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Students' Perspectives on AI Integration in Classroom-Based Sustainability Education in Malaysia

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Abstract

Sustainability education aims to enhance environmental knowledge and foster civic engagement through effective pedagogical strategies. The integration of Artificial Intelligence (AI) into education offers a transformative opportunity to support students in understanding sustainability-related opportunities and challenges. By cultivating a global perspective, optimizing resource allocation, and personalising learning experiences, AI-driven approaches can significantly enrich sustainability education and better prepare students for a sustainable future. AI applications in education encompass learning enhancement, individualized instruction, and administrative efficiency, ultimately contributing to more effective teaching and learning processes. This study examines students' perceptions of AI integration in the classroom in relation to sustainability education within Malaysian higher education institutions. A quantitative case study was conducted with 175 participants from a selected public university in Malaysia. Data were collected through online questionnaires, and the responses were

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analyzed using SPSS version 27. The findings provide valuable insights for academicians, researchers, universities, and policymakers in formulating strategies to equip future generations with the competencies required to address the complex sustainability challenges of the 21st century and beyond.

Keywords: Artificial Intelligence, sustainability, education, classroom

Introduction

Sustainability education has become an essential pillar in global pedagogical reform, aiming to equip learners with the knowledge, values, and competencies needed to address complex environmental and societal challenges. In Malaysia, the integration of sustainability principles into higher education curricula reflects a growing commitment to nurturing responsible, future-ready citizens. However, the effectiveness of sustainability education depends not only on content delivery but also on the pedagogical strategies employed to engage learners meaningfully. Artificial intelligence (AI) has emerged as a transformative tool in education, offering new possibilities for personalized learning, resource optimization, and global connectivity. In the context of sustainability education, AI presents unique opportunities to deepen students' understanding of ecological issues, foster civic engagement, and support interdisciplinary learning. A study by Leal Filho et al. (2025) highlights how AI-powered tools as intelligent tutoring systems and interactive simulation that, can enhance sustainability education by promoting solution-oriented thinking and real-time feedback. These technologies enable students to collaborate on global sustainability projects, thereby enriching their learning experience. Within the Malaysian higher education landscape, AI adoption is gaining momentum. Mat Yusoff et al. (2025) found that student satisfaction and perceived utility were key predictors of AI acceptance in university settings, while Mustaffa & Bahador (2024) emphasized the role of technological skills and ease of use in shaping student engagement. These findings underscore the importance of designing AI-enhanced learning environments that are intuitive, inclusive, and responsive to student needs. Despite its potential, the integration of AI into classroom settings raises important questions about student readiness, perception, and engagement, particularly in diverse Malaysian institutions where technological access and pedagogical approaches vary widely. Understanding students' perspectives on AI is essential for ensuring that its implementation aligns with educational goals and supports culturally responsive, student-centered learning environments. As sustainability education demands critical thinking, ethical reflection, and collaborative problem-solving, the role of AI must be examined not only through a technical lens but also through its capacity to enhance human-centered learning. This study investigates students' perceptions of AI

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integration in the classroom, with a specific focus on its role in advancing sustainability education within a Malaysian public university.

Literature Review

The Use of Artificial Intelligence in the Classroom

Sustainability education has become a central pillar of global pedagogical reform, aiming to equip learners with the knowledge, values, and competencies required to address complex environmental and societal challenges. In Malaysia, the integration of sustainability principles into higher education curricula reflects a growing commitment to nurturing responsible, future-ready citizens. The effectiveness of sustainability education, however, depends not only on the content delivered but also on the pedagogical strategies employed to meaningfully engage learners. AI has emerged as a transformative tool in education, offering new possibilities for personalized learning, resource optimization, and global connectivity. Within the context of sustainability education, AI presents unique opportunities to deepen students' understanding of ecological issues, foster civic engagement, and support interdisciplinary learning. Leal Filho et al. (2025) highlight how AI-powered tools, such as intelligent tutoring systems and interactive simulations, can enhance sustainability education by promoting solution-oriented thinking and providing real-time feedback. These technologies enable students to collaborate on global sustainability projects, thereby enriching their learning experiences.In the Malaysian higher education landscape, AI adoption is gaining momentum. Mat Yusoff et al. (2025) found that student satisfaction and perceived utility were key predictors of AI acceptance in university settings, while Mustaffa and Bahador (2024) emphasised the importance of technological skills and ease of use in shaping student engagement. These findings underscore the need to design AI-enhanced learning environments that are intuitive, inclusive, and responsive to student needs. Despite its potential, the integration of AI into classroom settings raises important questions about student readiness, perception, and engagement, particularly in diverse Malaysian institutions where technological access and pedagogical approaches vary widely. Understanding students' perspectives on AI is essential to ensure that its implementation aligns with educational goals and supports culturally responsive, student-centered learning environments. As sustainability education demands critical thinking, ethical reflection, and collaborative problem-solving, the role of AI must be examined not only through a technical lens but also in terms of its capacity to enhance human-centered learning. This study investigates students' perceptions of AI integration in the classroom, with a specific focus on its role in advancing sustainability education within a Malaysian public university.

