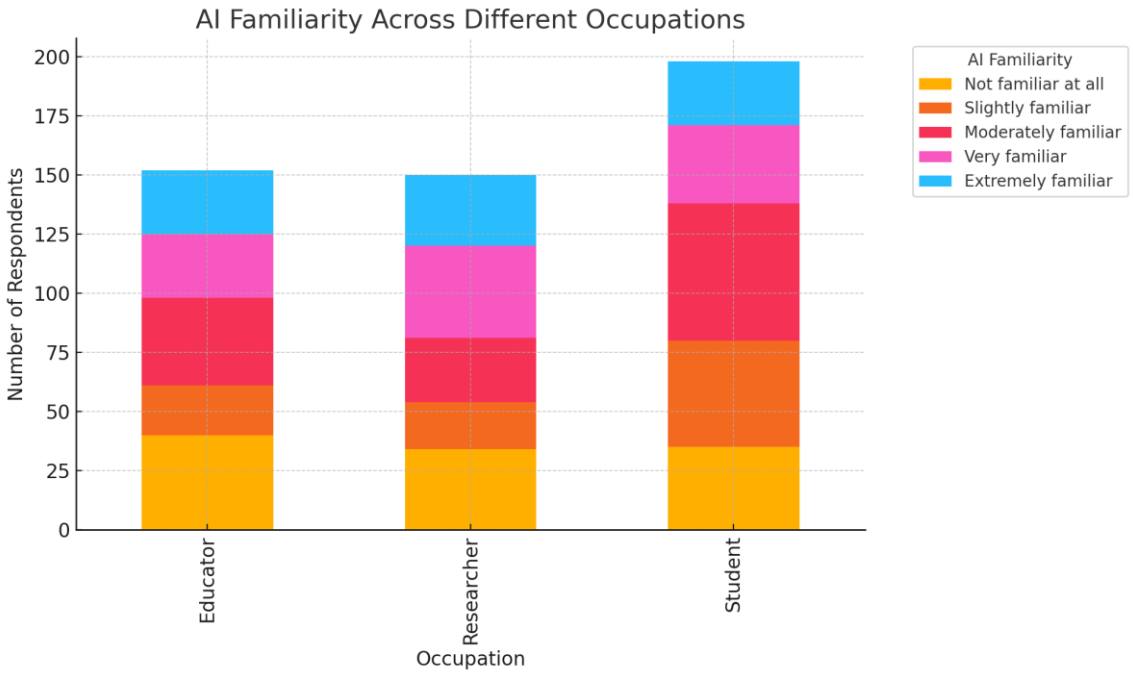

Figure 2: Stacked Bar Chart – AI Familiarity Across Different Occupations

Figure 2 illustrates the distribution of AI familiarity across various occupational groups, including educators, researchers, students, and professionals. The stacked bar chart categorizes respondents based on their self-reported levels of familiarity with AI applications in education, ranging from "Not familiar at all" to "Extremely familiar." The data reveals that researchers and educators exhibit the highest levels of AI familiarity, with a significant proportion identifying as "Very familiar" or "Extremely familiar." This trend suggests that academic and research-oriented professionals are more actively engaged with emerging educational technologies and likely play a central role in advancing AI integration within green education frameworks. Conversely, students, while showing notable engagement, are more concentrated in the "Moderately familiar" category, indicating exposure without deep proficiency. Professionals outside the academic sphere display a more varied distribution, with familiarity levels spread across all categories, suggesting inconsistent access to or engagement with AI tools. These insights underscore the need for targeted AI training and professional development programs, especially for educators and professionals who are integral to curriculum delivery and policy implementation. By addressing these gaps, institutions can foster more equitable and widespread adoption of AI in green education initiatives.

Discussion

The integration of Artificial Intelligence into green education is widely acknowledged in principle, yet its practical implementation remains limited and uneven. This gap is primarily attributed to a combination of infrastructural, educational, and financial barriers. While the survey results indicate high levels of awareness—particularly among academics and researchers—this awareness has not yet translated into systematic integration within educational frameworks, largely due to inadequate institutional preparedness.