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AI Tools in Sustainability Education

AI tools have been identified as highly beneficial in sustainability education, particularly by enhancing personalized learning and providing real-time feedback. These tools facilitate the understanding of complex sustainability concepts and promote critical thinking among students. Their effectiveness, however, depends on the quality of their design and the extent to which they align with educational objectives. In the realm of Intelligent Tutoring Systems (ITS) and personalized learning, AI-powered platforms can tailor content to individual learning needs, enabling deeper engagement with sustainability concepts. For example, systems such as Carnegie Learning and Squirrel AI adapt to learners' progress in real time, offering targeted support (Luckin et al., 2016). This adaptability increases knowledge retention and allows students to learn at their own pace, particularly in areas such as environmental science and climate modeling. The benefits of AI in sustainability education include increased engagement and motivation through gamification and simulations, the provision of real-time feedback, and the optimization of teaching methods. AI also supports educators by reducing administrative workload, thereby allowing them to focus more on content delivery and mentoring. Despite these advantages, students express significant concerns regarding academic integrity. Many are concerned that the use of AI may constitute cheating or plagiarism, especially in contexts where institutional policies remain unclear (Johnston et al., 2024). Concerns about being falsely accused of misconduct further contribute to anxiety surrounding even legitimate AI use (Wu et al., 2025). Another recurring issue in AI adoption is the trustworthiness of its outputs. Students increasingly recognize that generative AI tools may produce inaccurate or biased responses, which creates uncertainty about when it is appropriate or safe to rely on these technologies. This concern is particularly relevant in academic contexts where factual precision and ethical integrity are paramount. As noted by Vieriu and Petrea (2025), such ambiguity can undermine student confidence and highlight the need for critical evaluation skills alongside AI literacy.

Problem Statement

The integration of Artificial Intelligence (AI) into education has gained significant global attention as a means of enhancing teaching and learning processes. Despite its potential, however, there remains a gap in understanding how AI can specifically support sustainability education, particularly within the context of Malaysian higher education institutions. Sustainability education is critical for equipping students with the knowledge, skills, and attitudes necessary to address complex environmental and societal challenges (UNESCO, 2020). In Malaysia, where higher education institutions increasingly emphasise sustainable development as part of their mission, the

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adoption of AI tools in classrooms remains underexplored. According to the Malaysian Education Blueprint 2015–2025, fostering innovation and leveraging technology are key priorities for transforming the education system (Ministry of Education Malaysia, 2015). Yet, limited research exists on students' perspectives regarding AI's role in promoting sustainability education. This gap raises important questions: How do students perceive the use of AI in enhancing sustainability education? What benefits or challenges do they associate with AI integration? Addressing these questions is crucial, as students represent the primary stakeholders who will shape future sustainability efforts. Moreover, while the integration of AI technologies in educational settings, particularly in personalized learning environments, has received substantial scholarly interest (Wang et al., 2024), their application within sustainability-focused curricula remains insufficiently examined. Without a clear understanding of students' perceptions, educators risk deploying AI tools that may not align with learners' needs or intended educational outcomes. Therefore, this study seeks to address this gap by investigating students' views on AI integration in the classroom, with a specific focus on its role in advancing sustainability education within Malaysian higher education institutions.

Purpose of the Study

The purpose of the study was to investigate the students' perceptions of AI integration in classroom-based sustainability education in Malaysia. Specifically, the objectives were as follows:

- To identify the university students' perceptions of AI adaptation in the classroom;
- To identify the university students' perceptions of AI sustainability education;
- To examine the relationship between the students' perceptions of AI adaptation in the classroom and the students' perceptions of sustainability education.

Conceptual Framework

This study is grounded in Vygotsky's (1978) socio-cultural learning theory, which posits that learning is a socially mediated process occurring through interaction, language, and shared activities within a cultural context. The integration of Artificial Intelligence (AI) in the classroom aligns with this theoretical perspective, as AI technologies can serve as mediational tools that enhance collaborative learning, scaffold cognitive development, and support communicative engagement. Within this framework (Figure 1), AI integration is conceptualised as a catalyst influencing students' sustainability education outcomes, while demographic variables are examined as potential moderators

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of this relationship. The independent variable in this study is AI integration in the classroom, encompassing the use of AI-driven tools and systems that facilitate teaching and learning processes. Drawing from Vygotsky's socio-cultural learning theory, three key constructs underpin this variable: (1) social interaction, (2) language, and (3) learning. For the social interaction construct, AI applications enable cooperative and interactive learning experiences, fostering communication, collaboration, and peer support. For the language construct, AI technologies support language acquisition and development through intelligent feedback, adaptive dialogue, and personalized learning environments. Finally, the learning construct highlights the adaptive and data-driven nature of AI, which promotes individualised learning pathways, engagement, and self-regulated learning behaviors. The dependent variable is sustainability education, conceptualized based on the framework proposed by UNESCO (2015). Sustainability education aims to develop learners' capacity to contribute to sustainable development through four interrelated constructs: (1) knowledge and understanding, referring to cognitive comprehension of sustainability principles, environmental issues, and global challenges; (2) skills, relating to the ability to apply critical thinking, problem-solving, and decision-making toward sustainable practices; (3) values, emphasizing the cultivation of ethical principles and social responsibility aligned with sustainability ideals; and (4) attitudes and actions, representing the translation of knowledge and values into practical behaviors that promote sustainable living. The framework also incorporates demographic variables, specifically age, gender, and academic level, as moderating factors that may influence the strength and direction of the relationship between AI integration and sustainability education outcomes.

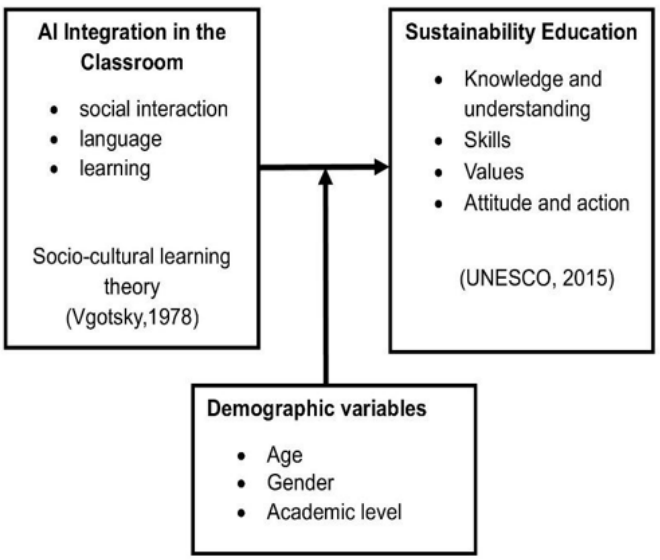

Figure 1: Conceptual Framework of AI Integration in Classroom-Based

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Sustainability Education

In summary, the conceptual framework illustrates the hypothesised relationships among the study variables. AI integration in the classroom (independent variable) is expected to influence sustainability education outcomes (dependent variable), with demographic factors such as age, gender, and academic level serving as moderating influences. The framework is grounded in the assumption that effective integration of AI within socio-culturally rich learning environments can foster the development of sustainable knowledge, skills, values, and actions among learners.