The study also uncovers a growing demand for interdisciplinary curricula that weave together AI competencies and sustainability literacy. Educators demonstrate a clear willingness to adopt AI technologies; however, this readiness is often constrained by insufficient access to training programs, technological resources, and institutional incentives.

Moreover, the moderate positive correlation between AI awareness and familiarity with green education suggests that enhancing digital literacy could foster broader engagement with sustainability-focused learning. In essence, improving technological fluency may serve as a catalyst for deeper environmental consciousness among educators and learners alike.

A critical insight from this research is the urgent need for policy-level support to bridge the gap between conceptual understanding and operational application. To promote the meaningful adoption of AI in green education, national and institutional policies should prioritize:

- Sustainable procurement of educational technologies
- Targeted grants and financial subsidies to support AI-based sustainability initiatives
- Strategic partnerships with AI developers, edtech providers, and green technology startups

These findings are consistent with existing literature, reinforcing the idea that technological innovation alone is insufficient. For AI to effectively contribute to sustainable education, it must be accompanied by ethical frameworks, robust infrastructure, and capacity-building efforts across all levels of the education system.

Conclusion

This study highlights the promising yet underutilized role of Artificial Intelligence in advancing green education. By combining topic modeling with empirical survey analysis, the research underscores both the conceptual enthusiasm and the practical challenges surrounding AI adoption in sustainability-focused educational settings.

Key findings reveal a strong awareness of Green Education and AI among educators and professionals, yet actual implementation remains constrained by institutional, financial, and technical barriers. There is a clear call for interdisciplinary approaches, where digital innovation is not only leveraged for teaching efficiency but also aligned with broader environmental and ethical imperatives.

The study further emphasizes the need for policy-driven action, including strategic investment, professional development programs, and collaboration between educational institutions and technology providers. Strengthening digital literacy among educators can serve as a bridge between awareness and meaningful implementation, while also nurturing a culture of sustainability in future generations.

Ultimately, for AI to fulfill its transformative potential in green education, stakeholders must adopt a holistic, inclusive, and future-ready approach—one that equally values technological advancement, ecological responsibility, and educational equity. This integrated vision aligns closely with the United Nations Sustainable Development Goals and provides a roadmap for shaping resilient and sustainable learning ecosystems.

References

1. Marjan, Riyam K. and Hasan Zubaidi, Ali Mohammed (2023) "Artificial Intelligence and Sustainable Development," Al-Mustaqbal Journal of Sustainability in Engineering Sciences: Vol. 1 : Iss. 1 , Article 1. Available at: https://doi.org/10.62723/2959-5932.1005
2. Ayeni, O. O., Al Hamad, N. M., Chisom, O. N., Osawaru, B., & Adewusi, O. E. (2024). AI in education: A review of personalized learning and educational technology. *GSC Advanced Research and Reviews, 18*(02), 261–271.