Method

This study employed a quantitative research design with a case study approach to examine students' perceptions of AI integration in the classroom for sustainability education. A sample of 175 participants was drawn from a selected public university in Malaysia using random sampling techniques. Quantitative data were analysed using SPSS software (version 27), while responses to open-ended items were examined through thematic analysis.

Data Collection

Data were collected through an online questionnaire designed to investigate students' perspectives on AI integration in the classroom for sustainability education. The questionnaire comprised four sections: (A) Student Profile (3 items), (B) Perceptions of AI Adaptation in the Classroom (21 items), (C) Perceptions of Sustainability Education (24 items), and (D) two open-ended items. For Sections A–C, the items were rated on a 5-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree." In total, the questionnaire consisted of 50 items.

Data Analysis

The collected data were analysed using SPSS (version 27). Descriptive statistics, including frequencies, percentages, means, and standard deviations, were employed to summarize demographic characteristics and general response trends. Inferential statistical analysis was conducted using Pearson's correlation to examine the relationship between students' perceptions of AI adaptation in the classroom and their perceptions of sustainability education.

Results and Discussion

This section presents and discusses the key findings derived from the analysis of data collected from 175 Malaysian university students. It begins with a detailed examination of the demographic profile of the participants. Following the demographic overview, the section transitions into an in-depth presentation of the descriptive statistics. This includes mean scores and

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standard deviations for the two primary constructs of the study: students' perceptions of AI adaptation in classroom settings and their perceptions of sustainability education. Mean values were interpreted using five categories: Strongly Agree (4.21–5.00), Agree (3.41–4.20), Uncertain (2.61–3.40), Disagree (1.81–2.60), and Strongly Disagree (1.00–1.80). Within the Likert scale analysis, the three highest and three lowest mean values were highlighted to provide deeper insights into students' responses. Together, the demographic profile and descriptive statistics establish a foundation for interpreting the subsequent inferential analyses, including correlation tests. The findings are presented in tables, beginning with the demographic profile of the students, followed by the results on respondents' perspectives, the relationships between variables, and the analysis of open-ended items.

Student Profile

A total of 175 students participated in this study. The demographic characteristics of the participants were analysed in terms of age, gender, and current academic level. As shown in Table 1, the majority of respondents (82.9%) were between 18 and 21 years old, indicating that most participants were in the early stages of their tertiary education. A smaller proportion (17.1%) were aged 22 to 25 years, while none of the respondents were above 25 years of age. This distribution suggests that the participants largely represent the typical age group of undergraduate learners in Malaysian higher education institutions. In terms of gender, female respondents constituted 65.1% of the sample, whereas male respondents accounted for 34.9%. This gender distribution reflects a higher representation of female students, which aligns with enrollment trends observed in many Malaysian universities, where female participation often exceeds that of males in language and education-related programs. With regard to academic level, the majority of respondents (75.0%) were diploma students, while 25.0% were bachelor's degree students. This indicates that most participants were at the diploma level, suggesting that perceptions of AI integration and sustainability education in this study primarily reflect the experiences of students in the early or intermediate stages of tertiary education.

Table 1: Student Profile (n = 175)

Characteristics	**Frequency**	**%**
Age (years)		
18-21 years	145	82.9
22- 25 years	30	17.1
25 years and above	0	0
Gender		
Male	61	34.9
Female	114	65.1
Current academic level		

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Bachelor's degree	34	5.0
Diploma	141	75.0

Table 2 illustrates students' perceptions of AI integration in the classroom across three main dimensions: social interaction, language, and learning. Overall, the mean score of 4.00 (SD = 0.50) indicates that students generally agreed with positive statements regarding AI use in educational settings. The three items with the highest mean scores reflect the strongest areas of agreement among participants. Item 7, which states that AI technologies help students interact with global peers through language translation and knowledge-sharing features, recorded the highest mean score (M = 4.32, SD = 0.76). This suggests that students highly value AI's capacity to facilitate global connectivity and cross-cultural communication. Through translation, virtual collaboration, and multilingual interfaces, AI enhances intercultural learning experiences and promotes global understanding. The second-highest item (item 18) indicated that AI-generated recommendations help students identify relevant study materials (M = 4.22, SD = 0.68). This finding highlights students' appreciation of personalised learning support provided by AI systems, which streamlines information retrieval and tailors content to individual academic needs. Such adaptive functionality enhances learning efficiency and engagement. Chen et al. (2023) emphasised that AI-driven educational tools enhance learner engagement, promote inclusivity, and improve access to digital resources, particularly in language learning and sustainability contexts. The third-highest item (item 21) showed that AI-based educational platforms contribute to the sustainability of education by reducing paper usage and enhancing digital learning (M = 4.21, SD = 0.78). This result highlights students' awareness of AI's role in sustainable educational practices, particularly in minimizing resource consumption and promoting environmentally conscious learning environments. Collectively, these three items underscore students' recognition of AI as a tool that enhances global communication, personalized learning, and educational sustainability, aligning with Vygotsky's socio-cultural perspective that learning is enriched through interaction and mediation using technological tools. Conversely, the three lowest mean scores reveal areas where students expressed comparatively less agreement, though all still fell within the "Agree" range. The lowest mean score was recorded for the item stating that students rely more on AI-generated feedback than peer feedback (M = 3.46, SD = 0.92) in item 4. This implies that while students acknowledge the usefulness of AI feedback, they remain cautious about its potential to reduce human interaction and collaborative learning, which are essential components of social constructivism. Another item suggested that dependence on AI for language learning may weaken students' ability to communicate naturally (M = 3.69, SD = 1.02) in item 13.

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This finding indicates that some students perceive a risk that over-reliance on AI could limit opportunities for authentic, spontaneous language use and interpersonal communication. Godwin-Jones (2022) similarly noted that while AI tools enhance accuracy and efficiency, they may reduce spontaneity and authenticity in learner communication. Finally, the item stating that AI reduces the need for face-to-face interactions in the classroom received a mean score of 3.61 (SD = 1.05) in item 3. This reflects concerns that AI integration may inadvertently diminish direct social engagement, an important aspect of collaborative learning emphasised in Vygotsky's framework. Overall, these findings demonstrate that while students generally hold positive perceptions of AI integration, they remain mindful of potential drawbacks, particularly in relation to human interaction and communication skills. The overall pattern reinforces the importance of adopting balanced pedagogical strategies that integrate AI tools while maintaining meaningful social engagement in the classroom.

Table 2: Perceptions of AI Integration in the Classroom (n = 175)

Item	Statement	M	SD	Interpretation
	Social Interaction			
1	AI tools enhance communication between students and lecturers.	3.91	0.90	Agree
2	AI-powered platforms promote collaboration among students in group discussions.	4.09	0.79	Agree
3	AI reduces the need for face-to-face interactions in the classroom.	3.61	1.05	Agree
4	Students rely more on AI-generated feedback than peer feedback.	3.46	0.92	Agree
5	The use of AI in the classroom creates a more engaging learning environment.	3.91	0.91	Agree
6	AI encourages independent learning but may decrease interpersonal engagement	4.02	0.80	Agree
7	AI technologies help students interact with global peers through language translation and knowledge-sharing features.	4.32	0.76	Strongly agree
	Language			
8	AI-assisted tools improve students' academic writing and grammar	4.20	0.87	Agree
9	AI-powered language models help students comprehend complex course materials	4.12	0.78	Agree
10	AI reduces the need for students to develop independent critical thinking in language learning.	3.82	0.94	Agree
11	The use of AI in the classroom encourages students to explore different languages.	4.12	0.90	Agree
12	AI-generated content helps students express ideas more effectively.	4.12	0.85	Agree
13	Dependence on AI for language learning may weaken students' ability to communicate naturally.	3.69	1.02	Agree
14	AI language tools assist non-native English speakers in improving their fluency and confidence.	4.08	0.77	Agree

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	Learning			
15	AI-driven tutoring systems provide personalized learning experiences.	3.92	0.75	Agree
16	AI-powered learning tools improve students' academic performance.	4.03	0.83	Agree
17	AI applications make learning more accessible and inclusive for all students.	4.19	0.73	Agree
18	AI-generated recommendations help students identify relevant study materials.	4.22	0.68	Strongly agree
19	AI makes students passive learners rather than active thinkers.	3.93	0.82	Agree
20	AI improves students' ability to understand and retain information.	4.02	0.87	Agree
21	AI-based educational platforms contribute to the sustainability of education by reducing paper usage and enhancing digital learning.	4.21	0.78	Strongly agree
	Total average	4.00	0.50	Agree