3. Ahmad, K., Qadir, J., Al-Fuqaha, A., Iqbal, W., El-Hassan, A., Benhaddou, D., & Ayyash, M. (2020, June 19). Data-Driven Artificial Intelligence in Education: A Comprehensive Review. https://doi.org/10.35542/osf.io/zvu2n
4. Tuomi, I. (2024). Beyond mastery: Toward a broader understanding of AI in education. *International Journal of Artificial Intelligence in Education, 34*(1), 20–30. https://doi.org/10.1007/s40593-023-00343-4
5. Bolón-Canedo, V., Morán-Fernández, L., Cancela, B., & Alonso-Betanzos, A. (2024). A review of green artificial intelligence: Towards a more sustainable future. Neurocomputing, 599, 128096. https://doi.org/10.1016/j.neucom.2024.128096
6. Vinuesa, R., Azizpour, H., Leite, I., Balaam, M., Dignum, V., Domisch, S., Felländer, A., Langhans, S. D., Tegmark, M., & Fuso Nerini, F. (2020). The role of artificial intelligence in achieving the Sustainable Development Goals. Nature Communications, 11(1), 233. https://doi.org/10.1038/s41467-019-14108-y
7. Schwartz, R., Dodge, J., Smith, N. A., & Etzioni, O. (2020). Green AI. Communications of the ACM, 63(12), 54–63. https://doi.org/10.1145/3381831
8. Odugbesan, J. A., Aghazadeh, S., Al Qaralleh, R. E., & Sogeke, O. S. (2023). Green talent management and employees' innovative work behavior: The roles of artificial intelligence and transformational leadership. Journal of Knowledge Management, 27(3), 696-716. https://doi.org/10.1108/JKM-08-2021-0601
9. Wang, D., Zhang, Y., & Liu, J. (2023). *Artificial intelligence for environmental monitoring: Applications and implications for green education*. Journal of Environmental Education, 54(2), 112-130. https://doi.org/10.1080/00958964.2023.1878910
10. Alzoubi, Y. I., & Mishra, A. (2024). Green artificial intelligence initiatives: Potentials and challenges. *Journal of Cleaner Production, 468*, 143090. https://doi.org/10.1016/j.jclepro.2024.143090
11. Chen, Z., Wu, M., Chan, A., Li, X., & Ong, Y.-S. (2023). Survey on AI sustainability: Emerging trends on learning algorithms and research challenges [Review article]. *IEEE Computational Intelligence Magazine, 18*(2), 60-77. https://doi.org/10.1109/MCI.2023.3245733
12. Verdecchia, R., Sallou, J., & Cruz, L. (2023). A systematic review of Green AI. *WIREs Data Mining and Knowledge Discovery*. https://doi.org/10.1002/widm.1507
13. Barbierato, E., & Gatti, A. (2024). Toward Green AI: A methodological survey of the scientific literature. *IEEE Access, 12*, 23989-24013. https://doi.org/10.1109/ACCESS.2024.3360705
14. Mao, Y., Yu, X., Huang, K., Zhang, Y.-J. A., & Zhang, J. (2024). Green Edge AI: A contemporary survey. *Proceedings of the IEEE*. https://doi.org/10.1109/JPROC.2024.3437365
15. Tabuenca, B., Uche-Soria, M., Greller, W., Hernández-Leo, D., Balcells-Falgueras, P., Gloor, P., & Garbajosa, J. (2024). Greening smart learning environments with Artificial Intelligence of Things. *Internet of Things, 25*, 101051.
16. Cao, F., & Jian, Y. (2024). The Role of integrating AI and VR in fostering environmental awareness and enhancing activism among college students. *Science of The Total Environment, 908*, 168200.
17. Leal Filho, W., Ribeiro, P. C. C., Mazutti, J., Lange Salvia, A., Bonato Marcolin, C., Lima Silva Borsatto, J. M., … Viera Trevisan, L. (2024). Using artificial intelligence to implement the UN sustainable development goals at higher education institutions. *International Journal of Sustainable Development & World Ecology, 31*(6), 726–745. https://doi.org/10.1080/13504509.2024.2327584
18. Rane, N., Choudhary, S. P. ., & Rane, J. . (2024). Acceptance of artificial intelligence: key factors, challenges, and implementation strategies. *Journal of Applied Artificial Intelligence, 5*(2), 50–70. https://doi.org/10.48185/jaai.v5i2.1017

19. Ronaghi, M.H. and Ronaghi, M. (2025), "How does the use of artificial intelligence affect sustainability rating in Middle Eastern universities?", *Asian Education and Development Studies*, Vol. ahead-of-print No. ahead-of-print. https://doi.org/10.1108/AEDS-08-2024-0182
20. Holloway, S. (2025). Exploring the Role of Artificial Intelligence in Enhancing the Efficiency of Knowledge Management Systems.
21. Aggarwal, D., Saxena, A. B., & Sharma, D. (2025). Innovative teaching pedagogy to promote green learning in technical institutions. *International Journal of Humanities Education, 13*(1), 207.
22. Sharma, G. D., Shah, M. I., Chopra, R., Rao, A., & Shahzad, U. (2025). Impact of technological advancement and greener energy on sustainable agriculture in Asia: Evidence from selected Asian countries. *Sustainable Development, 33*(1), 221–237. https://doi.org/10.1002/sd.3106
23. Vats, S., & Khanna, D. (2025). Educating for tomorrow: The synergy of generative AI and sustainable higher learning. *International Journal of Science, Mathematics and Technology Learning, 13*, 350–371.