The findings suggest that students' positive perceptions of AI reflect not merely acceptance of technology, but a broader shift in how learning is conceptualised from teacher-centred to technology-mediated environments. AI is perceived as an enabler of efficiency and autonomy, particularly in communication, language development, and personalised learning. This indicates that students increasingly view AI as an integral cognitive partner in their learning process rather than a supplementary tool. Overall, the findings imply that AI is not simply improving educational practices but is reshaping the epistemological foundations of learning itself. Students perceive AI as both empowering and potentially deskilling, highlighting the need for pedagogical frameworks that ensure AI functions as a thinking amplifier rather than a thinking substitute. This underscores the importance of integrating AI with instructional strategies that deliberately cultivate critical reflection, metacognition, and active knowledge construction.

Table 3 presents the findings on students' perceptions of sustainability education, with an overall mean score of 4.08 (SD = 0.54) in item 32, indicating a generally positive perception among participants. The results reveal that students acknowledge the role of AI in supporting sustainability-related learning, enhancing accessibility, and promoting environmentally responsible practices. The highest mean score was recorded for item 24: "I am aware of AI-powered tools or platforms being used in my educational environment" (M = 4.28, SD = 0.68). This suggests strong student awareness of AI integration in their learning environments and reflects the growing visibility of AI technologies in university settings. It indicates that students recognize the practical relevance of AI in sustainability-focused education. The second-highest score was for item 35: "AI has made education more

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accessible for students with disabilities" (M = 4.26, SD = 0.75). This finding demonstrates students' recognition of AI's inclusive potential, emphasising its ability to bridge accessibility gaps, support diverse learners, and promote equity in sustainable education. The third-highest score was for item 33: "More hands-on projects and activities will help me to develop my sustainability skills further" (M = 4.24, SD = 0.74). This result highlights students' preference for experiential and practical learning, aligning with sustainability education's emphasis on real-world engagement and active participation. These items underscore students' positive perceptions of AI as a supportive tool for inclusive, experiential, and sustainability-oriented learning. They reflect the principles of transformative and action-based education advocated by UNESCO (2015), reinforcing the importance of integrating AI in ways that promote accessibility, practical engagement, and environmentally conscious practices.

Table 3: Perceptions of Sustainability Education (n = 175)

Item	Statement	M	SD	Interpretation
	Knowledge and understanding			
22	I am aware the concept of sustainability in education is important.	4.19	0.76	Agree
23	I know the aim of sustainability in education is to address global challenges and promote sustainable practices for the environment, economy, and society	4.20	0.73	Agree
24	I am aware of AI-powered tools or platforms being used in my educational environment	4.28	0.68	Strongly agree
25	I understand the sustainability in education helps students understand complex interconnectedness between sustainability issues	4.06	0.76	Agree
26	I seek out new knowledge through or AI tools to help me live more sustainably, such as using sustainability apps	4.11	0.72	Agree
27	To develop more knowledge on sustainability in education, the university should integrate AI applications in the curriculum	3.92	0.82	Agree
	Skills			
28	When I am faced with an environmental issue, I know how to research and find potential solutions through AI tools.	4.13	0.74	Agree
29	I can design a project or campaign that encourages others to adopt more sustainable behaviours using AI tools	3.89	0.85	Agree
30	I engage in discussions or debates on sustainability issues with friends and community members that enhance my analytical thinking skills	3.74	0.89	Agree
31	Students should actively advocate for sustainable practices to your friends, family, or community to enhance sustainability skills	4.13	0.73	Agree
32	AI-powered platforms can help students understand and act on sustainability issues such as climate change and resource conservation	4.08	0.80	Agree

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33	More hands-on projects and activities will help me to develop my sustainability skills further	4.24	0.74	Agree
	Values			
34	I think it is important to integrate AI tools in learning for future generations	4.14	0.81	Agree
35	AI has made education more accessible for students with disabilities	4.26	0.75	Strongly agree
36	I believe AI been used in your educational environment to support students from diverse socio-economic backgrounds for sustainability in education	4.09	0.80	Agree
37	AI can help bridge the gap in educational inequality between rural and urban areas for sustainability in education	4.13	0.78	Agree
38	AI can assist teachers in improving the quality of instruction towards sustainability in education	4.15	0.75	Agree
39	I believe AI can reduce the cost of education in the long terms such as by providing digital resources and reducing the need for physical infrastructure for sustainability in education	4.11	0.81	Agree
	Attitude and Action			
40	I use AI-based tools for learning about sustainability in education	4.03	0.85	Agree
41	Students should participate in any sustainability-related activities or programs at university and in community	4.18	0.77	Agree
42	As a student, I participate sustainability-related activities or programs such as tree planting and environmental clubs at my university or in community	3.64	0.95	Agree
43	AI can make education more cost-effective by automating administrative tasks and providing scalable learning solutions for sustainability.	4.06	0.75	Agree
44	AI can support more sustainable management of educational institutions by reducing waste, such as paperless classrooms and digital assessments	4.16	0.73	Agree
45	Educators in university should integrate AI for promoting sustainability in education in the classroom	4.03	0.77	Agree
	Total average	4.08	0.54	Agree

On the contrary, the three lowest mean scores were observed in item 42: “As a student, I participate in sustainability-related activities or programs such as tree planting and environmental clubs at my university or in the community” (M = 3.64, SD = 0.95). This indicates relatively lower engagement in sustainability-related extracurricular activities, suggesting a potential gap between awareness and active participation. Item 30: “I engage in discussions or debates on sustainability issues with friends and community members that enhance my analytical thinking skills” (M = 3.74, SD = 0.89) reflects a similar gap between knowledge and practice. This finding is in line with the explanations of Sidiropoulos (2018) and Albareda-Tiana et al. (2019),

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who noted that university students often demonstrate theoretical understanding of sustainability but limited participation in real-world initiatives. Although still within the "Agree" range, this item highlights limited involvement in community-based sustainability dialogues, implying that opportunities for critical engagement may be underutilized.Lastly, item 29: "I can design a project or campaign that encourages others to adopt more sustainable behaviours using AI tools" (M = 3.89, SD = 0.85) suggests that while students acknowledge AI's usefulness, they may lack the skills or confidence to apply these tools for advocacy and community-driven sustainability efforts.

These lower mean scores highlight the need for greater emphasis on applied and participatory learning, where students not only understand sustainability concepts but also translate them into concrete action. Integrating AI-enhanced learning experiences with hands-on projects and community engagement could help bridge this gap, fostering both practical competencies and active citizenship in sustainability education.

Students show strong awareness of sustainability in education and view AI as an important tool for supporting sustainable learning. They believe AI enhances access to knowledge, promotes inclusion, and helps address educational inequalities. While students feel capable of using AI for sustainability-related tasks, they still value hands-on experiences as essential for developing real skills. Although attitudes towards sustainability are positive, actual participation is more limited, revealing a gap between awareness and action. Overall, AI is seen as a key enabler of sustainability, but its effectiveness depends on meaningful integration into teaching and practical activities.

Table 4: Overall Mean and Standard Deviation for Constructs

Construct	Mean	Standard Deviation
AI Integration in the classroom	4.00	0.47
Sustainability education	4.08	0.54

As shown in Table 4, the results of the three main constructs indicate that, in general, students perceived AI integration in the classroom positively (M = 4.00, SD = 0.47) as well as sustainability education (M = 4.08, SD = 0.54). Table 4 further revealed a significant, strong positive correlation between AI integration in the classroom and sustainability education ($r = 0.80$, $p < 0.05$). This suggests that students who hold more favorable perceptions of AI integration also tend to demonstrate higher awareness, knowledge, and engagement in sustainability-oriented educational practices. In other words, as AI becomes more embedded in learning environments, students are more likely to value and participate in sustainability-focused initiatives. This finding aligns with prior research by Leal Filho et al. (2022), who observed that the

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incorporation of intelligent digital tools in teaching fosters students' understanding of sustainable development goals (SDGs) by promoting eco-friendly practices, resource efficiency, and inclusive access to education. Similarly, Chen et al. (2023) noted that AI-driven personalization enhances student motivation and awareness of global sustainability issues by making content more relatable and contextually adaptive. The strong correlation in this study reinforces the notion that AI integration serves as a catalyst for advancing sustainability education. Consequently, institutions are encouraged to strategically integrate AI technologies within the curriculum not only to improve learning efficiency but also to cultivate a culture of sustainability, environmental responsibility, and digital innovation among students. To complement the quantitative findings, the study also incorporated open-ended items aimed at gaining deeper insights into participants' views on how AI can support sustainability in education and the challenges that may hinder its effective implementation. These qualitative responses provided richer perspectives on the practical and ethical dimensions of AI integration in educational settings. Participants were asked to identify the three most significant ways AI can contribute to making education more sustainable and the three main challenges or barriers that need to be addressed. The collected responses were analysed, categorised into common themes, and ranked based on frequency to highlight the most prominent perceptions among respondents.

Table 5: Open-ended Items Analysis

Open-ended items	**Rank**	**Main themes**	**Frequency (*f*)**
Three (3) most significant ways AI can contribute to making education more sustainable	1	Optimizes educational resources	91
	2	Personalised learning	60
	3	Create more content creation in education	10
Three (3) challenges or barriers that you think need to be addressed for AI to effectively promote sustainability in education	1	Lack of internet access and infrastructure	71
	2	Lack of data privacy and ethical guidelines	60
	3	Misleading data and information	12

The open-ended responses revealed that the most significant ways AI contributes to making education more sustainable include optimizing educational resources (f = 91), enabling personalized learning (f = 60), and facilitating content creation in education (f = 10). The open-ended responses indicate that students primarily view AI as a tool for optimising educational resources, particularly by reducing paper use, saving time, and improving efficiency. At the same time, participants identified several challenges that must be addressed for AI to effectively promote sustainability in education. These findings are consistent with prior research by Lim and Teng (2021) and

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Zawacki-Richter et al. (2019), which emphasise AI's potential to improve efficiency and personalisation in education while acknowledging persistent challenges related to access, ethics, and data reliability.

Personalised learning also emerged as a key theme, reflecting students' belief that AI can tailor learning experiences to individual needs and support more effective and inclusive education. Content creation was mentioned less frequently, suggesting that students value AI more for enhancing existing learning processes than for generating new materials. In terms of challenges, the most significant barrier identified was unequal access to the internet and digital infrastructure, highlighting concerns about the digital divide. Ethical issues, especially related to data privacy and governance, were also strongly emphasised, indicating awareness of the risks associated with AI adoption. Misleading or unreliable information was perceived as a lesser but still important concern, pointing to the need for critical evaluation skills and quality control in AI-driven education. Overall, the findings suggest that students see AI as a strong enabler of sustainable education, but stress that its success depends on equitable access, ethical regulation, and responsible use.

Conclusion

This study examined students' perceptions of Artificial Intelligence (AI) integration in the classroom for sustainability education, using a Malaysian public university as a case study. The findings contribute to the evolving discourse on digital transformation in Malaysian higher education, highlighting the importance of understanding students' perspectives to ensure that AI-driven innovations are pedagogically sound, ethically responsible, and contextually relevant. The results underscore the need for inclusive strategies that take into account diverse learner backgrounds, technological readiness, and disciplinary contexts when implementing AI in sustainability education. Insights from this study may inform curriculum development, teacher training, and institutional policy, enabling educators and administrators to design more responsive, student-centered approaches. AI should be leveraged not merely as a technological tool but as a catalyst for transformative learning, particularly in sustainability education, where interdisciplinary thinking and innovation are essential. Ultimately, this research affirms that AI integration in education is not a purely technical endeavor but a pedagogical and ethical one. It calls for thoughtful engagement with students' voices, continuous reflection on teaching practices, and a commitment to aligning technological advancement with human-centered learning. As Malaysian universities navigate the future of education, studies such as this provide a foundation for informed, inclusive, and visionary decision-making.

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